

Physical activity level of kindergarten staff working with toddlers and older children in Norway

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Abstract.

Background: Research suggests that one-third of Norwegian adults satisfy national health recommendations for physical activity, but little knowledge exists regarding activity levels in different occupations.

Objectives: This study investigates the level at which kindergarten staff fulfil these health recommendations, and examines differences in physical activity levels of staff working mainly with toddlers (1–3 years) and older children (4–6 years). The study also investigates physical activity level during working time and leisure time.

Methods: Physical activity levels among 43 kindergarten staff members were measured utilizing accelerometers and questionnaires.

Results: The results demonstrate that 86% of kindergarten staff satisfy the health recommendations for physical activity. Moreover, kindergarten staff working with older children were significantly more physically active than staff working with toddlers.

Conclusions: Physical activity level during working time was found to be of major significance for fulfilling the health recommendations among kindergarten staff working with toddlers.

Keywords: Health recommendations, preschool staff, kindergarten children

1. Introduction

Physical activity constitutes an important factor in preventing early death, cardiovascular disease, high blood pressure, obesity and being overweight, Type 2 diabetes, and some types of cancer [1]. A long-term follow-up study of 3050 twins from the Finnish Twin Cohort has shown that midlife, moderately vigorous physical activity is associated with better cognition

at old age [2]. Physical activity also has a positive effect on physical fitness [3]. An individual's physical fitness is of importance for the ability to carry out day-to-day functions, and physical fitness is therefore critical for people's ability to function. Rothmore and Gray [4] found a link between work ability and a range of physical and psychosocial risk factors, which if addressed, may improve the longevity of the workforce. Furthermore, physical activity during work, f. ex. lifting, walking or running, may promote good health. Work in kindergarten provides good opportunities for physical activity during the working day. This is in contrast to occupational groups sitting

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much of their working day [5]. Miller and Brown [6] found high sitting times among Australian workers are important because it has been estimated that each 2-hr increment in sitting time at work is associated with a 5% and 7% increase in obesity and Type 2 diabetes. The demographic characteristics of the sample included scientists, management staff, office and laboratory workers, as well as cleaners and administrative staff. The clear association between increasing sitting time, occupation and lower daily step counts among this sample of working adults, suggests that those whose daily work involves long hours of sitting should be the focus of efforts to promote physical activity both within and outside the workplace. In Norway in 2014, the national guideline for adults was at least 21.4 min of moderate and/or vigorous activity (MVPA) per day [7]. A Norwegian study showed that 35% of women and 28% of men in the 20–64 age group satisfied these health recommendations for daily physical activity [1]. However, little is currently known about the activity levels of different vocational groups – including kindergarten staff. In Norway, research in this area is particularly scarce: a study by Hoel and øren [8] demonstrated that carpenters had a daily MVPA of 38 min, while the corresponding number for academics was 29 min. Due to the physically demanding work of kindergarten staff, they arguably have a comparatively higher MVPA relative to more sedentary occupational groups such as office workers; and a large proportion of kindergarten staff fulfil the health recommendations of 150 min of MVPA per week, or 21.4 min daily. Kindergarten staff need to lift and carry, walk around the area in the kindergarten to observe children, and attend excursions or participate physical active play. Staff working with toddlers will also typically lift and carry them. Moreover, helping the children in different situations, such as finding toys, assisting in undressing or dressing them, or helping them if conflicts arise, all involve constant movement. Older children, on the other hand, uses large areas when they play, such as in chasing and catching games in outdoor areas. In addition, in kindergarten, more free play may be observed as the children age [9]. Working with older children may therefore necessitate more movement from staff, who move to where the play is, participate in games, and play and go on more trips in the neighbourhood.

Working with older children may necessitate more movement from staff, and this may due the high MVPA compared with the Norwegian study showing that 35% of women and 28% of men in the 20–64 age group satisfied these health recommendations for

daily physical activity [1]. Increased physical activity due to work is supported by international research. For example, a study of 55 construction workers showed that 73% of them achieved international health recommendations for physical activity through their work, while 31% satisfied these health recommendations by means of physical activity outside of work [10]. Similarly, Lagestad and Kippe [11] found that 73% of kindergarten staff in their study fulfilled the health recommendations for physical activity through their work; and Ekler, Nagyvaradi, Kiss-Geosits and Csanyi [12] reported that 81% of teachers in their study complied with the international health recommendations for physical activity through their work. These studies indicate that the workplace may constitute a significant arena for physical activity.

The physical activity level of kindergarten staff may differ depending on whether they are working with toddlers or older children [11], and a study by Lagestad and Kippe [11] investigated whether physical activity during working hours contributed to physical activity that satisfied the health recommendations. However, they did not consider in detail whether variations exist in activity level between those who work with toddlers and those who work with older children. Working with older children may require more movement and physical activity for staff, as they have to follow children where their play activity takes them, and participate in play and trips in the neighbourhood with increasingly mobile children. It may also be argued that physically active adults will be good role models for children, by encouraging a physically active lifestyle [13]. One study identified that the preschool staff emphasized the role of being a facilitator and supporter [14]. Furthermore, it seems to be a general agreement among several researchers [14, 15] that positive adult encouragement is especially important when preschool staff participate in children's physical activity. These findings also support the view of Sørensen [16], who suggests that preschool staff should engage in physical activity with children, whereby physical activity is expressed verbally as fun rather than a duty. The preschool educator is responsible for providing activities that give the children positive mastering experiences. Positive adult encouragement might increase children's physical activity through perceived sporting competence [15]. A systematic overview of studies of children's activity levels published between 1986 and 2007, shows that children's physical activity levels increase with age [17].

148 This study will attempt to answer the following
149 three research questions:

- 150 1. What proportion of kindergarten staff comply
151 with the Norwegian national health recommen-
152 dations for physical activity?
- 153 2. To what extent do differences exist between
154 staff working with toddlers and staff working
155 with older children regarding activity levels and
156 compliance with the national health recommen-
157 dations for physical activity?
- 158 3. To what extent do working hours and leisure
159 time contribute to physical activity among staff
160 working with toddlers and staff working with
161 older children, respectively?

162 The rationale for selecting kindergarten staff to this
163 study was to provide new knowledge to our expert
164 area as researcher team, and to the kindergarten them-
165 selves.

166 2. Methods

167 2.1. Sample

168 Participating kindergartens were selected from a
169 list of all 19 kindergartens in the municipality of
170 Levanger in central Norway. Kindergarten staff mem-
171 bers were excluded if they did not work full-time in
172 the seven kindergartens participating in this study.
173 Seven kindergarten were considered as sufficient if
174 everyone accepted to participate - a decision that was
175 supported by the large effect size in the analyses.
176 All 46 kindergarten staff members that had full-
177 time employment were invited to participate, and all
178 accepted. These staff members were informed about
179 the purpose and the procedures of voluntary partici-
180 pation in the study, and all agreed to participate. One
181 participant forgot to attach the accelerometer, one for-
182 got to fill in the questionnaire, one participant became
183 ill during the week that the testing was performed.
184 Thus, 43 participants answered the questionnaire and
185 provided valid accelerometer data. The sample com-
186 prised two men and 41 women; aged: 41.6 ± 10.2
187 years. Seventeen trained as preschool teachers (uni-
188 versity college education), 12 trained as child-care
189 and youth workers (upper secondary school educa-
190 tion), 14 had no training in child-care services, and
191 four had completed lower secondary school only.
192 Twelve participants worked in farm and/or nature and
193 open-air kindergartens; eight worked in music kinder-
194 gartens; and 23 worked in kindergartens without any

195 particular profile. Management at each kindergarten
196 consented for the study to be conducted at their
197 respective sites. The participants were fully informed
198 about the protocol before participating in this study,
199 and agreed to participate. Ethics approval to use the
200 data and conduct the study was given by the Norwe-
201 gian Social Science Data Services (NSD).

202 2.2. Measures

203 The Actigraph GT1M accelerometer was used to
204 measure physical activity levels among kindergarten
205 staff in the municipality of Levanger in central Nor-
206 way. The Actigraph GT1M is valid and reliable tested
207 for testing physical activity levels among adults [18].
208 Accelerometers detect intensity, frequency and dura-
209 tion of adults' physical activity [17], and filter other
210 noises that are not normal human movement [19].
211 Furthermore, accelerometers decrease subjectivity of
212 physical activity measurement [20] and eliminate
213 bias such as social desirability and recall problems
214 [21]. Moreover, validated accelerometers may be the
215 most promising method to capture physical activity in
216 free-living situations [18, 22], because direct obser-
217 vation is imprecise in identifying intensities and level
218 of energy expenditure during physical activity [23].

219 The accelerometer was placed at the participant's
220 right hip, as recommended by Ainsworth, Cahalin,
221 Buman and Ross [24], and the participants were
222 required to wear it daily except during sleep, shower-
223 ing or other water-based activities. Each participant
224 wore an accelerometer for one full week from Mon-
225 day to Sunday night in accordance with procedures
226 for accelerometer measurements of adults in Nor-
227 way [1]. This method has been tested for validity
228 and reliability in measuring physical activity lev-
229 els and satisfying the health recommendations [1].
230 Such a strategy makes it possible to compare the
231 physical activity levels of kindergarten staff MVPA
232 and counts per minute (CPM) with the health rec-
233 ommendations and other population groups. The
234 accelerometer produce a variable (counts) that trans-
235 lates into physiologically interpretable variables.
236 Counts are aggregated post-filtered raw accelerome-
237 ter data that are calculated over 1-minute epochs [25].
238 Hansen et al. [1] recommend 2019 counts per minute
239 as the limit to MVPA. The kindergarten staff also
240 filled in a questionnaire, which included questions
241 about how much they worked with toddlers and older
242 children. The questionnaire included was pilot-tested
243 before the kindergarten staff answered the questions.

2.3. Procedures

Participants were instructed on how to place the accelerometer correctly on the right hip and were told to wear it throughout the day, except when sleeping, showering, or swimming. The accelerometer registered data at 5-s intervals. After the 7 d, the accelerometers were collected from the kindergartens where the participants worked. The data were downloaded into the Actilife program. In accordance with the test protocol [1] 600 min of activity were required for the day to be considered valid, and periods of more than 60 min without activity were omitted. The participants needed at least three valid days of activity to be included in the study. Only workdays were included in the analysis. The limit value for MVPA was defined as more than 2019 counts per minute in accordance with Norwegian population studies [1].

2.4. Statistical analysis

The sample sizes were satisfactory in relation to a two-group comparison using *t*-tests, and *t*-test was appropriate to examine the research question [25], and the Shapiro-Wilk test showed the assumption of normality was met ($p > 0.05$). Three kindergarten staff members worked an equal amount of time with toddlers and older children, and were thus excluded from the analysis of between-group differences in physical activity. The results are presented as mean measurements, standard deviations (SD), and distribution according to percentage. An independent *t*-test was applied to highlight differences in MVPA and CPM relating to kindergarten staff who worked mostly with either toddlers or older children. A paired *t*-test was performed to identify the differences between kindergarten staff activity levels during leisure time and working hours. Chi-square tests were utilized to discern any differences between kindergarten staff members who worked mostly with either toddlers or older children, concerning the proportion who satisfied the health recommendations. The results are presented as proportions (%), mean values, and standard deviations. The effect size was evaluated using η^2 (Eta partial squared), where 0.01–0.06 indicates a small effect, 0.06–0.14 indicates a medium effect, and > 0.14 indicates a large effect [26]. The boundary for significance was set at $p < 0.05$. The statistical analysis was carried out using SPSS software, version 23.0 (SPSS, Inc., Chicago, IL).

3. Results

The questionnaire data revealed that 26 of the staff worked all of the time or most of the time with toddlers (0–3 years) and 15 staff members worked all of the time or most of the time with older children (4–6 years). No significant differences were found in the ages of the kindergarten staff regarding who worked with toddlers or older children.

The kindergarten staff spent 44.8 min (SD = 20.5) daily on activities with moderate to vigorous intensity, achieving 364.2 CPM (SD = 114.1). This standard deviation indicates a large variation in the number of minutes of MVPA among kindergarten staff; 95% spent between 24.3 min and 65.3 min with such intensity daily. Variation in the CPM is also high among kindergarten staff. Eighty-six percent of the kindergarten staff had an activity level that satisfied the health recommendations for daily physical activity (21.4 MVPA). Kindergarten staff working mostly with older children had significantly higher CPM (428) than those who worked with toddlers (324; $t = -3.2$, $p = 0.002$, $\eta^2 = 0.20$). Kindergarten staff working mostly with older children also spent significantly more time in MVPA (55 min daily) than those who worked with toddlers (38 min daily; $t = -3.0$, $p = 0.004$, $\eta^2 = 0.18$). Kindergarten staff who mostly worked with older children complied more with the health recommendations for physical activity, than staff working with toddlers (93% versus 80%). However, this difference was not statistically significant ($\chi^2 = 1.2$, $p = 0.273$). In other words, there was no difference in the proportion of kindergarten staff who met the recommendations for PA, based on the age groups of the children they worked with.

Figure 1 shows the number of minutes of daily MVPA during working hours and leisure time among staff working mostly with toddlers and staff working mostly with older children. There was no difference in the number of minutes of time spent in MVPA during working hours between staff working mostly with older children and staff working mostly with toddlers ($t = -1.4$, $p = 0.171$, $\eta^2 = 0.04$). However, kindergarten staff working mostly with older children spent more time in MVPA during leisure time, compared to those who worked with toddlers ($t = -3.0$, $p = 0.005$, $\eta^2 = 0.19$). There were no significant differences in time spent in MVPA during working hours and leisure time among staff working mostly with older children ($t = 0.89$, $p = 0.389$, $\eta^2 = 0.07$). However, staff working mostly with toddlers spent more time in MVPA during working

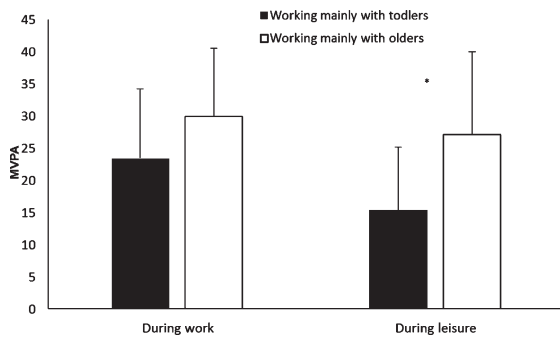


Fig. 1. Mean minutes of daily MVPA during working hours and leisure time among staff working mostly with toddlers and staff working mostly with older children. *Difference in the mean number of minutes of MVPA during leisure between staff working with toddlers and staff working with older children.

hours than during leisure time ($t=4.10$, $p=0.001$
 $\eta^2=0.44$).

4. Discussion

4.1. Physical activity levels of kindergarten staff

The results demonstrate that 86% of the kindergarten staff met the health recommendations of 21.4 min of daily physical activity with moderate and/or vigorous intensity. This is higher than other Norwegian women and Norwegian men. According to a population study of Norwegians [1], 34% of Norwegian women and 28% of Norwegian men in the 20–64 age group satisfied these recommendations. Ninety-five percent of the kindergarten staff in our study were between 30 and 50 years of age, with a mean age of 41.2 years. Data from the Directorate of Health, which are based on a nationwide study of 3267 persons, showed that just under 30% of Norwegian women aged in their 30s and slightly more than 30% of women aged in their 40s met the health recommendations for physical activity [3]. A higher proportion of female participants in our study satisfied the health recommendations for physical activity than Norwegian women in general.

Our study found that the kindergarten staff had a mean MVPA of 44.8 minutes per day that was higher than that reported in a previous study of Norwegian adults [28]. That study found that the mean time spent on MVPA in the 20–64 age group was 34.3 min for women and 36.5 min for men. The kindergarten staff in our study had a higher CPM of 364.2, compared to the CPM for Norwegians in the 20–64 age group (345

for women and 349 for men). The kindergarten staff in the municipality of Levanger, Norway in our study had a higher physical activity level, when compared with the findings of other studies of women and men in Norway and Sweden [28, 29].

If we compare the findings from our study with other occupations that also comprise elements of demanding physical work, kindergarten staff in the municipality of Levanger in our study have similar physical activity level as carpenters [8] and construction workers [10]. A study by Hoel and Øren [8] determined that carpenters and academics had 439 and 332 CPM in a working day, respectively. This shows that the number of counts (364) that kindergarten staff have is higher than academics and much lower than carpenters. One study showed that healthcare workers in hospitals had a mean MVPA of 23.57 min – an activity level substantially lower than that of the kindergarten staff in our study [30]. This is a somewhat surprising finding because kindergarten staff and healthcare workers have similarly physically demanding jobs. However, the authors [30] argued that walking in a patient care unit (which can be argued to be a major physical activity among these health-care workers) is probably not sustained for one minute, which is necessary to be categorized as moderate physical activity by the accelerometer. On the other hand, kindergarten staff take field trips with children and often help children in different situations where they play. This may entail physical activity that lasts for epochs of more than one minute, and may explain the differences in activity levels among kindergarten staff and healthcare workers.

This may indicate that working in a kindergarten, and in other jobs that demand physical activity contributes to satisfying the health recommendations for physical activity. Incidental physical activity throughout the workday reduces sedentary time and increases total physical activity. A relevant question is whether there may be differences in this occupation category depending on whether the staff are working with toddlers or older children.

4.2. Differences in physical activity levels between staff working with toddlers and older children

The results reveal that the kindergarten staff who worked mostly with older children spent more time in MVPA during a full day, compared to those who worked mostly with toddlers. Furthermore, kindergarten staff who worked mostly with older children

also had substantially more CPM (433 counts) than those who worked mostly with toddlers (321 counts). Figure 1 shows that no difference existed in terms of minutes with MVPA during working hours between those who worked with older children and those who worked with toddlers. However, kindergarten staff who mainly worked with older children had more minutes with MVPA during their leisure time than those who worked with toddlers. More kindergarten staff members who worked with older children satisfied the recommendations for daily physical activity compared to staff working with toddlers, even if this difference was not significant. As previously mentioned, kindergarten staff working with older children may have to follow the children where play activity takes them, and also take part in play and field trips in the neighbourhood with increasingly mobile children. Moreover, toddlers tend to sleep more than older children. Thus, it is reasonable to assert that kindergarten staff working with older children have a higher physical activity level during work. This assumption is supported by the findings of Tucker [17] and Reilly et al. [31], that children's physical activity levels increased with age. Three- and five-year-olds had, on average, 818 CPM measured by accelerometer [31]. The three-year-olds spent only two per cent of this time in MVPA, while the five-year-olds spent four per cent of the total time in MVPA. Children aged between 29 and 52 months had a CPM of 667 when playing outside [31]. In comparison, Brasholt et al. [33], found higher physical activity levels among children aged 62-months (877 +/- 233 counts/min).

The absence of large differences in the number of minutes with MVPA during working hours for those who work with older children and those who work with toddlers may be because physical activity is achieved through different physically demanding situations with the children. For example, toddlers typically engage in social actions in which the purpose is to establish contact with other children [33]. The youngest children also tended to use large objects to crawl into, get on top of, and move around in.

4.3. The importance of working time in relation to physical activity level

Extant research has indicated that physical activity during working hours in physically demanding jobs has great importance for an employee's total physical activity and compliance with health recommendations for physical activity [10, 11]. One

study found that physical activity during working hours contributes 65% of total minutes with moderate physical intensity and 29% of total minutes of vigorous intensity physical activity in the course of one day; whereas, physical activity during leisure time contributes 35% of the total minutes with moderate physical intensity and 71% of physical activity with vigorous intensity [10]. Therefore, evidence exists that the workplace may constitute an important arena for satisfying the recommendations for physical activity. 73% of construction workers satisfied the recommendations for physical activity through their work, while 31% fulfilled the recommendations through activities in their leisure time [10]. An other study found that 73% of kindergarten staff met the physical activity recommendations through their work; whereas, 57% did so through activities during leisure time [11]. A study by Ekler et al. [12] showed that 81% of teachers in their study achieved the recommended level through their day-to-day work.

An interesting finding in our study is that kindergarten staff working mainly with older children spent more time in MVPA during their leisure time, compared to those who worked with toddlers. Further studies are needed to investigate whether those who are most physically active in their leisure time also choose to work with older children, as older children are likely to require more physically active kindergarten staff. Staff who worked with toddlers only fulfilled half of their activity recommendations during their time off. This indicates that the focus on more physical activity in leisure time for those who work with toddlers will be important, as this group has insufficient physical activity in relation to the recommendations. Therefore, physical activity when working with children in kindergarten is essential for the contribution it provides to total physical activity in a day.

5. Conclusion

The current study found that 86% of kindergarten staff met the health recommendations for daily physical activity, and that kindergarten staff working with older children spent more time in MVPA during a whole day, compared to those who worked with toddlers. There was no difference in the total time spent in MVPA during working hours, between staff working with older children and staff working with toddlers. Staff working with older children spent

523 more time in MVPA in their leisure time. However,
 524 staff working with older children spent more time
 525 in MVPA in their leisure time, and a greater per-
 526 centage of these staff met the recommendation for
 527 daily physical activity, compared to those working
 528 with toddlers. On the other hand, staff working with
 529 toddlers had a significantly higher activity level dur-
 530 ing working hours than at other times of the day and,
 531 for this group, physical activity during working hours
 532 was essential for fulfilling the recommendations for
 533 physical activity.

534 6. Limitations and strengths

535 The major strength of the present study is that it is
 536 based on objective measurements of physical activi-
 537 ty, which decreases subjectivity [20], and eliminates
 538 bias, such as social desirability and recall problems
 539 [21]. Furthermore, the utilization of accelerometers
 540 is based on high-quality standard procedures, vali-
 541 dated and reliability-tested for researching physical
 542 activity levels for adults. Despite the small sample
 543 size, the effect size was large [27], which indicates
 544 real differences between the groups, and not just ran-
 545 dom variations. Furthermore, the sample sizes are
 546 not equal for the two groups of kindergarten staff
 547 working with toddlers and older children. However,
 548 the sample size in the two groups reflect the nat-
 549 ural distribution regarding work with toddlers and
 550 older children in Norwegian kindergartens. Working
 551 in a kindergarten necessitates a high degree of walk-
 552 ing, lifting, carrying, and physical activity together
 553 with children. Further research should shed light on
 554 how high physical activity levels among kindergarten
 555 staff, combined with ergonomic measures, increased
 556 knowledge and weight training, may have an effect
 557 on staff sickness absenteeism. It is also necessary to
 558 obtain additional knowledge about how the physical
 559 activity level of kindergarten staff influences chil-
 560 dren's physical activity levels. These studies should
 561 also include larger sample sizes than that in the
 562 present study.

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564 KK contributed to the design, and writing the intro-
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 567 discussion, and conclusion.

Conflict of interest

The authors declare no conflict of interests.

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