Routledge
Taylor & Francis Group

Education 3-13

International Journal of Primary, Elementary and Early Years Education

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/rett20

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To cite this article: Pål Lagestad & Karin Kippe (2021): Differences between Norwegian male and female preschool staff physical activity levels and their influence on PA levels of children, Education 3-13, DOI: 10.1080/03004279.2021.2010228

To link to this article: https://doi.org/10.1080/03004279.2021.2010228

Published online: 01 Dec 2021.

EDUCATION 3-13
https://doi.org/10.1080/03004279.2021.2010228

Differences between Norwegian male and female preschool staff physical activity levels and their influence on PA levels of children

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ABSTRACT

The aim of the study was to examine differences between Norwegian male and female preschool staff according to physical activity (PA) levels during preschool hours. Using a mixed-method design, accelerometers were used to examine objectively measured PA level among male and female preschool staff, while observations, interviews and questionnaires were used to support the accelerometer data, and identify patterns related to preschool staff and children's PA. The accelerometer data, observations, and interviews pointed towards male preschool staff as more physically active at preschool than female preschool staff. Observation and interview data further indicated that male staff interacted more than female staff in children's active play. The findings suggest that male preschool staff contribute especially positively according to children's PA in preschool, and that it is important to educate more male preschool teachers.

ARTICLE HISTORY
Received 11 June 2021
Accepted 18 November 2021

KEYWORDS
Staff; sex; differences; preschool; physical activity; accelerometer

Introduction

Physical activity (PA) levels in childhood has been positively linked to PA levels later in life (Telama et al. 2014). However, research has shown that not all children satisfy the health recommendations for PA (Aalto-Nevalainen et al. 2018; Giske, Tjensvoll, and Dyrstad 2010; Gunter et al. 2012; Larsen et al. 2017; Nyström et al. 2018; Reilly 2010). Preschools are an important area for PA, given that 90% of Norwegian children attend a preschool (Statistics Norway 2017), where children engage in most of their daily average PA (Fossdal et al. 2018; Finn, Johannsen, and Specker 2002). Previous research show positive effects of adult-structured activities in preschools (Brown et al. 2009a; De Marco, Zeisel, and Odom 2015; Dencker et al. 2006; Troiano et al. 2012; Trost 2007), and that preschool staff attitudes, encouragement and involvement might increase children's PA level at preschool (Bower et al. 2008; Brown et al. 2009a; Brown et al. 2009b; Gubbels et al. 2011; Mikkelsen 2011). However, gender issues in relation to preschool staff and their PA in preschools, are lacking.

The number of male staff at preschools is continuing to increase globally (Mukuna and Mutsotso 2011; SSB 2018). In 2019, the OECD published a report on good practice for good jobs in early childhood education and care (ECEC), suggesting that more men should be encouraged to work in preschools (OECD 2019). In particular, Norway has implemented significant measures to encourage more men to work in ECEC, making it a country with a high percentage of male workers in preschool. Currently, men account for 9.7% of the basic staff in Norwegian preschools (Digre and Haugberg 2016).

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Previous studies of male preschool staff point to their positive impact on children's confidence, engagement and development at preschool (Besnard and Letarte 2017; Drange and Rønning 2017; Harris and Barnes 2009; Tokić 2018). However, a literature search reveals that a lack of knowledge exists concerning male and female staff's objectively-measured PA level at preschool.

In our work related to PA in Norwegian preschools, we found that preschool staff's PA level affected the children's activity level (Fossdal et al. 2018), and our observations of preschool staff indicated that male staff seemed to be more involved in active play with children, compared to female staff. Those observations led us to the question: are there differences between male and female preschool staff in terms of PA level at preschool?

Previous research – some studies indicating sex differences

A literature search reveals that differences between male and female preschool staff in terms of objectively-measured PA level at preschool, has not been studied in previous research. However, some studies have been conducted related to sex, preschool staff and PA patterns. Sansolios and Mikkelsen (2011) found that male preschool staff initiate PA more frequently than female preschool staff – suggesting the need to explore sex differences. This is in accordance with Harris and Barnes (2009), who found that male preschool staff more often than female preschool staff, were playing physical sports and games with the children. In an interview study, one of the female preschool teachers claimed that male preschool staff were better at organising physical activities, and that boys, in particular, preferred to play with them (Sak, Sahin, and Sahin 2012). Sandberg and Pramling-Samuelsson (2005) reported that male preschool teachers contribute with more playfulness, more play 'willingness', and more physical development during physical and turbulent play, than female preschool teachers. However, all of these findings somehow point toward hegemonic masculinity. Hegemonic masculinity is a relational concept that is produced as the dominant concept that legitimates inequitable hierarchical relations between men and women (Connell and Messerschmidt 2005; Drummond 2003; Tucker and Govender 2017). The universal characteristics of hegemonic masculinities in physical education (PE) are related to strength, speed, muscularity, and competitiveness as being produced as dominant – characteristics that are central in PA and all of the presented studies.

As researchers, we position ourselves within a position that promote gender equality and diversity (Drummond 2003), and argue that there is a need to challenge the hegemonic nature of masculinised PA in every arena – also in preschool. The framing of this study – questioning gender patterns and the hegemonic nature of masculinised PA in preschool, will contribute to the early years field of research.

Previous research indicates that sex may affect preschool staff and their PA level and participation in PA with the children at preschool. According to (Paechter 2019) understanding the gender regime of any setting gives insight into power relations about how specific groups – such as male and female staff, place and position themselves within preschool. According to our review of the research area, no studies have examined differences between male and female preschool staff in terms of their PA level at preschool.

The aim of the present study was to investigate differences between Norwegian male and female preschool staff in terms of PA patterns during preschool hours. The research question for the study was: Are there differences between male and female preschool staff according to their PA level during preschool hours, and their initiative and participation in children's PA at preschool?

Materials and methods

A mixed-method design was used to collect quantitative and qualitative data on male and female preschool staff, and their PA patterns. The quantitative data includes objectively measured PA level and self-reported initiative and participation in children's PA level. The qualitative data

include observations and interviews with the aim of identifying gender roles related to PA patterns with the children. Accelerometers were used to measure objectively PA level among the preschool staff. To be able to examine differences between male and female preschool staff in terms of their initiative and participation in children's PA level, a questionnaire was used. In addition, observations and interviews of preschool staff were performed to observe what actually happened in relation to PA patterns, and to get preschool staff and their experiences and reflections about differences between male and female preschool staff according to their PA at preschool. With such a strategy and combination of research methods, the quantitative and qualitative methods complement each other, and taking advantage of the strengths of each other, giving more robust analysis (Creswell and Clark 2007).

Participants

Independent of size and type of preschool, 13 of the 122 preschools from the region of Nord-Troendelag, Norway, were randomly chosen and invited to participate in the quantitative part of the study. From the 13 preschools, the two criteria for participating in the study were that the staff were full-time in preschool, but also worked mainly with children aged four to six years. All of the 72 preschool staff (57 women and 15 men) that met the criteria in these preschools, agreed to participate. The distribution of the sex among preschool staff reflects the actual sex distribution in preschools in Norway.

To enable examination of gender roles among preschool staff according to PA level in preschool, three of the 13 preschools included in the quantitative part of the study were selected for a case study with observations. A stratified selection using MVPA level of the children in the different preschools was used, and one high active, one middle active, and one low active preschool were selected for the observations (Johannessen, Tufte, and Kristoffersen 2006). Using the same strategy, five preschools with different MVPA level were included for focus group interviews.

The participants received written and oral information about the procedures and ethical standards in the research project, related to the quantitative (questionnaire and accelerometer) and qualitative (interview and observation) data collection, and were informed that the study was voluntary. The preschool staff and the parents of the children signed a written consent form. The study was approved by the Norwegian Centre for Research Data (NSD), ref. 52221 (28 February 2021). Ethical issues according to confidentiality and anonymity were found to be satisfactory by NSD.

Accelerometery

Accelerometers measure intensity, frequency and duration of PA, and also decrease subjectivity, social desirability, and recall problems (Evenson et al. 2008; Plasqui and Westerterp 2007; Sirard and Pate 2001). Actigraph GT1M accelerometers (ActiGraph, Fort Walton Beach, FL, USA) were assessed to objectively measure preschool staff's PA over seven consecutive days, which is recommended by several researchers (Addy et al. 2014; Anderssen et al. 2009; Trost, McIver, and Pate 2005). The Actigraph GT1M is validated and reliability-tested for testing PA levels for adults (Plasqui and Westerterp 2007), and is a standard measure for global health recommendations of PA (Hansen et al. 2014). The accelerometer was placed on the participant's right hip, and the participants were required to wear it every day except during sleep, showering, or other activities involving water (Anderssen et al. 2009; Ainsworth et al. 2015).

Actilife v6.13.3 (ActiGraph, LLC, Pensacola, FL, USA) was utilised for initialising and data reduction. Accelerometers were set to start recording at 06:00 am the day after they were distributed and put on, as an attempt to counteract the Hawthorne effect with higher PA levels the first day of using accelerometers (McCambridge, Witton, and Elbourne 2014). Following the test protocols of Anderssen et al. (2009), the accelerometers were programmed to save data in 60s epochs, where PA higher than 2020 counts (vertical acceleration) per minute (CPM) were considered as moderate or vigorous

activity (MCPA). Valid days required at least 480 min of daily recorded activity (also included sedentary behaviour), whereas, sequences of 60 min or more with consecutive zero counts were interpreted as non-wear time and omitted – all according to the protocol of Anderssen et al. (2009). Furthermore, in accordance with the test protocols of Anderssen et al. (2009), preschool staff were required to have at least three valid days in order to be included in the study. Data between 00:00 am and 05:59 am were excluded due to instructions specifying that accelerometers should not be worn during sleep. Wear-time were categorised as follows: preschool hours (08:00 am–03:29 pm), leisure time on weekdays (06:00 am–07:59 am and 03:30 pm–11:59 pm), and weekends (06:00 am–11:59 pm). Both accelerometer and questionnaire data were collected during five consecutive weeks from the middle of May until the end of June in 2017.

Questionnaires

The questionnaire was designed on the basis of already validated and reliability-tested questions from Anderssen et al. (2009) and HUNT3 (Rangul et al. 2012). Preschool staff were told to fill in the questionnaire at the end of the week, as self-report questionnaires impose demands on respondents' memory and abilities to recall PA (Boon et al. 2018). This study used two of the questions in the questionnaire – one related to age (measured on a ratio level), and a dichotomic variable measuring if the preschool staff were educated as preschool teachers or not. All of the 72 preschool staff had valid data on these questions.

Observations and interviews

The observations took place 08:00 am–15:30 pm, on 2–3 days during spring 2018. In addition, field notes were taken and informal conversations occurred regarding the preschool's habits and activity patterns, in order to obtain additional insight about gender roles in relation to PA. The Environment and Policy Assessment and Observation (EPAO) protocol were used in the observation, where exploring the interactions between the children and preschool staff in every situation that PA took place were a main aim. The EPAO protocol is a tool developed when using direct observation to evaluate the PA environment, policies, and practices in pre-school (Bower et al. 2008). One strength related to the use of the EPAO protocol is the use of direct observation, which is a more valid goal compared to self-reporting (Gubbels et al. 2011). The interviews with employees were conducted as focus group interviews three weeks after the observations, with five employees working mainly with children four to six years of age. The questions asked were related to male and female activity level in interactions with the children, and gender-related field notes according to PA patterns were discussed. The interviews lasted for approximately 4560 min.

Analyses

To examine differences between sex, independent *t*-tests were appropriate to examine the research question in cases in which parametric data were available in the quantitative data (O'Donoghue 2012). The sample sizes were satisfactory in relation to a two-group comparison using *t*-tests, and the Kolmogorov–Smirnov test showed that the assumption of normality was met ($p > 0.05$). The effect size was evaluated by univariate analyses of variance, 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 (Cohen 1988). Mann Whitney *U* tests were utilised when dealing with nonparametric data with three or more reply options, while chi-square tests were used with nonparametric data with few reply options on the independent variables. The level of significance was set at $p < 0.05$. The statistical analysis was performed using SPSS software, version 25.0 (SPSS, Inc., Chicago, IL, USA).

The interviews were transcribed and analyzed with QSR NVivo 10 (QSR, Doncaster, Australia). The analyses were based on transcribed answers focused on meanings, as described by Johannessen,

Tufte, and Kristoffersen (2006). Such an approach is preferred when researchers intend to describe and understand preschool staff's interpretations of a certain phenomenon. Opinions and statements in the text were identified according to gender-related PA patterns in preschool, by concentrated, condensed, coded, and categorised parts of the interview text in units of analysis. In this process, the preschool staff's statements were assigned codes that were classified into categories. The data were sorted based on these categories in order to elucidate patterns, similarities, relationships, or differences between the statements. The main codes turned out to be: 'Male and much PA play', 'female and less PA play', 'children flocking around men', 'few men making them special to children', 'gendered expectations about PA', 'gendered roles', and 'preschool attract PA males'. Various alternatives for interpretation and perspectives were discussed among the three researchers. This strategy contributed to an intersubjective consensus in the analysis, and strengthened the credibility of the findings.

Findings

Quantitative results

Statistical analyses of the descriptive characteristics in Table 1 show that male preschool staff did not differ from female preschool staff in terms of age or preschool education ($p > .05$). However, male preschool staff had 58% higher MVPA than female preschool staff during preschool hours ($t = 3.6$, $p = .001$, $\eta^2 = 0.13$), and also a higher MVPA at leisure time on weekdays ($t = 2.8$, $p = .006$, $\eta^2 = 0.09$), and daily in general ($t = 3.2$, $p = .002$, $\eta^2 = 0.10$), but not on the weekends ($p > .05$). Male preschool staff also had higher CPM than female preschool staff during preschool hours ($t = 2.8$, $p = .006$, $\eta^2 = 0.10$), leisure time on weekdays ($t = 2.2$, $p = .034$, $\eta^2 = 0.06$), and daily in general ($t = 2.6$, $p = .013$, $\eta^2 = 0.09$), but not on the weekends ($p > .05$). Significantly more male preschool staff than female preschool staff met the health recommendations of PA in general ($X^2 = 6.7$, $p = .010$) and during work at preschool ($X^2 = 5.1$, $p = .024$), but not with 10 min bouts and during preschool hours with 10 min bouts ($p > .05$).

Statistical analyses of the descriptive characteristics demonstrate that male preschool staff reported less encouragement to participate in PA by other staff members, than female preschool staff (mean 2.5 (SD 0.8) on a five-point scale and mean 3.1 (SD 0.9), $Z = -2.1$, $p = 0.044$). However, no significant differences were found between male and female preschool staff according to;

Table 1. Descriptive characteristics of male and female preschool staff's age, education, objectively-measured activity level, and fulfilment of health recommendations.

	Men (Mean, SD)	Women (Mean, SD)
Sample size (*n*)	15	57
Age	36 ± 10.9	39.8 ± 10.3
Preschool education (%)	30.8	49.1
Objectively-measured activity level		
MVPA daily in general (min)[a]	44.8 ± 16.6	30 ± 18.1
MVPA preschool hours (min)[a]	26.2 ± 13.9	15.2 ± 11
MVPA leisure time weekdays (min)[a]	23.6 ± 11.6	14.5 ± 12.1
MVPA weekends (min)	27.5 ± 28.9	33 ± 26
CPM in general[a]	470 ± 125	381 ± 118
CPM preschool hours[a]	545 ± 154	425 ± 146
CPM leisure time weekdays[a]	470 ± 225	356 ± 169
CPM weekends	354 ± 214	361 ± 156
Health recommendations for daily PA		
Met (%)[a]	100	64.9
Met during preschool hours (%)[a]	40	12.3
Met with 10 min bouts (%)	36.4	37.7
Met during preschool hours with 10 min bouts (%)	9.1	7.5

[a]Differences between gender with $p < .05$.

initiative to children's PA, participation in children's PA, and reported encouragement to be physically active with the children by other staff members ($p > .05$).

Qualitative results

During the interviews, preschool staff reported that male preschools staff, in general, were more physically active with the children than female preschool staff. This finding was supported by the observation data. During the observations, two men and several children were outdoors. The male staff members were running with a sliding board inside of the fences of the preschool, while the children were partly sitting on the board and partly trying to get on the board. The children were both laughing and running, while the male adult pulled the sliding board over a jump. During the interviews, this incident was discussed by a preschool staff member:

> Yes, I remember it. The children had so much fun. In that case, we [female preschool staff] would have taught them of the danger of such things. We cannot drive with them over that jump – suddenly we would land on top of them.

indicating that such barriers may decrease this type of activity among female preschool staff.

In the field notes, it were reported that the children flocked around the male staff. During the interview, a female preschool staff member supported these observation data: 'If there are male preschool staff at the preschool, the children are stuck fast together with them. If a male preschool staff comes walking in the preschool, the children are around him immediately'. During one of the focus group interviews, a female preschool staff supported this finding, pointing out that the children very often 'flocked' around male preschool staff, and that male preschool staff were very popular among most of the children, stating 'they [males] become very popular. The children become very pleased with them. Somethings happens around them – positive things'. As an explanation of this behaviour, the preschool staff also highlighted that, since there were few male staff at the preschool, the children were not used to dealing with males at preschool, and thus find them exiting. As one of the female preschool staff members stated, 'we are different, males and females. There are many female preschool staff at preschool. Then, it is not very special when a female comes along'. During the observations, another male preschool staff also seems to be very popular outside of the preschool's fences, going up and riding down a hill on sliding boards together with many children. During the interview, one of the female staff referred to this situation: 'As I told you when you were here observing, he [the male preschool staff] runs with them, and it clearly creates activity when he participates in the play. The children find it amazing'. Later during the interview, the female preschool staff explained further:

> The day we saw the male preschool staff running down the hill – I had never run like that you know. No, then I become sweaty. I think a lot about such things. None of us [females] are keeping up like that, running down the hill like an idiot with the children down the hill. Only males do that.

Another female preschool staff member supports the above statement, and claimed that 'it always ends up with running like that. I think it happens all the time'. When a female preschool staff member was asked why it happens, she suggested that this is the play that men like the most, and that 'it is experiences they bring with them from when they were young (…). I see that when male preschool staff are coming, there will be running'. One of the explanations of the more active males was that male preschool staff differed from other men, as a female staff member stated: 'I think men that become preschool teachers, in general, are pretty active. It is active boys that want to play'. The preschool staff also identified gender-related patterns as an explanation of different activity levels, as one female preschool staff claimed: 'Usually, I play the Mama in a role-play we used to play. For males, it is easier to run and play "cops and robbers" – that is a game they [males] are good at'. The observation revealed that the children seemed to prefer being together with the male preschool staff – a finding that that was supported by the interview analysis. When the preschool staff were

asked whether there were different expectations among male and female preschool staff, and whether male preschool staff felt more expectations towards PA with children, a staff member stated:

> Actually, I do not think so. I think they [males] feel like doing it. It is their way to be together with children (…). I think it is very pleasurable – If not, the children would not have participated with them.

However, that many of the male preschool staff enjoy soccer, and are good at it, also leads to PA among children according to the preschool staff, as most children are interested in soccer.

Discussion

The results have identified some main differences between male and female preschool staff and their PA at preschool. The first main finding is that the accelerometer data show that male preschool staff were more physically active than female preschool staff, according to both counts per minute and minutes of MVPA, and at both leisure and at work in the preschool (Table 1). According to Cohen (1988), these differences have medium effects. The finding according to the objective measurements of PA was also supported by both observation and interview data. During the interview, the preschool staff pointed to more physically active male staff than female staff in the preschool. The observation also revealed that every man inside of the preschool fences were busy in physically active play with the children. This was also the case for many female preschool staff, but not all. Even if there were fewer male than female staff in the preschools – and thereby a greater possibility for variation among females, this finding is somewhat in accordance with Sandberg and Pramling-Samuelsson (2005), who during interviews of preschool teachers found that male preschool staff contributed with more playfulness than did female preschool staff, and that male preschool staff accentuated the significance of physical development at preschools more than females. This result is also supported by Sak, Sahin, and Sahin (2012), in which female preschool teachers reported male preschool staff to be better at organising physical activities, and that boys, in particular, preferred to play with them. In a study, Sargent (2005) point that male staff express expectations that they will act as male role models. One distinct form of male role model were the role of the possibility of exposing girls to an alternative and more gentle form of masculinity. Research has shown that not all children satisfy the health recommendations for PA (Aalto-Nevalainen et al. 2018; Giske, Tjensvoll, and Dyrstad 2010; Gunter et al. 2012; Larsen et al. 2017; Nyström et al. 2018; Reilly 2010). Preschool is the most important arena for PA, because children get most of their daily PA during preschools hours (Fossdal et al., 2018; Finn, Johannsen, and Specker 2002). Our findings indicate that male preschool staff contribute especially positively according to children's PA in preschool.

Our findings can be explained by the findings of Sargent (2005). Sargent reported that male staff found themselves caught between engaging in a subordinate form of masculinity and structural demands for them to perform a form of complicit masculinity, that is more supportive of a patriarchal gender regime. Our findings also support a patriarchal gender regime. Sargent (2005) highlights that it may be difficult for male staff to achieve expectations to be physically active with the children, and at the same time operate under structural demands created by female staff. Male staff construction of gender strategies plays contradictory roles in forcing them to manifest sex in ways that ultimately reproduce the patriarchal gender order (Sargent 2005). Also, Brownhill (2014) reported that male role models will present a diverse range of personal and professional qualities and characteristics. Brownhill asserts that male role models are likely to be shaped, not only by the needs and circumstances of the children with which the male staff interact, but also by the expectations of others, e.g. parents and other preschool staff. Indeed, a real tension exists between those qualities and characteristics of male role models that are created as a result of their personality and individual beliefs, and those that are anticipated or enforced by others.

We will argue that the findings that men were more physically active and engages more with children in PA, are two folded. Taking the positive impact of preschool staffs PA level on children's PA level into consideration (Fossdal et al., 2018), men could benefit preschools by supporting children's PA by reproducing their construction of gender strategies according to masculinity and PA. On the other side, according to the equality and diversity among preschool staff, we find the result problematic. In the light of the finding, we argue that there is a need to challenge the hegemonic nature of masculinised PA in preschool. According to Drummond (2003), this can take place when preschool staff have a practical understanding of the critical theories associated with hegemonic masculinities. Knowing that Norway is one of the leading countries to promote gender equality and diversity, such gendered expectations and beliefs that men are more physically active with children that were found in the interviews – and confirmed by the observation and accelerometer data, suggests actions to be taken to challenge those gender stereotypes in early childhood settings, creating a more gender diverse and inclusive ECEC environment. This could be done by challenging the patriarchal gender regime. The fact that educators in Norwegian kindergartens still hold very strong gender stereotypes is very alerting, and promoting both men's and women's participation in physical activities by challenging this 'doxa' (Bourdieu 2000) on a global scale, is of great importance. With such a starting point, this study hopes to challenge rather than reinforce the nature of masculinised PA in preschool.

In his study, Tokić (2018) found that male preschool teachers were intrinsically motivated and viewed this profession as a calling. The results can also be explained by interests of the men that choose to work in preschool, and the fact that PA in nature and generally outdoors plays a significant role in Norwegian preschools (Ministry of education 2006; Bjørgen and Svendsen 2015). Emilsen and Koch (2010) draw the conclusion that men with the opportunity to stay outdoors, feel more freedom to work with children in their own way, without the tradition of caring in a 'mother's home'. Emilsen and Koch (2010) suggest that enhancing the outdoor-sector within the concept of childcare would increase the number of men in early childhood education and care. It could be that men who choose to work in preschool are more physical active than other men. This argument is supported by the fact that the results in the present study show that significantly more male preschool staff than female preschool staff fulfilled global health recommendations for PA, both at leisure and at work in the preschool. However, taking the 10 min bouts into consideration, male preschool staff did not differ from female preschool staff in terms of fulfilment of the health recommendations for PA, neither at leisure nor at work in the preschool (Table 1). The findings indicate that male staff have much shorter periods of activity at moderate to high intensity levels than do female staff. Harris and Barnes (2009) reported that, in preschools, cricket, football, baseball, playing with balls, playing hide and seek, skipping, and dancing were associated with male preschool staff. Such PA may involve shorter periods of activity at moderate to high intensity, and may explain this finding.

The second main finding is that male preschool staff reported less encouragement to be physically active with the children from other staff members, than female preschool staff. This finding may be ascribed to the interview data, indicating that other preschool staff feel that the male preschool staff do not need such encouragement due to their high activity level.

Drange and Rønning (2017) showed that female staff in a childcare centre were more likely to be somewhat older than their male colleagues. Also, the female preschool staff in our study were somewhat older than the male staff, but this difference is not significant (Table 1). However, given the decline in PA and physical performance (Hall et al. 2017) and physical health (McPhee et al. 2016) with increasing age, the age differences in our study could have biased the results. Furthermore, years of experience from working in preschool could also influence the PA level. However, such data were lacking in our study.

Strengths and limitations of the study

The present study includes participants from 13 randomly selected preschools, reflecting a representative sample of preschool staff from different types and sizes of preschools, as well as the actual sex

distribution of preschool staff of four to six year-old children in Norwegian preschools. To the best of our knowledge, this is the first study to objectively assess preschool staff's PA both at preschool and leisure time with accelerometers, while examining sex differences regarding PA patterns. Researchers have argued that validated accelerometry constitutes the most effective method to measure PA in free-living situations (Brage et al. 2015; Plasqui and Westerterp 2007). The Actigraph GT1M is validated and reliability-tested for measuring PA levels for adults (Plasqui and Westerterp 2007). The questionnaire was designed on the basis of already validated and reliability-tested questions. Using a mixed model design, the qualitative findings both support the quantitative findings, but also explain the sex differences.

Nevertheless, the present study is not without limitations. Although accelerometry is considered to be an optimal measurement when assessing PA in free-living situations, it underestimates activities related to cycling, swimming, and riding vehicles (Sirard and Pate 2001). To prevent the Hawthorne effect, the first day of the measurements can be deleted (Dössegger et al. 2014). However, in our data, there were no significant changes in the activity levels between the five days, and the MVPA only differed between 10% between the days. Furthermore, the third day of the five was the day with the highest level of MVPA. These findings indicate that the Hawthorne effect was limited in our study. Moreover, six of the questions about initiation and attitudes towards children's PA were designed for this study, and not based upon already validated and reliability-tested questions. There were considerable fewer men then females in the study. However, all of the male and female preschool staff in the randomly selected preschools agreed to participate, and the gender distribution reflects the natural sex distribution in Norwegian preschools. Furthermore, the study design is applying small samples, especially the qualitative data. Nevertheless, the findings from this preschool concerning activity level, were supported by the quantitative data. Although, a larger number of preschool staff and preschools would have been preferable for increased generalisability and credibility.

Conclusion

To the best of our knowledge, this study is the first to publish objectively-measured PA data about differences between male and female preschool staff's PA level at work. Objectively-measured PA data (accelerometer) during a week demonstrate that male preschool staff were significantly more active than female staff, both at preschool and at leisure time. That male preschool staff were significantly more active than the female staff at preschool is supported by observation data and interview data – even if interview and observation data from only one preschool and few days of fieldwork make these data less reliable, and more participants and a longer fieldwork would have been preferable to conclude. In relation to the previous finding of a positive correlation between preschool staff and preschool children's activity level, the findings suggest that male preschool staff contribute especially positively with their presence in terms of children's PA in preschool, and this highlights the importance of educating and recruiting more male preschool teachers.

On the other side, in light of the findings, we argue that there is a need to challenge the hegemonic nature of masculinised PA in preschool. This takes place when preschool staff have a practical understanding of the critical theories associated with hegemonic masculinities. In of the leading countries to promote gender equality and diversity, such gendered expectations, beliefs and PA patterns related to gender stereotypes in early childhood settings, should be challenged. This could be done by seeking to eliminate gender roles, both at preschools and institutes that educate preschool teachers. Female staff should seek more playfulness and to be more involved in children's physical play, physical sports and physical games at preschool. Furthermore, focusing more upon physical development during physical and turbulent play during preschool education at Universities that educate preschool teachers, is also important. Further research should examine gender patterns between preschool staff's active play with children more extensively, include more preschool staff, and use observations in more preschools.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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