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# **Comparison of the Physical Activity of 11–12 Year Old Pupils in Two Schools in Norway and Iceland, using Pedometer Registrations and Activity Diaries**

► **About the authors** ► **Key words**

Detailed knowledge about physical activity (PA) in both school and leisure time is of great importance in order to promote children's health. This study investigated and compared the PA levels of sixth-grade pupils, 11–12 years of age, in two Nordic schools, during both school and leisure time by combining pedometer measures with activity diary records. Pupils from Norway (n= 44) and Iceland (n=37) wore pedometers for seven consecutive days and kept an activity diary for the first two days. After pupils' PA had been registered for one week using a pedometer, no significant differences in pedometer step counts were found. Nor were there significant differences in the pedometer step counts between weekdays and weekends. But when looking only at the group of pupils reporting to meet the standard of at least 60 minutes PA and 12,000 pedometer step counts per day for girls and 15,000 for boys, results revealed that there were a higher percentage of Norwegian pupils in this group. However, within this group the Icelandic pupils were active for a longer period and had higher pedometer step counts. The Norwegian pupils reported a significantly higher daily PA from walking or cycling to school than the Icelandic pupils. Among boys, there were no other significant differences. On the other hand, the Norwegian girls reported a significantly higher level of exercise in sports club and a significantly lower level of leisure time walks than the Icelandic girls. In conclusion, although the total amount of PA of Norwegian and Icelandic pupils was similar, a closer look at the various activities during school time and leisure time revealed significant differences between the case schools, including gender differences. Our study has contributed to the knowledge about PA among

11–12-year-old pupils in two Nordic countries. The results of our study have revealed a need for more research into different factors, in both school and leisure time that can contribute to increasing Nordic pupils PA levels.

### Samanburður á hreyfingu 11 til 12 ára nemenda í Noregi og á Íslandi byggður á skrefamæli og hreyfidagbók

#### ► Um höfunda ► Efnisorð

Nákvæm þekking á hreyfingu (e. *physical activity*) á skólatíma og í tómstundum er ákaflega mikilvæg þegar efla á heilsu barna. Í þessari rannsókn var könnuð og borin saman hreyfing 11 til 12 ára barna í sjötta bekk í tveimur norrænum skólum, bæði á skólatíma og í frjálsum tíma með því að tefla saman skrefamælingum og hreyfidagbókarfærslum. Nemendur í Noregi (n=44) og á Íslandi (n=37) gengu með skrefamæla í sjö daga samfleytt og héldu hreyfidagbók fyrstu tvo dagana. Eftir að hreyfing nemenda hafði verið mæld með skrefamæli í eina viku fannst enginn marktækur munur á fjölda skrefa. Ekki mátti heldur greina marktækan mun á skrefafjölda á virkum dögum og helgardögum. En þegar einblínt var á þann hóp nemenda, sem taldi sig mæta þeirri lágmarkskröfu að hreyfa sig í minnst 60 mínútur og taka fyrir stelpur 12.000 mæld skref á dag en fyrir stráka 15.000 mæld skref á dag, leiddu niðurstöður í ljós að hærra hlutfall norskra nemenda fyllti þann hóp. Íslendingarnir í hópnum, aftur á móti, reyndust hreyfa sig lengur og skila hærri skrefatölu. Norsku nemendurnir gerðu grein fyrir marktækt meiri hreyfingu fólginni í því að ganga eða hjóla til og frá skóla. Á meðal stráka var enginn annar marktækur munur. Stelpurnar aftur á móti gáfu til kynna marktækt meiri hreyfingu á æfingum á vegum íþróttafélaga og marktækt minni göngu í frístundum. Í hnotskurn má segja að þótt hreyfing norskra og íslenskra nemenda hafi verið á móta mikil á heildina litið hafi nánari athugun á athöfnum á skólatíma og í frístundum leitt í ljós marktækan mun á þátttökuskólunum, meðal annars eftir kynjum. Rannsókn okkar hefur aukið þekkingu á hreyfingu 11 til 12 ára skólabarna í tveimur Norðurlanda. Niðurstöður okkar sýna þörf fyrir frekari rannsóknir á ýmsum þáttum sem geta stuðlað að því að nemendur á Norðurlöndum hreyfi sig meira.

## Background

It is widely believed that physical inactivity will likely be responsible for a variety of health problems in society in the future. Lack of physical activity (PA) and its effects on health are evident in most developed countries today, including the Nordic countries (Rasmussen, Andersen, Borodulin, Enghardt Barbieri, Fagt, Mathiessen, Sveinsson, Thorgeirsdóttir & Trolle, 2012). The benefits of regular participation in PA are well-documented (Janssen & Leblanc, 2010). Because PA in childhood has repercussions in adulthood, it represents a core factor that must be addressed in efforts to reduce the risk of chronic diseases (Telama, Yang, Viikari, Valimaki, Wanne, & Raitakari, 2005). Furthermore, PA contributes to healthy bone and muscle development, reduces the risk of becoming overweight and promotes psychological well-being among children and youth (Biddle, Gorely, & Stensel, 2004; Sothorn, Loftin, Suskind, Udall, & Blecker, 1999). It is therefore of great importance, from a public-health perspective, that children and youth develop good PA habits. Nordic (Nordic Council of Ministers, 2004) and international (World Health Organization, 2006) guidelines recommend a minimum of 60 minutes of moderate to high intensity PA daily for children and young people. Only one-third of the children in the OECD countries reach this target (UNICEF, 2007). The guidelines have been translated into a recommended number of steps per day; the cut off points for normal-weight 6–12-year-olds is 12,000 steps per day for girls and 15,000 for boys (Tudor-Locke & Bassett, 2004). According to Laurson, Eisenmann, Welk, Wickel, Gentile, & Walsh, (2008), 55–75% of the children did not meet the recommended number of steps per day.

It is extremely important, therefore, to motivate young people to engage in daily PA (World Health Organization, 2006).

Pupils spend a lot of their awake time at school, and the Nordic governments encourage more PA at school (Nordic Council of Ministers, 2006) in the form of Physical Education classes and other PA throughout the school day. The Norwegian curriculum, *The National Curriculum for Knowledge Promotion* (Ministry of Education and Research, 2006), includes more PA than its Icelandic counterpart (Ministry of Education and Research, 2008; Ministry of Education, 2012). This emphasis is not always followed up, however, and despite governmental encouragement and prioritization, some schools may have problems offering pupils enough PA every day, and many schools lack a sufficient number of competent staff to organize the activities (Samdal, Haug, Slåtten, Larsen, Holthe, Hasnes, Fredbo, Manger, & Hansen, 2008). It is necessary, therefore, to acquire more knowledge about children's voluntary engagement in PA during the school day and the contribution this makes to children's overall PA. Recess is one of the few periods during the school day in which pupils can choose to be physically active, and may contribute significantly to the recommended 60 minutes of daily PA (Babkes & Sinclair, 2004; Beighle, Morgan, Le Masurier, & Pangrazi, 2006; Ridgers & Stratton, 2005). At elementary school, the recommendation is that at least 30 minutes per day should be allowed for recess periods (Pate, Davis, Robinson, Stone, McKenzie, & Young, 2006), not including PA programs. PA during the school day is primarily linked to getting to and from school, Physical Education lessons, Outdoor Education and recess activities. Active transporting to school can make a significant contribution to children's PA, and those who cycle or walk to school have the highest overall PA levels (Slingerland, Borghouts, & Hesselink, 2012). Another important contributor to overall PA levels is leisure time PA, which is primarily linked to exercise, leisure play, leisure walks and other physical activities (Slingerland et al., 2012).

Various studies have investigated children's leisure-time activity levels using pedometers and heart rate monitors (Mota, Silva, Santos, Ribeiro, Oliveira, Duarte, 2005; Verstraete Cardon, De Clercq & De Bourdeaudhuij, 2006), but these methods provide little insight into the contexts in which the activity occurs (Wechsler, Devereaux, Davis & Collins, 2000). Bates (2006) suggests that self-reporting and objective measures should be combined to enrich and optimize the quality of the data collected. Therefore, we chose to use two different data collection methods: self-reported registration and pedometer step counts.

A large number of international studies of the PA of children and adolescents have been carried out both within and outside Europe (Allison, Adlaf, Dwyer, Lysy & Irving, 2007; Currie, Roberts, Morgan, Smith, Settertobulte, Samdal & Rasmussen, 2004; Vincent Pangrazi, Raustorp, Tomson & Cuddihy, 2003). A few studies have included Icelandic data (Magnusson, Arngrimsson, Sveinsson & Johannsson, 2011; te Velde, De Bourdeaudhuij, Thorsdottir, Rasmussen, Hagstromer, Klepp & Brug, 2007) and Norwegian data (Klasson-Heggebo & Anderssen, 2003; Samdal et al., 2009). However, our study contributes to this research field by studying children in these two Nordic countries.

The purpose of our study was to investigate and compare the PA levels during both school and leisure time of pupils from one Icelandic and one Norwegian school, as well as to examine where the PA took place. Our research question was: Are there differences between Norwegian and Icelandic 11–12-year-old pupils' PA levels, and where does their PA take place?

## Methods

### Participants

The participants were 81 elementary-school children (n=38 males, n=43 females) from two schools, one in western Norway (n=44) and one in western Iceland (n=37). The pupils were in grade 6 and were 11–12 years old.

### Case schools

Both case schools were elementary schools (Grades 1–7), and were located in suburban communities; both were built around 1970, and had approximately 250 pupils and 40 employees. The pupils in both schools could walk or cycle to school using various paths. The schoolyards were covered in asphalt and there were gravel pitches for ballgames and playgrounds with climbing equipment. In addition, there was some open grassland and various natural settings where pupils could play in during recess. The pupils at both schools started the first lesson at 8:15 in the morning and finished their last lesson every day at 14:00. The frequency and the length of recess periods were identical in both schools. The pupils in the Norwegian school had PE classes on Thursdays. The Icelandic pupils did not have PE classes during the particular research week.

### Procedures

The schools, parents and pupils were informed about the study, and the pupils for whom passive consent was obtained constituted the sample. Participation was voluntary and anonymous, and the pupils were free to withdraw at any stage.

Data were collected in September 2008 in Norway and in May 2009 in Iceland, in accordance with the suggestion that the observations should be conducted in spring or fall in order to control for the effect of available daylight (Chan, Ryan & Tudor-Locke, 2006). The weather conditions during the test weeks were much the same: some hours of daylight, little wind, some rain and temperatures between 12–15 degrees.

The pupils were informed about the study and they familiarized themselves with both the activity diary and the pedometers in the week before the project started. This was also intended to counteract the Hawthorne effect (Brannigan & Zwernman, 2001) that might arise when pupils know their PA level is being monitored.

The participants were instructed on how to wear and use the pedometers. For example, they were told not to shake them, to put them on every morning and wear them throughout the day, and take them off at bedtime. The researchers also instructed participants on how to fill in crosses in the activity diary for every ten minutes of PA (*Figure 1*). The pupils were to have the form at hand both at school and at home. At bedtime, each pupil was to record in the activity diary both the total number of crosses and the total number of steps counted. Every morning at school, the teacher checked that the pupils had filled in the form. The activity diary was returned to the teachers the first schoolday in the following week. The data collection procedures were identical at both schools and the protocols were identical.

### Instruments

Self-reporting of PA is widely used when conducting field-based research because it is inexpensive and easy to administer (Sallis, 1991). However, children have problems recalling their past activity behavior (Baranowski, Dworkin, Cieslik, Hooks, Clearman, Ray, & Nader, 1984; Pate, 1993), and the method does not include objective measurements of PA. The use of multiple approaches overcomes this shortcoming and strengthens the validity of the reports, so both pedometers and activity diaries were used in this study.

### Pedometers

Pedometers and other motion sensors are often used in field research because they store information on step counts with virtually no inconvenience, they are easy to use and they represent a cost-effective, valid and reliable alternative that provides a summary of PA throughout the entire day (Freedson & Miller, 2000; Tudor-Locke & Bassett, 2004; Hart, Brusseau, Kulinna, McClain & Tudor-Locke, 2011).

The pedometers used in this study were specially designed for The Norwegian Heart and Lung Patient Organization for their *Every Step Counts* campaign in 2006. A study examining potential differences between sealed and unsealed pedometers had found no significant difference (Ozdoba, Corbin & Le Masurier, 2004). Therefore, we decided to use unsealed pedometers, since they were easier to obtain and less expensive.

### The activity diary

The activity diary was a modified version of an activity diary designed and used in the Norwegian PA campaign: *Around Norway in 21 days*, organized in 2003 by The Norwegian Sports Association and the Norwegian Olympic Committee. Since the results of this campaign have not been published scientifically, we validated our modified activity diary by using a group of 12-year-old pupils who registered their PA in an activity diary for one day. The Icelandic version was translated into Icelandic by a native speaker. In the activity diary, the pupils had to fill in all their physical activities: walking to school, cycling to school, Physical Education, Outdoor Education, recess, exercise in sports clubs, play and other leisure time activities, leisure time walks and other PA (Figure 1). In the activity diary, the pupils were also asked to fill in the registered pedometer step counts for each day. The activity diary was piloted prior to the research in order to control the validity and the reliability. The pupils in our study had to register their activity in the activity diary for a whole week prior to the start of the study. The result of the pilot made us confident that the activity diary was useful for this purpose.

School									
Class:									
Name(code/boy or girl)									
Week number	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total	
X = 10 minutes physical activity									
Example	XX	X	XXX	XXX	XXXXX	XXX	XXXXXXXX		
Walk to school									
Cycle to school									
Physical Education									
Outdoor Education									
Activity during recess									
Exercise in sports club									
Play and other leisure time activities									
Leisure time walks									
Other physical activity, specify									
Total crosses daily									
Total step counts from pedometer daily									

Figure 1 – The Activity Diary in which pupils had to fill in an X for each 10 minutes of physical activity.

### Data Analyses

The descriptive analyses of the data include statistical means and standard deviations (SDs), and percentage of participants. Pedometer step counts and minutes spent on different activities were averaged across the days for each participant, except for the ana-

lysis of the pupil percentages participating in various activities and the total measure of at least 60 minutes of daily PA. Independent sample t-tests were used to compare the differences between schools. The analyses were performed using *SPSS 21.0* (SPSS, Inc., Chicago, IL).

### Human subjects Approval Statement

The Data Protection Office for Research was contacted and no sensitive personal data were collected. This study is not subject to notification.

### Results

When the data on pupils' step counts for one week were registered, they revealed no significant differences between pupils in the Norwegian and Icelandic case schools (*Table 1*). When the mean daily pedometer step counts registered in the activity diaries and standard deviations were calculated for the first two days of the week, the results were similar.

<b>Table 1 – Daily physical activity using pedometers</b>			
<b>Pedometer step counts</b>	<b>Norwegian school (n=44)</b>	<b>Icelandic school (n=37)</b>	<b>P-value</b>
One week registration	13,826 ± 5,293	15,102 ± 6,651	P = 0.36
Girls	13,719 ± 4,989	12,803 ± 5,033	P = 0.57
Boys	14,112 ± 6,325	16,670 ± 7,252	P = 0.40
Two-days registration	15,131 ± 5,299	17,253 ± 6,668	P = 0.14
Girls	14,810 ± 4,240	16,261 ± 6,908	P = 0.41
Boys	16,025 ± 7,790	17,930 ± 6,575	P = 0.59

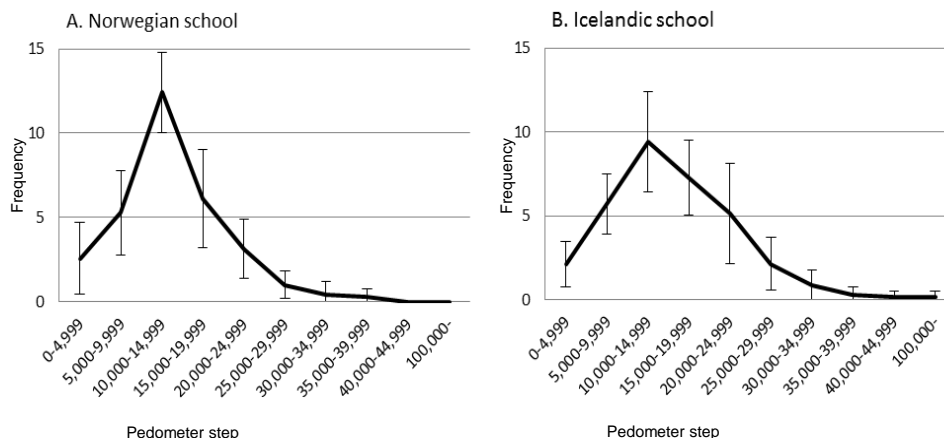
The table shows daily pedometer registrations presented as mean ± SD. The data were assembled as a self-reported daily pedometer registration for one week. The results are shown for one week and for the first two days of the study week.

It was also of interest to investigate whether there were any differences between pedometer step counts on weekdays and weekends. As *Table 2* reveals, there were no significant differences here between the Norwegian and Icelandic case schools.

<b>Table 2 – Daily physical activity using pedometers during weekdays and weekend</b>			
<b>Pedometer step counts</b>	<b>Norwegian school (n=44)</b>	<b>Icelandic school (n=37)</b>	<b>P-value</b>
Weekdays (Monday to Friday)	14,126 ± 5,016	15,943 ± 6,236	P = 0.30
Girls	13,980 ± 4,712	13,789 ± 5,442	P = 0.91
Boys	14,523 ± 6,023	16,655 ± 6,590	P = 0.39
Weekend (Saturday to Sunday)	12,364 ± 7,618	15,103 ± 11,514	P = 0.28
Girls	12,610 ± 7,616	10,787 ± 5,722	P = 0.46
Boys	11,653 ± 8,101	18,403 ± 13,749	P = 0.21

The table shows daily pedometer registrations presented as mean ± SD. The data were assembled as a self-reported daily pedometer registration for one week. The results are shown for weekdays and for the weekend.

The standard deviations for the results presented in *Tables 1* and *2* were high, indicating high variations in the pedometer step counts among the pupils. This is confirmed in *Figure 2*, which shows the variation in pedometer step counts. However, the peak of reported pedometer step counts is also obvious and corresponds to 10,000 – 14,999 step counts for the pupils of both the Norwegian and the Icelandic schools (*Figure 2*).



**Figure 2 – Average frequency distribution of pedometer step counts for one week at the two case schools, shown as an average with standard deviations**

When the pupils from the Icelandic and the Norwegian case schools reported their daily PA for two days in the activity diary, the school-related PA was mainly achieved during recess, and the leisure activity was mainly exercise in sports club, play and other leisure time activities and leisure time walks (*Table 3*).

Although the total self-registered PA did not differ significantly between the pupils in the Norwegian and the Icelandic case schools, *Table 3* reveals that the Norwegian pupils reported a significantly higher daily PA from walking or cycling to school than the Icelandic pupils. In addition, during recess the Norwegian pupils reported a higher daily PA compared to their Icelandic counterparts (*Table 3*). During leisure-time activities, however, there was no significant difference between the two groups of pupils.

Although there were no significant differences in any of the leisure time activities between the Norwegian and the Icelandic schools when the results for girls and boys were combined (*Table 3*), there were significant differences in leisure time activities when the results for girls only were investigated. *Table 4* reveals that girls in the Norwegian school reported a significantly higher level of exercise in sports clubs and a significantly lower level of leisure time walks compared to girls from the Icelandic school. These differences between the two schools were not evident when the results from boys' activity diaries for leisure time activities were compared (*Table 5*). The higher PA-level during active transport to school in the Norwegian school compared to the Icelandic school was, however, still evident when the data were separated into girls and boys (*Tables 4* and *5*). The higher PA level during recess in the Norwegian school than the Icelandic school was mainly linked to a significantly increased PA level among the Norwegian girls (*Tables 4* and *5*).

As the results presented in *Tables 3* to *5* indicate, there were large variations in the registered PA between pupils, and so it was of interest to view the frequency distributions of scores for the various PAs measured. The frequency distributions presented in *Figure 3* show different distributions of scores depending on the PA presented. For instance, *Figure 3A* shows that most of the boys and girls at the Norwegian school reported that they had spent 10-20 minutes walking or cycling to school. In contrast, the reports of the pupils

<b>Table 3</b> <b>Pupils' self-reported registration of school- and leisure-related activities using an activity diary for two days</b>			
<b>Daily physical activity (minutes)</b>	<b>Norwegian school (n=44)</b>	<b>Icelandic school (n=37)</b>	<b>P-value</b>
Total activity	144 ± 50	139 ± 125	n.s.
Activities at school or to/from school			
Walk or cycle to school	17 ± 10	7 ± 6	P < 0.01
Activity during recess	48 ± 8	34 ± 28	P < 0.01
Leisure time activities			
Exercise in sports clubs	31 ± 30	31 ± 53	n.s.
Play and other leisure time activities	33 ± 29	39 ± 75	n.s.
Leisure time walks	7 ± 13	23 ± 52	n.s.
Other physical activities			
	7 ± 21	10 ± 24	n.s.

The table shows daily physical activities in minutes presented as mean ± SD. The data were assembled as a self-reported registration of physical activity for two days. Significant differences between schools are denoted as P < 0.01 and P < 0.05 and n.s. for non-significant differences.

<b>Table 4</b> <b>Self-reported registration of school- and leisure-related activities of girls using an activity diary</b>			
<b>Daily physical activity (minutes)</b>	<b>Norwegian school (n=44)</b>	<b>Icelandic school (n=37)</b>	<b>P-value</b>
Total activity	146 ± 42	144 ± 159	n.s.
Activities at school or to/from school			
Walk or cycle to school	19 ± 10	9 ± 6	P < 0.01
Activity during recess	49 ± 6	29 ± 22	P < 0.01
Leisure time activities			
Exercise in sports clubs	33 ± 30	9 ± 25	P < 0.01
Play and other leisure time activities	34 ± 24	64 ± 117	n.s.
Leisure time walks	5 ± 8	44 ± 80	P < 0.05
Other physical activities			
	7 ± 24	4 ± 8	n.s.

The table shows daily physical activities for girls in minutes presented as mean ± SD. The data were assembled as a self-reported registration of physical activity for two days. Significant differences between schools are denoted as P < 0.01 and P < 0.05, and n.s. for non-significant differences.



**Table 5**  
**Self-reported registration of school- and leisure-related activities of boys using an activity diary**

Daily physical activity (minutes)	Norwegian school (n = 44)	Icelandic school (n = 37)	P-value
Total activity	139 ± 64	135 ± 100	n.s.
Activities at school or to/from school			
Walk or cycle to school	14 ± 9	5 ± 7	P < 0.01
Activity during recess	45 ± 10	38 ± 31	n.s.
Leisure time activities			
Exercise in sports club	28 ± 29	44 ± 60	n.s.
Play and other leisure time activities	31 ± 37	24 ± 27	n.s.
Leisure time walks	11 ± 19	10 ± 18	n.s.
Other physical activities	9 ± 17	14 ± 31	n.s.

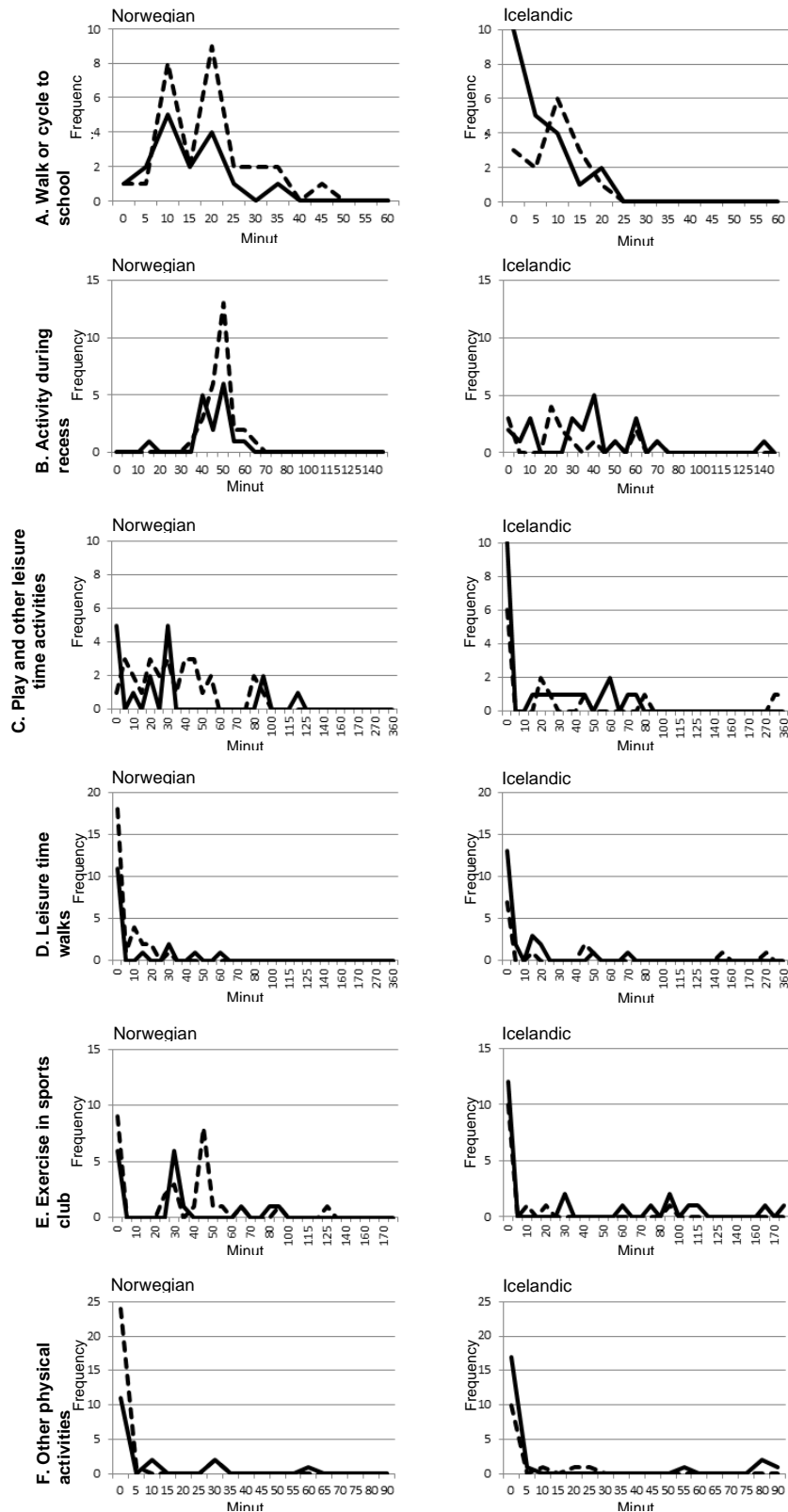
The table shows daily physical activities for boys in minutes presented as mean ± SD. The data were assembled as a self-reported registration of physical activity for two days. Significant differences between schools are denoted as P < 0.01 and P < 0.05, and n.s. for non-significant differences.

at the Icelandic school showed that most of the girls spent 10 minutes walking or cycling to school, while the majority of the boys were not physically active during transport to school. Another interesting difference between the two case schools was the difference in the frequency distribution of PA during recess. *Figure 3B* reveals that, while the majority of both boys and girls at the Norwegian school were physically active for 30–60 minutes during recess, the distribution pattern was more variable for pupils at the Icelandic school and they were physically active for a shorter time. *Figures 3D, E and F* show that many of the pupils were less physical active in leisure time.

According to *Figures 3C–3F*, it seems that a large number of pupils don't do each leisure time activity. Within the Norwegian sample group, 63% of the pupils participated in none or only one of the leisure time activities shown in *Figure 3C–3F*. The equivalent number for the Icelandic sample group was 74% (data not shown). The inactive pupils therefore tend to be the same individuals across activities.

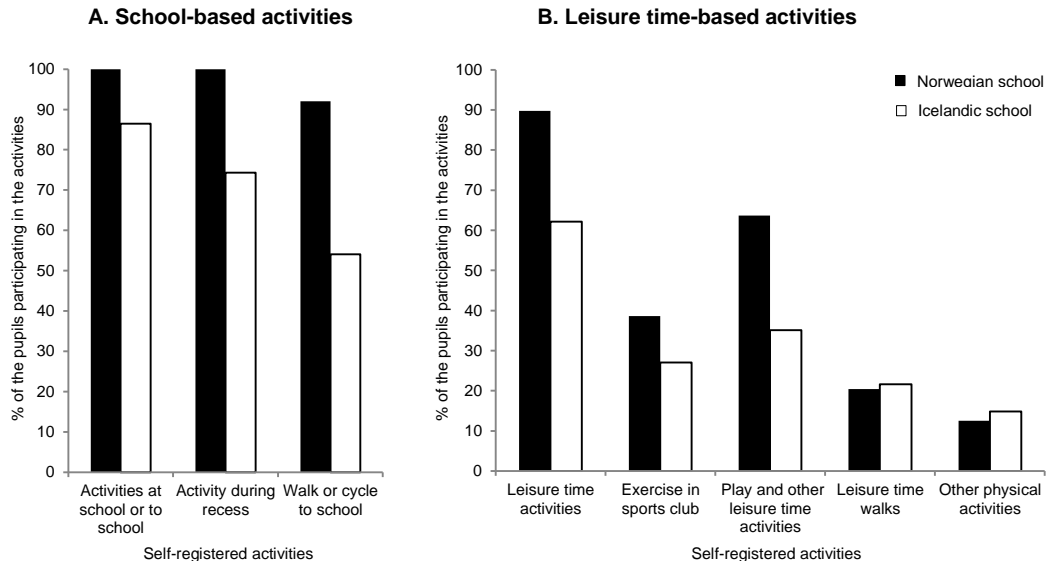
During the two days of self-registration, the sample group from the Norwegian school reported that they were active at school, including during recess, and around 90% of them reported that they walked or cycled to school (*Figure 4A*). In contrast, only 75% of the sample group from the Icelandic school reported any activities during recess for these two days, and almost half of them did not walk or cycle to school on those days (*Figure 4A*). Similarly, a higher percentage of the Norwegian sample group seemed to be active in their leisure time compared to the Icelandic sample group. This is illustrated in *Figure 4B*; 90% of the pupils from the Norwegian sample school reported that they were active during leisure time, while only 65% of the Icelandic sample group was active during leisure time.

Netla – Veftímarit um uppeldi og menntun



**Figure 3 – Frequency distribution of activity scores achieved from the diaries from the two case schools: A) walk or cycle to school, B) activity during recess, C) play and other leisure time activities, D) leisure time walks, E) exercise in sports clubs, and F) other physical activities. The dashed line represents girls and the solid line represents boys at the two sample schools. The data were assembled as the mean of different self-reported physical activities for two consecutive days at a Norwegian (n = 44) and an Icelandic school (n = 37).**

Comparison of the Physical Activity of 11–12 Year Old Pupils in Two Schools in Norway and Iceland, using Pedometer Registrations and Activity Diaries



**Figure 4 – The percentage of pupils reporting participation in various: (A) school-based, and (B) leisure-based activities in their activity diaries during the two-day registration period. The number of activities registered during the two days were n = 88 for the Norwegian school (i.e. 44 pupils), thereof 56 registrations for girls and 32 registrations for boys; and n = 74 for the Icelandic school (i.e. 37 pupils), thereof 30 registrations for girls and 44 registrations for boys.**

The bars representing physical activity during school time (*Figure 4A*) and leisure time (*Figure 4B*) in the Norwegian case school compared to the Icelandic case school, indicate that a higher percentage of Norwegian pupils achieved the recommended level of daily PA, both when measured as minutes of PA and as pedometer step counts (*Table 6*).

Table 6 – Percentage of recommended pedometer-based and duration-based levels of physical activity		
Measurement of physical activity	Norwegian school (n = 44)	Icelandic school (n = 37)
Pedometer step counts for two days		
All	74%	73%
Girls	80%	80%
Boys	56%	68%
Pedometer step counts for one week		
All	68%	49%
Girls	74%	47%
Boys	50%	50%
Activity of at least 60 minutes for two days		
All	100%	78%
Girls	100%	73%
Boys	100%	82%

The table indicates the percentage of pupils that achieved the recommended activity levels of 60 minutes of daily total physical activity, or at least 12,000 (girls) and 15,000 (boys) pedometer step counts.

When looking only at the group of pupils reporting to meet the standard of at least 60 minutes of PA, the results reveal that, of those pupils who achieved the recommended daily level of PA, the Norwegian pupils were active for an average of 151 minutes while the Icelandic pupils were active for an average of 203 minutes (*Table 7*). The significantly higher level of self-reported PA among these Icelandic pupils was due to a more pronounced PA during leisure time (*Table 7*). It is interesting to note that, although these Icelandic pupils reported a higher total PA during the two days of registration, their Norwegian counterparts spent more time walking or cycling to school (*Table 7*). Given the higher self-reported daily PA among these Icelandic pupils, it was not surprising that their daily pedometer step counts were also significantly higher (*Table 7*).

<b>Table 7 – Self-reported physical activity levels of pupils reporting at least 60 minutes daily and their daily pedometer measurements during the two-day registration</b>			
<b>Daily physical activity (minutes)</b>	<b>Norwegian school (82 registrations)</b>	<b>Icelandic school (56 registrations)</b>	<b>P-value</b>
Total activity	151 ± 67	203 ± 165	P < 0.05
Activity at school or to school	66 ± 17	75 ± 37	n.s.
Walk or cycle to school	18 ± 11	8 ± 7	P < 0.01
Activity during recess	48 ± 12	41 ± 29	n.s.
Leisure time activities	85 ± 63	128 ± 154	P < 0.05
<b>Daily physical activity (step counts)</b>			
Pedometer	14,938 ± 6,792	17,486 ± 7,529	P < 0.05

The table shows daily physical activity in minutes presented as mean ± SD for the pupils who had reported at least 60 minutes total daily physical activity. The data were assembled in a self-reported registration of physical activity for two days. There were 44 pupils at the Norwegian school and 37 pupils at the Icelandic school, and the data consist of 0 to 2 registrations per pupil during the two registration days. Significant differences between schools are denoted as P < 0.01 and P < 0.05 and n.s. for non-significant differences.

## Discussion

In this study to investigate and compare the PA levels during school and leisure time of 81 pupils from one Icelandic and one Norwegian school, several interesting findings were derived from the pedometer step count data. For example, the study revealed that the pedometer step counts for both the Norwegian and the Icelandic girls were in line with the recommendations of 12,000 steps/day (Tudor-Locke et al., 2004) (*Table 1*). However, the Norwegian boys had a mean of only 14,112 steps per day during the registration week, while the Icelandic boys' pedometer step counts were in line with the recommendations for boys, which is 15,000 step counts (Tudor-Locke, Pangrazi, Corbin, Rutherford, Vincent, Raustorp, Tomson & Cuddihy, 2004). These figures are in accordance with those of Tudor-Locke, McClain, Hart, Sisson and Washington (2009), who found a range of weekday step counts ranging from approximately 12,000–16,000 steps per day for boys and 10,000–14,000 for girls.

During weekends, the corresponding values were 12,000–13,000 steps per day for boys and 10,000–12,000 for girls (Tudor-Locke et al., 2009) *Table 2* and *Figure 2* reveal that our results are also within these ranges. Interestingly, Icelandic boys tended to have an

increase in step counts at the weekend compared to the weekdays (*Table 2*). In contrast, the girls from both Norway and Iceland and the Norwegian boys tended to have lower step counts at the weekend. This is in line with the results of Tudor-Locke et al. (2009) regarding the lower step counts on weekends found in studies from Australia and the USA. Therefore our findings are not just within a Nordic range. During the one week registrations of pedometer step counts (*Table 1*) the mean results revealed that the Norwegian pupils, who had a PE lesson, had a lower pedometer step count than the Icelandic pupils, who did not have a PE lesson. This is interesting and actualizes a need for more research about PE lesson contribution to pupils' overall PA.

The relationship between the pedometer records and the PA registration in the activity diary revealed a number of interesting differences between the two sample groups. During the two days of both pedometer and activity diary registrations, there were no PE lessons in the two schools. Therefore, the registered PA was engaged in voluntarily. The recorded pedometer step counts were in accordance with the self-reported two-day registrations of PA in the activity diaries for both the Norwegian and the Icelandic pupils (*Table 3*). Although there was no significant difference in the pedometer registrations for the two groups during these two days (*Table 1*), the Norwegian pupils were physically active at school for a longer period, according to their activity diaries. This was due to the significantly greater amount of time spent walking or cycling to school and to activities engaged in during recess (*Table 3*).

Our findings showed that the Norwegian pupils, even when controlled for gender (*Tables 4 and 5*), spent more time walking or cycling to school than their Icelandic counterparts. This is of importance since Cooper, Andersen, Wedderkopp, Page and Froberg (2005) found that elementary-school children who walked to school had higher PA levels than those who were driven to school. These data are in agreement with the findings of Duncan, Scott Duncan and Schofield (2008), who conclude that encouraging pupils to walk and cycle to and from school appears to be an effective way to increase weekday steps. In addition, Tudor-Locke et al. (2005) found that children usually biked or walked to school because they lived nearby and because they enjoyed the exercise. Those who did not bike or walk to school mentioned traffic concerns and personal safety issues as the reason for taking the bus or being driven by parents (Tudor-Locke, 2005). Since the opportunities to get to school under their own volition were similar in the two case schools, the differences in our results were surprising. Further studies would be required to determine whether or not these same factors influence the different patterns exhibited by the Norwegian and Icelandic groups. In the present study most of the participants from Norway were physically active and the average activity level was not skewed by a few extremely active pupils. For the Icelandic pupils the pattern is different and the results indicate that the activity level seems to be skewed by some pupils.

Recess is an unstructured block of time that is scheduled at regular intervals in the elementary school timetable. It can make a valuable contribution to pupils' daily PA level. Elementary schools in both Norway and Iceland have a recess after lunch and one or more additional recesses during the school day. In spite of the fact that these recess periods are similar, the Norwegian pupils spent more school time in physical activity than their Icelandic counterparts (*Table 3*). When divided by gender, these results were especially pronounced for the Norwegian girls (*Tables 4 and 5*). A possible explanation of the difference between the countries may be the fact that the Norwegian government has focused on increased PA in schools for the last ten years in a project entitled *Physical activity and meals in schools* (Samdal et al., 2008). The project has encouraged schools to facilitate more PA during the whole school day and not only during recess periods (Samdal et al., 2008). Although only a limited number of schools participated in the pro-

ject, the results of the follow-up study have been referred to in the media and in professional journals. It is possible, therefore, that the Norwegian school that participated in our study had been influenced by the attention drawn to the *Physical activity and meals in schools* project (Samdal, Leversen, Torsheim, Manger, Brunborg & Wold, 2008), which may explain the higher level of PA measured for the Norwegian pupils compared to the Icelandic pupils. It is also possible that the differences between PA levels the Norwegian and the Icelandic groups during recess may be attributed to cultural differences.

Our results on PA during recess are in agreement with other studies of the amount of time spent on PA during recess, which range from 20% to 50% (Beighle et al., 2006; McKenzie, Sallis, Elder, Berry, Hoy, Nader, Zive & Broyles, 1997; Mota et al., 2005; Ridgers, Stratton & Fairclough, 2005). Recess is one of the periods at school in which pupils can choose to be physically active. Erwin, Abel, Beighle, Noland, Worley and Riggs (2012) recently published a study which revealed that a 15-minute recess accounted for 17–44% of step counts during the school day, and argued that the increased emphasis on academic achievement should not be at the expense of opportunities for PA at school (Ommundsen, 2013).

During leisure time, the children have many opportunities to be physically active in a variety of different activities. In this study, there were generally no differences between the Icelandic and Norwegian groups with regard to play and other leisure time activities (*Table 3*). However, when divided by gender, it was evident that the Norwegian girls spent significantly more time on exercise in sports clubs (*Table 4*). In contrast, the Icelandic girls spent significantly more time on leisure walks than the Norwegian girls. The large standard deviations for the different leisure activities in our study indicate that the amount of time spent on leisure activities varied greatly between participants. This may be attributed to the availability of recreation facilities locally. According to Hardman, Horn and Rowlands (2009), the out-of-school environment should be a focus for activity interventions for pupils who are less physical active.

In this study, the percentage of pupils who reported that they were physically active for at least 60 minutes daily seemed to be higher in the Norwegian sample group (100%) than in the Icelandic (78%) (*Table 6*). However, when the results for the pupils who met this standard were analyzed, it was evident that the Icelandic pupils in this category were physically active for several more minutes per day than their Norwegian counterparts (*Table 7*). This is in accordance with the significant tendency for the Icelandic pupils in general to have higher pedometer step counts (*Table 7*). A Nordic report (Rasmussen et al., 2012) supports these findings, and shows that the time spent on PA differs among Nordic countries, with Iceland and Finland having the most physically active children and Norway and Sweden the least physically active. The average number of minutes spent on PA for pupils in the sample groups who meet the standard for daily PA is higher for the Icelandic pupils, 203 minutes, compared to the Norwegian pupils' average of 151 minutes. Interestingly, the results show that there were fewer pupils in Iceland contributing to the higher average number of minutes of PA. This may indicate that pupils in Norway are being increasingly socialized into a culture in which physical activity is common, compared to their Icelandic counterparts. This is probably linked to the way the school day is organized in Norway, where there is a culture for outdoor learning activities, and the pupils are not confined to the classroom (Gronningsaeter, Hallas, Kristiansen & Naevdal, 2007).

## Conclusions

In this study, the PA levels during both school and leisure time have been compared for children at two schools, one in each of Norway and Iceland. The aim was to look for dif-

ferences between Norwegian and Icelandic 11–12-year-old pupils with regard to their PA levels and where the PA takes place.

The findings revealed that pupils in the Norwegian case school were more active during recess and in getting to school on their own compared to the Icelandic pupils. These differences were less clear for the leisure activities, but when controlled for gender, it was evident that the physical activity of the Norwegian girls involved more exercise in sports clubs, while that of the Icelandic girls involved more leisure time walks. A closer examination of the findings for the pupils that met the PA recommendations of at least 60 minutes per day revealed that the Icelandic pupils had a higher total PA level as well as higher pedometer step counts than the Norwegian pupils.

In terms of the study's limitations, it would have been an advantage to measure the intensity of the PA, for example using a heart-rate monitor, in order to obtain a more complete picture of the participant's PA. In addition, a wider sample might have been included since this study is limited to only 81 participants from just two case schools, which limits the generalizability. This is further limited by the fact that the data-collection period was only a few days in one season (autumn in Norway and spring in Iceland). Further studies in this field are needed that use multiple data sources and focus on the various activities engaged in at school (including recess) and leisure.

This study could open the door for more research in the field of comparative PA assessment. Follow-up studies are needed. Our results imply that it is important to gain even more detailed knowledge of the PA behavior of Icelandic and Norwegian pupils in order to identify when they are most active during the day, as well as what role schools can play in increasing PA.

## Implications for school health

In the Nordic Ministry Council, the goal is that all children from 1–12 years of age and at least 85% of adolescents 12–16 should be physically active for at least 1 hour per day by the year 2021 (Nordic Council of Ministers, 2006). A common strategy should be to take advantage of the opportunities pupils have to be more physically active during the school day. To increase our knowledge of this field, further study is necessary, involving larger groups of pupils, extended over longer periods of time and including a wider variety of schools situations. Only then will it be possible to draw firm conclusions about when children and young people are physically active during the day and about the role schools can play in meeting the Nordic standard of an hour of daily PA.

In schools, it is possible to have an impact on the lives of all children from an early age. The results of this study indicate that walking or cycling to school every day is important for the pupils' activity level. In addition, it seems that an increase in PA throughout the whole school day may be an area in which effort may be rewarded. Such an increase in the PA level at school may form habits that are maintained during leisure time, and thereby make a substantial contribution to higher overall levels of PA. In order to achieve this, all children must be included in PA and motivated to participate, and not just those who have already acquired good PA habits.

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#### **Key words**

*physical activity – Norway – Iceland – pedometer – activity diary – school time – leisure time*

### Um höfunda

Björg Oddrun Hallás (boh@hib.no) er dósent í íþróttakennarafræðum við Íþróttta- og íþróttakennaradeild á Menntavísindasviði Björgvinjarháskóla í Noregi. Rannsóknir hennar beinast einkum að íþróttakennslu, hreyfingu, lýðheilsu og útikennslu í skólum. Hún leiðir rannsóknarhóp um menningaruppeldi á vettvangi náttúrunnar.

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### Efnisorð

*hreyfing – Noregur – Ísland – skrefamælir – hreyfidagbók  
– skólatími – tómstundir*



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