Exploring food environment-related factors in Norwegian kindergartens and their role in vegetable promotion

Anne Himberg-Sundet

PhD Thesis

Department of Nutrition
Institute of Basic Medical Sciences
Faculty of Medicine
University of Oslo

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Summary

Background: Health authorities at all levels have emphasized the importance and the health benefits of increased consumption of vegetables by the population. However, consumption of vegetables still remains far too low. Although many studies have focused on increasing vegetable intake by children aged up to 5 years, there is still limited evidence on *how* to increase vegetable intake. Furthermore, only a few studies have focused on how to make sustainable and supportive changes in the kindergarten environment to promote vegetable intake. In Norway, 91% of all children under the age of 5 spend approximately 41 hours each week in the kindergarten. This highlights the importance of exploring factors in the kindergarten environment that may affect the children's food environment and subsequently their vegetable intake.

Aim: The overall aim for the BRA study (an acronym for the Norwegian words *Barnehage* [kindergarten], *gRønnsaker* [vegetables] and *fAmilie* [family]) was to design, implement and evaluate a multicomponent intervention to increase the vegetable intake of children aged 3–5 years, and to make supportive and sustainable changes in the kindergarten and home environments to promote vegetable intake. This thesis investigates, first, the association of factors in the kindergarten environment (economic, political, physical and social) with the vegetables served and eaten. Second, the effect of the intervention on frequency, variety and amount of vegetables served and the staff's food-related practices are investigated. Finally, associations are explored between workplace climate and culture in the kindergartens and the staff's food-related practices and vegetables served, and also the mediating role of the staff's food-related practices.

Method: The BRA study was a cluster randomized controlled trial, including 73 private and public kindergartens in Vestfold and Buskerud counties (15.2% response rate). A total of 37 kindergartens received a multicomponent programme targeting the kindergarten environment through changing

the employees' practices. Baseline data were collected in the spring of 2015 and follow-up data in the spring of 2016. Paper-based questionnaires (one each for the kindergarten leaders, the pedagogical leaders and the assistants) assessed factors in the kindergarten environment, frequency and variety of vegetables served, and the staff's food-related practices concerning the situations at mealtimes. Furthermore, a 5-day, weighted, vegetable diary was used to assess the amount of vegetables served and eaten.

Main results: The results indicated that the economic environment might be important with regard to vegetables served and eaten, as well as to some factors in the political environment. Few or no associations were found between the physical or sociocultural environments and the vegetables served or eaten.

The evaluation of the intervention showed an increase in the variety of one and a half types of vegetables used per month, in favour of the intervention group. In addition, there was an increase in the amount of vegetables served, an increase of approximately 20 grams per person per day in the intervention group compared with the control group. No significant effects were found for the frequency of vegetables served during the week, or for the kindergarten staff's food-related practices.

Some factors in the workplace climate and culture in the kindergarten seemed to be associated with the staff's food-related practices, and the frequency and variety of vegetables served. A more favourable food-related practice among staff mediated the effect of both *commitment to organization* on the frequency and variety of vegetables served, and *support from a superior* on the variety of vegetables served.

Conclusions: Several factors in the kindergarten's environment seemed to be associated with vegetables served and eaten in the kindergarten. The most important factors seemed to be within the economic and political environments. In addition, a feasible and multicomponent kindergarten-based intervention could increase the variety and amount of vegetables served. Finally, *support from a superior* and *commitment to the organization* seemed to be important factors to target in the kindergarten's workplace climate and culture, when developing kindergarten-based interventions aimed at increasing vegetables served, because they were related to more favourable food-related practice among the staff.

List of papers

The present thesis is based on the following papers:

Paper 1 **Himberg-Sundet, A.**, Kristiansen, A. L., Bjelland, M., Moser, T., Holthe, A., Andersen, L. F. and Lien, N. (2018). Is the environment in the kindergarten associated with the vegetables served and eaten? The BRA study. *Scandinavian Journal of Public Health* **47**: 538-547.

Paper 2 **Himberg-Sundet, A.**, Kristiansen, A. L., Andersen, L. F., Bjelland, M. and Lien, N. (2020). Effects of a kindergarten intervention on vegetables served and staff's food-related practices: results of a cluster randomised controlled trial – the BRA-study. *Public Health Nutritio*n **23**(6): 1–10.

Paper 3 **Himberg-Sundet, A.**, Kristiansen, A. L., Gebremariam, M., Moser, T., Andersen, L. F., Bjelland, M. and Lien, N. (2019). Exploring the workplace climate and culture in relation to staff's food-related-practices and vegetables served. The BRA-study. *PLoS ONE* **14**(12): e0225831.

Preface

During my PhD I worked on a project (BRA-med grønnsaker) that developed, implemented and evaluated a kindergarten-based, multicomponent intervention study to promote vegetable consumption – the BRA study. I was involved in the project from January 2014. At this time point, the project was at the preliminary phase of developing the intervention and its components. During this process I took part in reviewing the literature and participating in meetings with experts in children's eating development. During this phase I became more aware of distal organizational factors, such as workplace climate and culture, and how these might affect how kindergarten employees conduct their work and the outcomes of their intervention. As I participated in the development of questionnaires, I wanted to include measures that assessed the workplace climate and culture in kindergartens. Two Master's students developed and tested the intervention components, led by Professor Nanna Lien. As I had some years' experience of working in kindergartens I used this experience and knowledge as an input into the development of the intervention and the questionnaires.

The post-doctoral student involved with the project, and I, recruited eligible kindergartens in Vestfold and Buskerud counties. We also took turns assisting Professor Lien during the inspirational days we organized to start kick the implementation of the intervention. In 2015, I conducted the baseline data collection in Buskerud county, whereas the postdoctoral student conducted the collection in Vestfold county. Within this large project the focus of my research was the *kindergarten environment*, because few intervention studies targeting children's vegetable intake have moved beyond the individual level, so my thesis would make an important contribution to this field of research. The effects on children's vegetable intake and the home environment were the research focus of the post-doctoral student on the project.

Introduction

Daily consumption of a sufficient amount of vegetables is essential for the maintenance of a healthy diet and the prevention of non-communicable diseases (NCDs) (Jacob et al., 2017). Health authorities have emphasized the importance and the health benefits of increasing the population's consumption of vegetables to the recommended amount (Norwegian Directorate of Health, 2011, 2014; (Organisation for Economic Co-operation and Development/European Union (OECD/EU), 2016; Jacob et al., 2017). Nevertheless, across developed countries vegetable intake falls below the World Health Organization's recommended daily intake of 200 g/day (OECD, 2017). Several interventions and programmes have been identified as successful in increasing vegetable intake among both adults and children (in primary and secondary schools) (Pomerleau et al., 2005). Moreover, the childcare setting has been shown to be a potentially important setting for affecting food choices and increasing vegetable consumption at an early age (Mikkelsen et al., 2014; Matwiejczyk et al., 2018). Despite this, the evidence for *how* to increase vegetable intake in children aged 5 years and younger is still limited (Hodder et al., 2018). Furthermore, positive and supportive environments have been recognized as important in affecting children's eating behaviour in general, and may be necessary to influence children's vegetable intake in particular (Hendy and Raudenbush, 2000; Cullen et al., 2001). The home environment is the first environment that children experience, and it has been acknowledged that it affects dietary habits and food preferences (Rosenkranz and Dzewaltowski, 2008). The childcare setting is the second major environment that children experience, and it has been recognized as a health-promoting setting for improving heath behaviours and knowledge of both children and their families (Gupta et al., 2005), through policy and practices (Alkon et al., 2009).

Most of the previously conducted interventions in this age group have targeted individuals, so it is important to move beyond the individuals and investigate the kindergarten environment and factors within this environment, because these factors may be of importance in understanding how to increase children's vegetable intake. The BRA study was conducted with this understudied age group

between 2015 and 2017, and focused solely on increasing the vegetable intake of 3- to 5-year-old, preschool children through increasing the availability and accessibility of vegetables, and changing encouragement and modelling by kindergarten staff and parents, in the kindergarten and home environment, respectively. This thesis focuses on the food environment in kindergartens.

Part I: The problem and the setting

Vegetable consumption: health effects, current intakes and recommendations

Insufficient intake of fruit and vegetables is associated with many NCDs (Jacob et al., 2017). Globally, about 9% of deaths from stroke, 11% from ischaemic heart disease and 14% from gastrointestinal cancer have been estimated to result from insufficient intake of fruit and vegetables (Jacob et al., 2017). A meta-analysis showed that, for every additional amount of 200 g of vegetables eaten per day, the risk of stroke for adults was reduced by 11% (Hu et al., 2014). Consumption of fruit and green leafy vegetables has also been found to be associated with reduced risk of type 2 diabetes for adults (Cooper et al., 2012; Li et al., 2014). In addition, there is probable evidence linking consumption of foods containing dietary fibre and a decreased risk of colorectal cancer for adults (World Cancer Research Fund/American Institute for Cancer Research, 2018). The report also concludes that the overall greater consumption of non-starchy vegetables probably protects against several aerodigestive cancer types (WCRF/AICR, 2018). These results emphasize the importance of not only increasing vegetable consumption but also eating a variety of different vegetables to reduce the risk of NCDs.

In the European Union (EU) about 60% of the adult population report eating vegetables every day, women more often than men (OECD, 2017). Among children from EU countries, an average of 32% ate vegetables daily and girls reported a larger intake than boys (OECD, 2017). In Norway, the national recommended intake of fruit and vegetables for adults is a minimum of 500 g/day (Norwegian Directorate of Health, 2014), of which 250 grams should be vegetables. Total daily fruit

and vegetable intake among Norwegian adults was approximately 363 and 387 g/day for men and women, respectively, in the latest national dietary survey (Norwegian Directorate of Health, 2012b). Among Norwegian 2 and 4 year olds, the vegetable intake was roughly 50–70 g/day in the two latest national surveys (Kristiansen et al., 2009; Hansen et al., 2016). There are no specific recommendations for the vegetable intake for Norwegian children, but an intake of 50–70 g/day falls well below the adult recommendation of 250 g/day for vegetables and the recommendation of 100 g/day of vegetables for preschool children in the UK (National Health Service, 2015). There is evidence that eating behaviours established early in life may track into adulthood (Lien et al., 2001. Mikkila et al., 2005; Craigie et al., 2011). An increase in the consumption of vegetables among children may, therefore, be an effective primary prevention strategy in reducing the risk of NCDs later in life (Currie et al., 2004; Boeing et al., 2012). An adequate vegetable intake in childhood may also have many immediate benefits, such as reduced risk of several respiratory illnesses and micronutrient deficiencies (World Health Organization [WHO], 2003; Boeing et al., 2012).

The kindergarten as a health-promoting setting

> 'Health is created and lived by people within the settings of their everyday life, where they learn, work, play and love.'
>
> WHO (1986, p. 4)

The first international conference on health promotion was held in 1986, and in the Ottawa Charter the importance of supportive environments in health promotion was highlighted (WHO, 1986). Based on the Ottawa Charter, the Sundsvall Statement called for action on healthy settings and highlighted the many dimensions of these settings – physical, social, political, spiritual and economic – and the interaction between these dimensions (WHO, 1991). Subsequently, the Jakarta declaration

acknowledged the practical opportunities (reaching many people at the same time) within particular settings (i.e. school, kindergarten) in which comprehensive strategies could be implemented (WHO, 1997). A setting is defined as 'The place or social context in which people engage in daily activities in which environmental, organizational, and personal factors interact to affect health and wellbeing' (WHO, 1998, p. 19). Several health-promoting settings have been defined in the Ottawa Charter, such as schools (WHO, 1986). It has thus been recognized that school is a practical setting where many children can be reached simultaneously, and through the implementation of health-promoting strategies in such settings many children will receive and benefit from these strategies. However, out-of-home childcare in the preschool years has become more common. Thus, many preschool children are spending several hours a day and several days a week in care outside the home. This makes the kindergarten a potential setting with practical opportunities for enhancing the children's physical and psychological health, by ensuring a safe and challenging environment in which the children will thrive, and experience self-worth, mastery and enjoyment of life through interaction, friendship and community.

The Norwegian kindergarten context

In Norway, kindergartens should have a health-promoting role in society, as stated by law and in the guidelines (Ministry of Education and Research, 2005; Norwegian Directorate for Education and Training, 2017a). The use of out-of-home childcare has rapidly increased over the last 20 years in Norway, resulting in a 91% attendance rate, with each child spending approximately 40 hours each week in a kindergarten (Statistics Norway, 2016). Together, these two conditions give Norwegian kindergartens the exceptional possibility of contributing to the future health of the Norwegian population.

Norwegian kindergartens are open mostly from approximately 07:30am to 05:00pm, Monday to Friday (Statistics Norway, 2016). All children aged >1 year have a statutory right to attend a high-quality kindergarten. A maximum amount is set by the government for the parental fee, independent of public or private ownership of the kindergarten (Norwegian Directorate for Education and Training, 2017b). The distribution of public (47%) and private (53%) kindergartens is almost equal in Norway (Statistics Norway, 2016). The content and tasks of the kindergarten are regulated by law (Ministry of Education and Research, 2005) and the framework plan (Norwegian Ministry of Education and Research, 2011). Kindergartens are organized in many different ways (Vassenden et al., 2011), but the leading practice involves one kindergarten leader with the required education (Bachelor's degree as a kindergarten teacher). There is an pedagogue-norm that requires one pedagogical leader (of equivalent education to the kindergarten leader) for every 7–9 children aged <3 years and one pedagogical leader for every 16–18 children aged >3 years (Engel et al., 2015). The number of additional employees is not specified, other than that they must be sufficient to carry out the pedagogical activity satisfactorily (Engel et al., 2015). Someone working as a kindergarten assistant has no formal educational requirements to work, but a 4-year vocational training course is recommended, of childcare in upper secondary school or as a youth worker (Engel et al., 2015). The pedagogical leaders work directly with the children and have a responsibility to mentor any kindergarten assistants and provide a learning and coping environment for the children. However, the kindergarten has, for the most part, a flat organizational structure.

The most recent normative national guidelines for food and meals in kindergartens emphasize that the kindergarten should facilitate at least three fixed, fully nutritional meals each day (Norwegian Directorate of Health, 2018). These three meals are either brought from home (lunch box) or provided by the kindergarten, but only some kindergartens have dedicated kitchen staff or a cook. The kindergartens are allowed to ask for additional payment from parents to cover the expense of food and beverages. Those kindergartens that choose to do so incorporate this additional payment

into the monthly parental fee (Norwegian Directorate for Education and Training, 2017b). However, the amount of this additional payment varies across kindergartens, and subsequently the quality of food and beverages also varies across kindergartens. Two national dietary surveys in Norwegian kindergartens, conducted in 2005 and 2011, both reported the low availability of vegetables (Social and Health Directorate, 2005; Norwegian Directorate of Health, 2012). The normative national guidelines for food and meals were first issued in 2007 (Norwegian Directorate of Health, 2007), but were recently revised in 2018 (Norwegian Directorate of Health, 2018).

Part II: The target group and the food environment

Development of eating habits of children aged 0–5 years

Each child develops at his or her own pace, but some characteristics and abilities have been associated with a child's age (Tetzchner, 2019). When children are aged about 1 year, most have started to walk by themselves, and can explore the world around them to a greater extent, understand more of what they are told and clearly express what they want (Norwegian Directorate for Children Youth and Family Affairs, 2019; Tetzchner, 2019). Most 2 year olds can walk and run (Tetzchner, 2019), put together two or more words, understand simple explanations/messages, want to manage themselves and play mostly by themselves (Norwegian Directorate for Children Youth and Family Affairs, 2019; Tetzchner, 2019). The 3 year olds are even more physically capable and may be able to dress themselves, count and recognize different letters, play more with others and show compassion towards others (Norwegian Directorate for Children Youth and Family Affairs, 2019). The 4 year olds are curious and want knowledge and information, use their fantasy a lot, can think about many difficult subjects, and manage to play alone and with others (Norwegian Directorate for Children Youth and Family Affairs, 2019). In addition, the 4–5 year olds have a much more developed set of gross and fine motor skills (Tetzchner, 2019). These characteristics and abilities form the basis for further development. A child's ability to eat must be understood in light of both his or her age and developmental level (Arvedson et al., 2019).

To learn how to eat is a complex process that is influenced by several factors (Birketvedt, 2009; Arvedson et al., 2019). Children learn and develop abilities to eat at their own pace and in different ways. Primarily, children are born with reflexes to seek, suck and swallow (Delaney and Arvedson, 2008), and over the first period after birth the child normally feeds from his or her mother's breast or a bottle. Around one year of age, many children handle foods that need to be chewed (Carruth et al., 2004). When children start to consume solid foods that need chewing, they need time to practise new abilities because eating development encompasses the child's motor and psychosocial development, oral motor skills and swallowing function (Delaney and Arvedson, 2008; Arvedson et al., 2019). During this phase food still needs to be easy to chew (Birketvedt, 2009). If the food is too hard to chew, the child might give up and finish the meal before being sufficiently full. Around age 3 years, most children have a fully developed chewing pattern; however, raw vegetables may still be hard to chew for children up to age 5 years (Carruth et al., 2004). To learn how to eat is also about seeing, touching, smelling and having to taste several times before the child learns to enjoy new foods (Harris, 2008). Meals are also a good context within which a child can experience several sensations and different foods, and differentiate between familiar and new foods; recognition provides safety and a good foundation for learning to enjoy new foods (Birketvedt, 2009).

Food preferences are one of the main factors that determine what children choose to eat (Birch, 1999). They are influenced by *biological*, *social* and *environmental* factors (Ventura and Worobey, 2013). As children have an innate preference for sweet and salty tastes, and reject bitter and sour tastes (Cowart, 1981), this may affect the quality and variety of the child's diet when he or she transitions from a strictly breast/formula milk diet to the introduction of solid foods. There are several normal variations among children in how they eat; some are 'picky/fussy' eaters, whereas others have a good appetite; some enjoy everything, whereas others may need time and help before they feel safe to try new foods (Arvedson et al., 2019). Two well-established psychological barriers can limit the child's adoption of a healthy and varied diet – food neophobia (Birch, 1995; Falciglia et

al., 2000) and 'picky/fussy' eating (Galloway et al., 2003). Food neophobia is the rejection of new foods, whereas 'picky/fussy' eating is the rejection of both familiar and new foods, resulting in low dietary variety (Tandon et al., 2016). Food neophobia and 'picky/fussy' eating have been shown to peak between age 2 and 6 years (Cooke et al., 2003; Holley et al., 2018).

As mentioned above, food preferences are also influenced by *social* and *environmental* factors. The child develops his or her perception and thinking through interaction with the world (Piaget, 1953; Haugen, 2015). As such, the social interactions that children have with their parents are the first important factor to shape a child's eating behaviour. Parental food practices have been grouped under three overarching constructs: *coercive control* (i.e. restriction, threats and bribes), *structure* (i.e. food availability and accessibility, modelling, and rules and limits) and *autonomy support* (i.e. child involvement, encouragement and praise) (Vaughn et al., 2015). Parents' food practices have been recognized as important (Gevers et al., 2014; Vaughn et al., 2015), because parents control what food is available and accessible in the home environment by making food choices for the family. These food choices are influenced by what parents want to feed their child, which may have different motivations: promoting health, short preparation time or tasty or familiar to the child, and regulation of the child's mood through emotional feeding (Gibson et al., 1998. Moore et al., 2010; Sealy, 2010; Carnell et al., 2011).

As children learn through the observation of others, parents' eating behaviours will also influence the child's eating behaviours. Several studies have confirmed that parents play an important role in influencing their children's eating behaviours through parental intake, parental modelling and parental encouragement (Blanchette and Brug, 2005; Rasmussen et al., 2006; Brug et al., 2008). However, some parental food practices have had unintended consequences, because studies have found that children who are highly restricted have poorer self-regulation of energy intake (Birch and Fisher, 1998; Fisher and Birch, 1999; Faith et al., 2004). Also, if these restrictions concern intake of and access to highly palatable foods, it has been shown that they may promote increased preference

and consumption of these foods (Fisher and Birch, 1999; Faith et al., 2004). Furthermore, pressurizing or encouraging children to eat more vegetables is associated with a lower intake (Fisher et al. 2002; Kristiansen et al., 2017). However, parents who attempt to control what the child eats with little regard to the child's preferences have been found to be positively associated with the vegetable intake of preschool children (Patrick et al., 2005).

To sum up, children are born with a set of natural reflexes and preferences, and there is normal variation in how they develop new abilities, such as eating. As children learn through new experiences and interactions with their surroundings and others, the creation of supportive and positive food environments and relationships with significant others is important for the child to develop new abilities and food preferences.

Food environment

The interplay of supportive environments and health-related behaviours has proved to be complex. To grasp this complexity, ecological models (Bronfenbrenner, 1979) have been applied to many social groups and settings to understand supportive environments and health-related behaviours (Sallis et al., 2008; Story et al., 2008), including the interplay of behaviour and environment in research into the food environment (Glanz et al., 2005; Brug et al., 2008; Swinburn et al., 1999, 2013). Ecological models are useful to illustrate how different factors affect the individual from proximal to distal levels of the ecological model, and that these factors may also interact with each other within and across the levels (Sallis et al., 2008). However, these factors need to be identified. As such, health promotion practitioners recognized the lack of suitable tools for understanding and measuring the environment (Nutbeam, 1997), which called for a more practical and conceptual framework of identifying and measuring relevant factors in the environment (Swinburn et al., 1999; Glanz et al., 2005).

Swinburn et al. (1999) developed and described an ecological framework known as the Analysis Grid for Environments Linked to Obesity (ANGELO). This is divided into four different types of environment: physical, sociocultural, economic and political (Swinburn et al., 1999). This framework was developed for researchers and practitioners as a practical tool for prioritizing environmental factors for research and/or intervention purposes (Swinburn et al., 1999). Even though food is acknowledged as an important part of the obesogenic environment, the ANGELO framework was not specifically developed to identify and prioritize interventions aimed at the food environment. Subsequently, a conceptualization of the food environment was proposed by Glanz et al. (2005). Based on an ecological framework, the researchers identified four different nutrition environments, found or hypothesized to be related to healthy eating (Glanz et al., 2005): (1) *community nutrition environment* – type and location of stores and/or restaurants, accessibility by opening hours and drive through; (2) *organizational nutrition environment* – home, school, work; (3) *consumer nutrition environment* – availability of healthy options, nutrition information, price, promotion, placement; and (4) *information environment* – advertising, media. Based on the conceptualization of Glanz et al. (2005) and other previous work (Swinburn et al., 1999; Story et al., 2008), Swinburn et al. (2013, p. 14) adapted a definition of the food environment as: 'The collective physical, economic, policy and sociocultural surroundings, opportunities and conditions that influence people's food and beverage choices and nutritional status.' This definition of the food environment was found to be suitable for the kindergarten setting and has been used throughout this thesis.

In a more recent publication, Turner et al. (2018, p. 94) criticize Swinburn and colleagues' definition of the food environment of lacking a defined set 'of measurable dimensions to guide empirical research'. In the development of more supportive food environments to increase vegetable intake in the kindergarten setting, it is important to know how to measure factors in the food environment that could affect availability and accessibility of vegetables. In a review of the literature, Ohri-Vachaspati and Leviton (2010) discovered 25 instruments with the primary focus of measuring the

organizational food environment; of these, only three assessed the childcare food environment (Benjamin et al., 2007; Ward et al., 2008a; Whitaker et al., 2009). Furthermore, these instruments were developed and validated for assessment of the food environment in childcare settings in the USA, which could limit their relevance in other countries and in relation to vegetables.

An ecological approach to the kindergarten's food environment

Based on the ecological model (Sallis et al., 2008) and the definition of the food environment given by Swinburn et al. (2013), Figure 1 illustrates the different layers of environments that directly or indirectly affect preschool children's eating behaviours. Figure 1 includes both evidence-based factors and, theoretically, potentially important factors. The ecological model consists of five different levels: individual, interpersonal, organizational, community and policy (Sallis et al., 2008). This thesis is limited to focusing on the three first/inner levels of the model. Figure 1 does not include the home or parents, although they may both affect the food environment in the kindergarten if the children bring food from home (i.e. a lunch box).

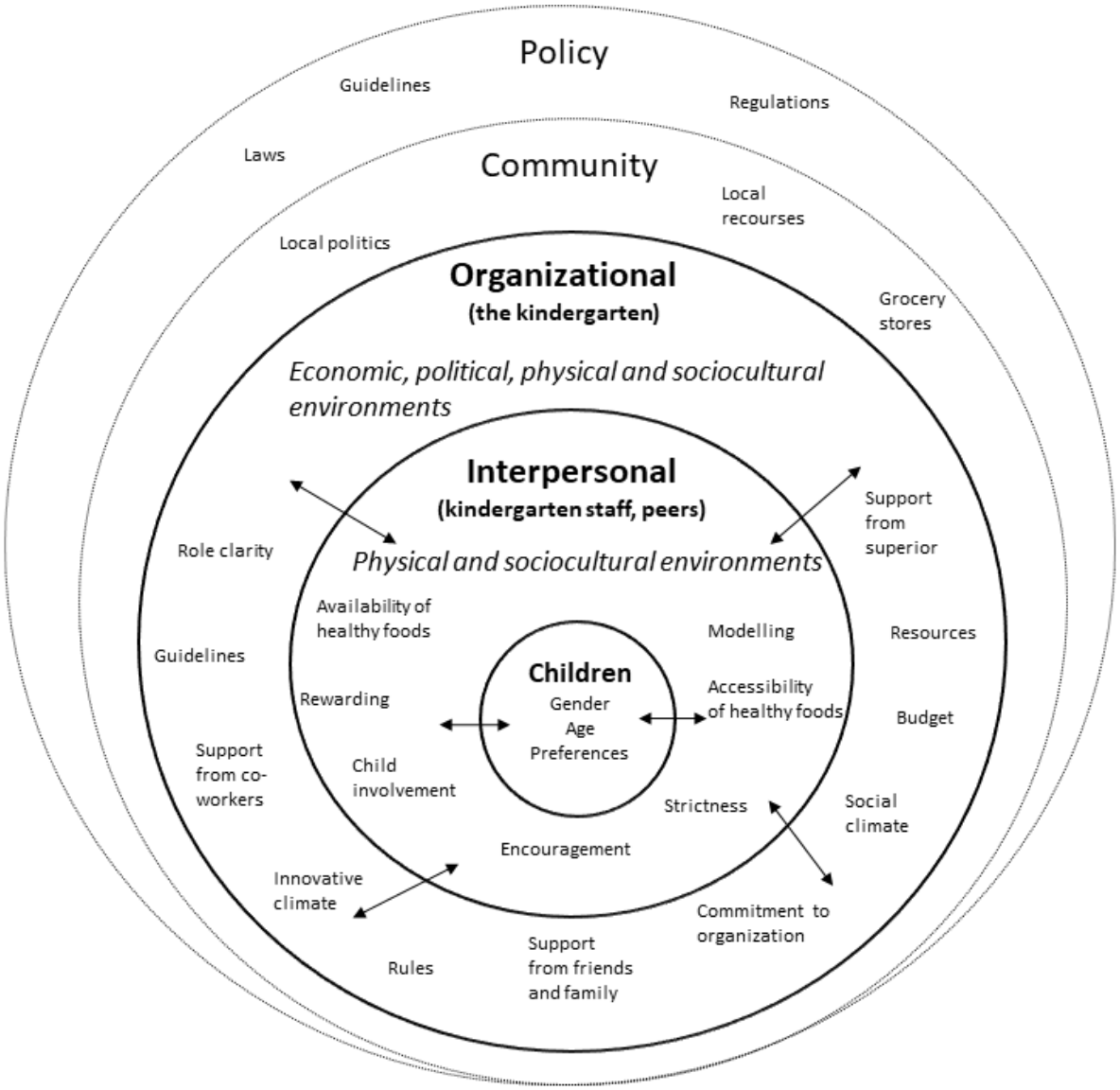

Figure 1 An ecological model illustrating the factors in different layers that may affect preschool children's eating behaviours in the kindergarten setting (developed based on Sallis et al. [2008]).

The first layer is the individual layer, and therefore the children. As previously mentioned, the key determinant of consumption of foods is preference (Birch, 1999). Thus, children's preferences may affect what they choose to eat. As children are predisposed to reject bitter and sour tastes (Cowart, 1981), this may lead to the choice not to eat a variety of foods that are bitter and sour in taste, which may affect vegetable intake because they are often bitter in taste. The second layer, which implicates

the children directly, is called the interpersonal layer. Within the interpersonal layer, Figure 1 includes both the *sociocultural environment* and the *physical environment.* As the physical environment consists not only of what is visible but also the opportunities within one's reach, such as vegetable availability and accessibility, within this thesis this is defined as proximal factors that belong within the interpersonal layer. Within the physical environment, evidence points to that availability: vegetables available in the home/childcare facility, and accessibility or in a ready-to-eat form, seem to be essential determinants for increasing vegetable intake in school-aged children and youth (Cullen et al., 2003; Blanchette and Brug, 2005; Brug et al., 2008), and to affect preferences of infants and young children (Birch et al., 2007). Furthermore, the *sociocultural environment* consists of a society's or community's cultural and social norms related to food (Swinburn et al., 1999). The sociocultural environment comprises the people in the child's immediate surroundings. Within the kindergarten, these people are kindergarten employees and peers, who can affect children's eating behaviour through modelling, strictness, rewards, involvement and encouragement. Evidence points to parents playing an important role in affecting children's healthy eating (Blanchette and Brug, 2005; Rasmussen et al., 2006; Brug et al., 2008); however, limited research has examined the role of childcare staff's modelling behaviour. Some studies have shown positive associations between the staff's food-related practices and children's food intake among 2–3 year olds (Gubbels et al., 2010), vegetable intake among 1–4 year olds (Gubbels et al. 2015) and 3–5 year olds (Anundson et al., 2018), and food acceptance among preschool-aged children (Hendy and Raudenbush, 2000). These findings indicate that people and availability of healthy foods/vegetables within the child's interpersonal layer are factors that can influence the child's intake of vegetables.

Thus, it is important for kindergarten employees to model healthy eating and show that they enjoy eating vegetables, in addition to making vegetables available and accessible, to increase the possibility of children developing similar behaviour and preferences for healthy food in general, and vegetables more specifically. However, there is a need for more comprehensive studies investigating

the role of childcare staff's modelling behaviour in children's vegetable intake, because some of the previously conducted studies were considered to be of a low or moderate quality (Ward et al., 2015). In addition, peers have been shown to be another influential factor on preschool children's consumption of vegetables (Birch, 1980), which could also be an important factor in the kindergarten setting. However, a review of experimental research on how to change children's eating behaviour did not find evidence to support the findings of Birch (DeCosta et al., 2017).

The third layer is the organizational layer, which in this thesis is the kindergarten. In this thesis the organizational layer consists of more distal factors within the economic, political, physical and sociocultural environments. These factors may indirectly affect the children through regulation of the children's proximal environment. A very limited amount of research has been conducted on kindergartens' organizational layers (Farmer et al., 2015; Ritchie et al., 2015. Lucas et al., 2017; Lehto et al., 2019). *The economic environment* is related to the costs of making a healthy or unhealthy choice with regard to food (Swinburn et al., 1999). With regard to the kindergarten setting, factors in the economic environment can be the cost of serving more vegetables, the food budget, the sources of money for the food budget, and so forth. The economic resources in the kindergarten may affect both the nutritional quality of the foods available and the amount of vegetables available to the children. However, there is a need for more studies investigating the relationship between kindergartens' economic resources and the food served. The more distal factors within the *physical environment* consist of kitchen facilities, food storage, cookbooks, and so forth. *The political environment* consists of the rules, regulations, laws and policies (formal or informal) that have a profound effect on the organizations and individuals in relation to food (Swinburn et al., 1999). The kindergarten may have different rules and regulations about the food provided to the children in terms of the law, guidelines, recommendations and information. As each kindergarten might adapt these rules and regulations in different ways, together with employees' personal opinions about

food, this will in turn contribute to variety between kindergartens despite having to follow the same national guidelines.

Previous studies that have examined kindergartens found that policy was associated with what type of beverages was served to children in childcare (Ritchie et al., 2015). A review of the impact of policies on diet in preschools found that there is uncertainty about whether the policies have actually improved diet quality in the UK, there is little evidence on food provided or eaten in preschool settings in Australia and there are no national data on preschool meal quality in Sweden (Lucas et al., 2017). However, a more recent Finnish study found that kindergartens that had more food policies in place were associated with a higher vegetable intake by the children (Lehto et al., 2019). Yet, these limited results have led to a call for more studies on how food policies impact the quality of food served in kindergarten settings. Of further interest are the results from a qualitative study conducted in kindergartens in Canada, which found that a critical determinant for organizational behaviour was the director's strong leadership, and that leadership, health champions, organizational culture, and networking and knowledge brokering were factors that positively influenced adoption of nutritional guidelines (Farmer et al., 2015). In this thesis, psychosocial factors within the workplace climate and culture, such as support from co-workers, superiors, friends and family, role clarity, commitment to the organization, and innovative climate and social climate, are defined as more distal factors within the *sociocultural environment*. These psychosocial factors are recognized as essential factors in the working environment and associated with motivation and organizational learning (Lindström et al., 2000). Factors within the workplace climate and culture are understudied with regard to the food environment in the kindergarten setting and should therefore be explored.

The fourth layer is the community, and factors within this layer can be local politics, resources and grocery stores. In Norway, the municipality own the public kindergartens and, as some municipalities might want their kindergartens to focus more on healthy food, this could lead to a greater focus on food. In addition, where the kindergarten is located in terms of access to grocery stores could also

affect what kind of food or variety of vegetables the kindergarten can provide if they shop or order their food from them. Finally, the fifth and outer layer, called society, includes national politics, laws, guidelines, ideologies and regulations. As an example, Norway has normative national guidelines for food and meals served by kindergartens (Norwegian Directorate of Health, 2018), and has a tradition of cold, sandwich-based lunches brought from home.

In summary, the kindergarten can influence children's eating behaviour through provision of a positive and supportive environment, and by making healthy food and vegetables available and accessible. However, there is limited evidence in this research field, especially on the kindergarten staff's modelling behaviour, and how factors in the kindergarten's economic and political environment affect the food provided by the kindergarten. Furthermore, no studies have investigated how more distal factors in the kindergarten's workplace climate and culture may affect what food is being served by the kindergarten or the serving of vegetables.

Part III: Intervention development and current evidence

Development of theory- and evidence-based interventions

Interventions developed and implemented to change behaviour and environmental factors related to health are considered to be most effective when systematically developed and based on theory and evidence (Bartholomew et al., 2011). As there is a distinct difference in testing theory and solving a public health problem, many practitioners may have struggled with applying these theories accordingly. Moreover, even though interventions claim to be theory based, it has been questioned whether any theories have been used (Michie and Prestwich, 2010). Bartholomew et al. (2011) have emphasized that, when working from a problem-driven perspective, a combination of one or multiple theories, empirical evidence and new research is more useful in solving real-life problems, and the use of logic models can assist in the process of developing health-promoting programmes and interventions.

Five steps have been recognized as necessary in developing and implementing health-promoting programmes (Brug et al., 2005). The first is to identify the health problem and the second to identify behavioural risk factors. The third is to identify and investigate mediators or determinants of the identified risk behaviour; by doing this, one can conduct the fourth step to develop strategies to achieve change that will lead to the fifth step: implementation, followed by a process and effect evaluation of the programme — and, finally, dissemination of the intervention (Brug et al., 2005).

With regard to the third step, an ecological framework such as the one presented above may be useful to categorize determinants or possible mediators of the target behaviour and it has also been used when framing interventions. It is essential when proceeding to the fourth step to have well-defined determinants of behaviour and environmental factors influencing the behaviour of the target group. These determinants are the most immediate targets of the intervention (Bartholomew et al., 2011), such as the factors in Figure 1. However, previously conducted interventions have not used

the full potential of the model (Richard et al., 2011). By combining organizational interventions with interpersonal and individual interventions, this may have a potential impact that will exceed the use of targeting just one level (Glanz et al., 2008). This underlines the importance of developing interventions that target several levels within the ecological framework.

The implementation part of conducting an intervention, defined as the fifth step, is crucial to know whether the full potential of the intervention has been tested. Interventions implemented to a larger degree, and measured by fidelity or dosage, have been found to have better outcomes than less well-implemented studies (Durlak and DuPre, 2008). However, positive results have been obtained with approximately a 60% level of implementation and no studies were found that documented 100% implementation (Durlak and DuPre, 2008). Furthermore, it has been emphasized that it is essential to find the right balance between fidelity and adaptation to local conditions to achieve better intervention outcomes (Durlak and DuPre, 2008). From research on implementation of teacher programmes in school-based interventions (Han and Weiss, 2005), several factors have been identified as relevant to good implementation: administrative support by the leader of the institution, the staff's self-efficacy beliefs, programme acceptability and pre-implementation attributions about the programme. Furthermore, the following factors should be included to develop a sustainable programme: the programme is acceptable to the leaders and staff involved; it seems to be effective; it is feasible to implement on an ongoing basis with minimal but sufficient resources; and it is flexible and adaptable (Han and Weiss, 2005).

Interventions targeting kindergartens

To solve the problem of low vegetable intake in children aged 5 years and younger, the kindergarten setting has been recognized as an important arena to reach many children and promote vegetable consumption (Mikkelsen et al., 2014). Several systematic reviews focused on fruit and/or vegetable intake of preschool-aged children have been conducted (Nixon et al., 2012; Mikkelsen et al., 2014;

Hodder et al., 2018; Holley et al., 2018; Murimi et al., 2018; Nekitsing et al., 2018). These systematic reviews include a range of intervention strategies from single component to multiple components, from examining individual factors to changing environmental factors, including parents and the home setting versus targeting only the kindergarten (Mikkelsen et al., 2014; Hodder et al., 2018). Furthermore, the interventions vary in length, training sessions, implementation, exposure time and duration (Mikkelsen et al., 2014; Hodder et al., 2018).

Most previously conducted interventions have targeted the individual level, that is, the children (Mikkelsen et al., 2014; Hodder et al., 2018). The type of interventions conducted can be divided into: single exposure interventions, educational interventions and multicomponent interventions. *Single component interventions* have for the most part focused on modifications to the serving of vegetables (e.g. preparation method, different portion sizes, salted or unsalted, serving vegetables first, serving a single type versus serving a variety), feeding practices (e.g. repeated exposure, flavour–flavour learning, flavour–nutrient learning, associative conditioning, taste exposure, rewards), introducing non-preferred or new vegetables, and investigating the effect of peer models and preferences (Mikkelsen et al., 2014; Hodder et al., 2018). The results from one of these reviews showed no significant increase in vegetable consumption and that the younger children were more influenced by role models, especially if girls were the role models (Mikkelsen et al., 2014). However, the other review concluded that the results from the child-feeding interventions were mixed, and that eleven intervention studies had a positive effect on vegetable consumption, but only two of these studies were included in both reviews, which could explain the different results (Mikkelsen et al., 2014; Hodder et al., 2018). *Educational interventions* have usually been carried out by kindergarten teachers or individuals who have had training (Mikkelsen et al., 2014; Hodder et al., 2018). Some educational interventions have found promising results regarding vegetable consumption; however, only one reached statistical significance (Mikkelsen et al., 2014; Hodder et al., 2018). *Multicomponent interventions* have consisted of educational activities for the children,

availability of healthy food options, including children growing vegetables, involving children in food preparation, educating parents and teachers about modelling and nutritional needs, food modifications, changes in the kindergarten environment, healthy policies and a newsletter for parents (Mikkelsen et al., 2014; Hodder et al., 2018). Mikkelsen et al. (2014) found that more of the multicomponent interventions showed positive significant results on vegetable consumption, whereas Hodder et al. (2018) found that the effects of multicomponent interventions on vegetable consumption were mixed.

Despite so many different strategies and components being included in a variety of interventions, the evidence on *how* to increase children's vegetable intake is still scarce (Hodder et al., 2018). However, some successful factors have been identified by an 'umbrella' review and other recently conducted reviews (Matwiejczyk et al., 2018; Murimi et al., 2018; Nekitsing et al., 2018). With regard to nutrition educational interventions, the successful ones targeted specific behaviours, engaged parents face to face, provided hands-on activities, and aligned activities with the stated objectives and expected behaviours (Murimi et al., 2018). Furthermore, interventions including taste exposure should include approximately 8–10 exposures to achieve a significant effect on the intake of vegetables (Nekitsing et al., 2018). Taste exposure has also been shown to have a better impact on vegetable intake than educational interventions. Repeated taste exposure has also been considered a simple technique that could be suitable for childcare settings (Nekitsing et al., 2018).

A growing number of studies have found positive results related to sensory-based food education in increasing vegetable intake of school-aged children (Dazeley et al., 2012; Hoppu et al., 2015). Sensory-based education is conducted by letting children explore different foods using all five senses: hearing, vision, olfaction, taste and touch (Puisais and Pierre, 1987). However, interventions in the kindergarten setting that apply this strategy have found mixed results (Hoppu et al., 2015; Coulthard and Sealy, 2017; Kahkonen et al., 2018). In the study conducted by Kahkonen et al. (2018), the consumption of vegetables was lower in the group that received sensory-based food education than

in the reference group. Another study found that only cucumber reached the significance level of 0.05 (Coulthard and Sealy, 2017). Finally, a study conducted by Huppo et al. (2015) found that the children in the intervention group ate significantly more of the different types of vegetables served from baseline to follow-up. However, this study was conducted on a small sample size and the analyses were conducted separately for the two groups; the control group was not included in the analyses.

Although few preschool-based interventions have moved beyond the individual level, five of the interventions included in the review conducted by Hodder et al. (2018) seem to target staff's food-related practices or some parts of the kindergarten environment (Vereecken et al., 2009; De Bock et al., 2012; De Coen et al., 2012; Brouwer and Neelon, 2013; Natale et al., 2014). The two interventions that were successful in increasing vegetable intake among children included: (1) cooking and eating meals together in groups, consisting of teachers, children and their parents, and offering the children healthy snacks (fruit and vegetables) every week during the intervention (De Bock et al., 2012); and (2) developing policies to increase healthy eating, modifying menus, a snack policy that included healthy snacks such as vegetables and/or fruit (Natale et al., 2014). These interventions target parts of the kindergarten's environment and the staff's food-related practices, but the primary outcomes for these interventions were whether the children increased their *consumption* of vegetables (Vereecken et al., 2009; De Bock et al., 2012; De Coen et al., 2012; Brouwer and Neelon, 2013; Natale et al., 2014; Williams et al., 2014), and no secondary outcomes on changes in the kindergarten or home *environment* were presented. This highlights the need for research that includes secondary outcome measures on changes in the kindergarten's food environment.

The American Nutrition and Physical activity Self-Assessment for Child Care (NAP SACC) intervention study was one of the first large intervention studies that reported outcome measures on changes in the childcare environment (Ward et al., 2008b). The NAP SACC intervention consisted of a self-assessment scheme developed for the childcare employees to self-assess their physical activity or

nutritional areas to consider which actions would lead to improvement in the childcare environment (Benjamin et al., 2007). The NAP SACC project was later translated into an online-delivered intervention called Go NAP SACC (Ward et al., 2017), and a recently published study conducted in family childcare homes in Nebraska was successful in improving several of the nutritional areas assessed, some of which were: frequency and variety of vegetables served; supporting healthy eating through staff's food-related practices; feeding practices; nutrition education for staff, children and parents; and nutrition policy (Dev et al., 2018).

Although the European ToyBox study is comparable to the studies above without secondary outcomes at the kindergarten level, and with no effects on vegetable intake, the study of the development of strategies and concepts on how to motivate and train kindergarten teachers in implementing the intervention still provides some valuable lessons (Payr et al., 2014). The authors concluded that teacher training should focus on practical information about how to implement the intervention, self-efficacy-enhancing components and opportunities for kindergarten teachers to share experiences. In addition, the training sessions should consist of learning approaches that facilitate reflective thinking, active participation and personal involvement (Payr et al., 2014).

To sum up, the three parts of the introduction show that kindergartens are potentially important health-promoting settings for affecting food choices and increasing vegetable consumption at an early age. There are several known factors in the home food environment that affect how children learn to eat and what they prefer to eat. However, many factors exist in the kindergarten food environment that could potentially affect children's vegetable intake. These factors are understudied and need to be investigated further to know which would be important to target in future interventions. Finally, more comprehensive interventions were more likely to achieve behaviour change. In addition, multicomponent- and multilevel-interventions, which targeted both individual and environmental determinants of healthy eating behaviours, were the most effective in childcare settings. However, there seems to be a research gap in interventions targeting and measuring

changes in the kindergarten environment in addition to changes in the dietary behaviours of the children. Thus, there is a need to know which factors in the kindergarten environment can affect whether and how vegetables are served to the children, and whether interventions can change these factors in the kindergarten food environment.

Objectives

The BRA study was a kindergarten-based, group RCT, with an overall aim of improving vegetable intake among preschool children (aged 3–5 years at baseline) (primary outcome) through changing the food environment and food-related practices both in the kindergarten and at home (secondary outcomes).

The overall aim of this thesis is to discuss defined parts of the BRA study, concerning factors in the kindergarten environment, measures of kindergarten workplace climate and culture, and effects on vegetables served and staff's food-related practices.

Accordingly, the following objectives were formulated:

1. To investigate factors in the kindergarten's environment (economic, political, physical and social) associated with the vegetables served and eaten.
2. To investigate measures of the kindergarten's workplace climate and culture and explore staff's food-related practices and vegetables served, and whether the staff's food-related practices mediate the interrelationship of factors in the kindergarten's workplace climate and culture, and vegetables served.
3. To investigate the effect of the intervention on frequency, variety and amount of vegetables served and the staff's food-related practices.

Methods

Study design, sample and data collection

The BRA study was a group RCT with a multicomponent intervention that was developed based on a logic model of vegetable consumption by preschool children (Figure 2). The model specifies that, for children to taste and eat vegetables, vegetables must first be available in the kindergarten, and second made accessible during times of eating. These actions could be sufficient for children to taste and eat vegetables, but most probably kindergarten employees will need to encourage the children to taste/eat vegetables, and they should also model the tasting/eating of vegetables. While developing the intervention, we emphasized the importance of including kindergartens in the process to ensure that the intervention components would be perceived as credible and easily adapted and relevant, regardless of how the kindergartens were organized and whether or not they had a prior focus on food/diet.

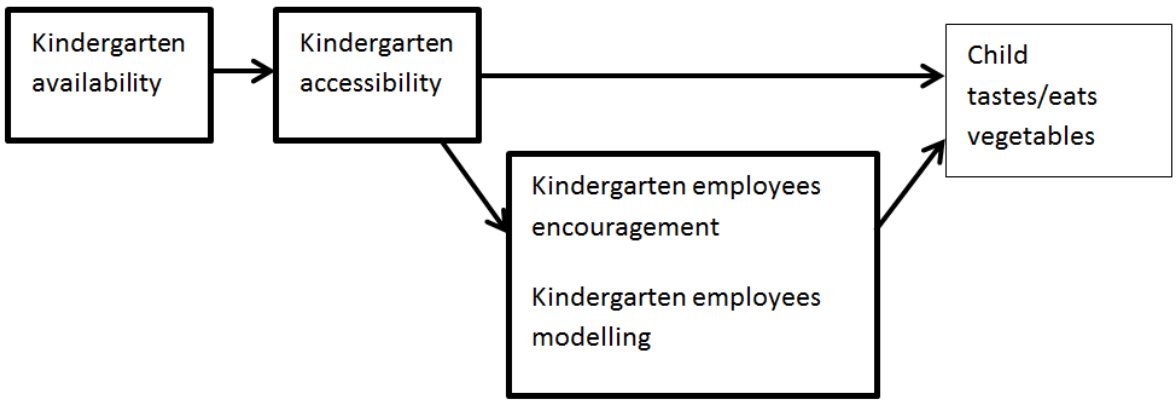

Figure 2 The logic model of the intervention in kindergartens: the BRA study.

Eligible kindergartens were those with children born in 2010 and 2011, publicly or privately owned and located in the counties of Vestfold and Buskerud, Norway. Of the 479 kindergartens invited, 73 chose to participate (response rate 15.2%) (Figure 3). The kindergartens were randomized into 37

kindergartens in the intervention group and 36 in the control group. The allocation of the kindergartens was carried out using stratified block randomization, conducted by a statistician not involved in the project.

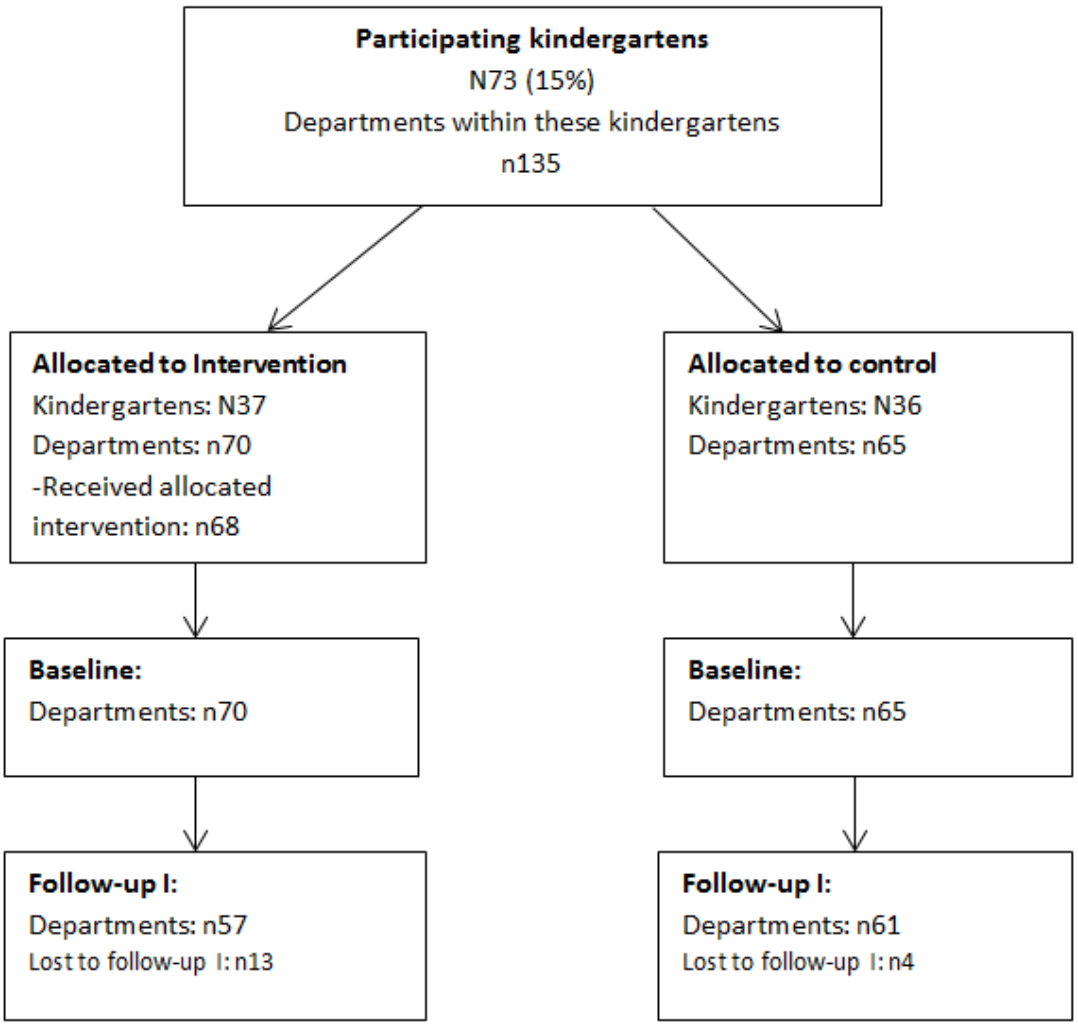

Figure 3 Flow chart of recruitment, randomization and participation of kindergartens, and number of departments in the BRA study at baseline and follow-up I.

N, number of kindergartens; *n*, number for departments.

Table 1 Design, data collection and time points of the BRA intervention study.

	Baseline	**Intervention**	**Follow-up I**	**Follow-up II**
	April/June 2015	Sept 2015 – Feb 2016	April/June 2016	April/June 2017
Age of children in intervention kindergartens (years)	3–5	X	4–6	5–7
Age of children in comparison kindergartens	3–5		4–6	5–7

X, intervention implementation.

Baseline data collection was conducted from April 2015 to May 2015 (Table 1). Two teams of two visited the kindergartens over this period to hand out digital kitchen scales (capacity = 5 kg; gradation = 1 g) and give face-to-face instructions on how to measure and report in the 5-day, weighted vegetable diary. The kindergartens also received paper-based questionnaires by regular mail (to be answered by the kindergarten leader, pedagogical leader and kindergarten assistants), which they returned together in a prepaid envelope. The training and intervention components were received by the intervention kindergartens between September 2015 and February 2016. Follow-up I data collection was conducted in the same way in April 2016 to May 2016 (Table 1). When follow-up II data collection was conducted, we did not visit the kindergartens, and both the paper-based questionnaires and the 5-day, weighted vegetable diary were sent by mail because half the children had moved on to school, and the main purpose of visiting the kindergarten was to observe the children during meals. The follow-up II data are not included in this thesis.

Power calculations

The power calculations were based on calculations for detectable effect sizes. To detect changes in the kindergarten practices of frequency of vegetables served and staff's food-related practices, standard deviations (SDs) from the Norwegian kindergarten survey (Norwegian Directorate of Health 2012a) and the NAP SACC study (Ward et al., 2008a) were used. It was estimated that a sample size of 30 kindergartens in each group would be sufficient to detect a difference of 1.4 servings per week for the frequency of vegetables served, and a difference of 1.23 in a practice score. This was based on an SD of 1.9 for serving vegetables per day/week (Norwegian Directorate of Health, 2012a) and an SD of 1.7 from the nutrition practice score in the NAP SACC study (Ward et al., 2008a), assuming a significance level of 5% and a power of 80%.

Ethical issues

The BRA study was conducted according to the guidelines laid down in the Declaration of Helsinki and the Norwegian Centre for Research Data approved all procedures involving human subjects. All kindergartens signed a written informed consent agreeing to participate in the BRA study (N73) (Appendix I). To secure anonymity of the respondents, no names were reported on the questionnaires, and they could thus be returned together in a prepaid envelope when everyone had filled in theirs. However, we know nothing about how the questionnaires were handled within the kindergarten before being returned to the BRA study. Unfortunately, if the questionnaires were available to other employees in the kindergarten, it would have been possible for them to identify the respondent based on age, gender, nationality, etc. To assess the primary outcome of the study (which is not addressed in this thesis), observation of the children at two meals in the kindergarten was conducted. For this purpose the parents of 1631 children born in 2010–2011 in the 73

kindergartens were invited by letter to participate, and parental consent was obtained for 633 children. Families with more than one child were allowed to participate. The number of participating children in each kindergarten varied from none to 23 children.

Instruments

Thee paper-based questionnaires were used to collect data from the kindergarten leaders (Questionnaire A), pedagogical leaders (Questionnaire B) and assistants (Questionnaire C).

Questionnaire A assessed kindergarten characteristics and environmental factors (Table 2), and the 35 questions had mostly precoded answer categories, although some had open options. This questionnaire was answered and thus piloted by two kindergarten leaders, who completed the questionnaire in approximately 14 minutes. The pilot test led to some small adjustments. The questionnaire was answered by 69 leaders at baseline (papers I–III) and 65 at follow-up I (paper II). Several of the questions used in this questionnaire were from the last national dietary survey conducted in Norwegian kindergartens (Norwegian Directorate of Health, 2012b). Four different aspects of the kindergarten food environment were described through several questions (paper I). Questionnaire B consisted of 53 questions that assessed frequency and variety of vegetables served, the staff's food-related practices and the kindergarten's workplace climate and culture; the questions had mostly precoded answer categories (Table 2). This questionnaire was answered and thus piloted with 11 pedagogical leaders, who completed the questionnaire in approximately 20 minutes. The pilot test led to some small adjustments. Questionnaire B was answered by 116 pedagogical leaders at baseline (papers I–III) and 129 at follow-up I (paper II).

Questionnaire C assessed the staff's food-related practices and the kindergarten's workplace climate and culture, and the 19 questions had mostly precoded answer categories (Table 2). This

questionnaire was answered by and thus piloted with 12 assistants, who completed the questionnaire in approximately 12 minutes. The pilot test led to some small adjustments. Questionnaire C was answered by 283 assistants at baseline (papers II and III) and 311 at follow-up I (paper II).

Modified items from statements and questions used in previously published international studies (Musher-Eizenman and Holub, 2007; Zeinstra et al., 2010; Baranowski et al., 2013; O'Connor et al., 2016) and national studies (Bjelland et al., 2011; Melbye et al., 2011) were included to measure the staff's food-related practices. Factors measuring the workplace climate and culture in the kindergarten were assessed by using scales from the validated General Nordic Questionnaire for Psychological and Social Factors at Work (QPS_{Nordic}) (Dallner et al., 2000).

In addition to the three questionnaires, a 5-day, weighted vegetable diary was developed to assess the amount of vegetables served and eaten per person per day in the kindergarten (papers I–III). This vegetable diary was self-reported by any staff working in a participating department, and was piloted by one department.

Measures

Table 2 An overview of measures according to instruments used in papers I–III

	Questionnaire A[a]	Questionnaire B[b]	Questionnaire C[c]	5-day, weighted vegetable diary[d]
Amount of vegetables *eaten:* at lunch and the afternoon meal				Paper I
Amount of vegetables *served:* at breakfast, lunch and the afternoon meal				Papers II and III
Frequency of vegetables served: at lunch and the afternoon meal		Paper I		
at breakfast, lunch and the afternoon meal		Papers II and III		
Variety of vegetables served: at lunch and the afternoon meal		Paper I		
at breakfast, lunch and the afternoon meal		Papers II and III		
Staff's food related practices		Paper II and III	Papers II and III	
Environmental factors	Paper I			
Workplace climate and culture	Paper III	Paper III	Paper III	
Kindergarten characteristics	Papers I–III			

[a]Answered by kindergarten leader.

[b]Answered by pedagogical leader.

[c]Answered by kindergarten assistant.

[d]Filled in by employees working at a participating department.

Assessment of amount of vegetables served and eaten

Amount of vegetables *served* (papers II and III) and *eaten* (paper I) were assessed using the 5-day, weighted vegetable diary (Table 2 and see Appendix II). The diary was designed to provide information about vegetables served and eaten through a typical week in the kindergarten (i.e. 5 days) at breakfast, lunch and the afternoon meal. In addition, it was possible to fill in information about snacks between meals. One employee from each participating department had to weigh and fill in information about the amount of vegetables served for each meal, and indicate whether they were ready to be served after weighing. After the meal, participants should then weigh and fill out the question for the amount of vegetables left over, information on how many children were attending the meal, and if and how many adults ate the vegetables served. If vegetables were included in a warm dish, they were asked to attach the recipe. The amount of vegetables served per person per day was calculated by dividing the weight of vegetables served by the number of people (children and adults) registered at each meal. This sum was calculated for breakfast, lunch and the afternoon meal, and then added together to get the mean amount of vegetables served per person per day. The figure for the amount of vegetables eaten in **paper I** was calculated as the vegetables served at the meal minus the vegetables left after the meal, before summing to find the vegetables eaten per day. The calculations of the amount of vegetables eaten did not account for vegetables left on children's plates or that had fallen on the floor. Furthermore, the amount of vegetables eaten was divided by the number of children and employees attending the meal, without knowing how many of them actually ate the vegetables. These two factors may have contributed to an overestimation of the amount of vegetables eaten in **paper I**. Therefore, the measure of *vegetables eaten* was not included in **papers II** and **III**. For **papers II** and **III**, the data collected with the 5-day, weighted vegetable diary were used to assess the amount of *vegetables served* per person per day. This amount was also divided by the total number of both children and employees present and eating. Compared with the assessment of the amount of vegetables eaten, this measure could be more

accurate because it does not have uncertainties about how much each child or adult ate. However, as the employees who prepared the meals probably knew that one or several of the employees were going to eat as well, they might have served a larger amount than if it was only for the children, because adults in general eat more.

Assessment of frequency and variety of vegetables served

Frequency and variety of vegetables served were assessed in Questionnaire B (Appendix III). The *frequency of vegetables* served for breakfast (papers II and III), lunch (papers I–III) and the afternoon meal (papers I–III) was assessed through three separate questions: 'How often does your department offer vegetables for breakfast/lunch/afternoon meal?' Response alternatives were given on a 7-point scale ranging from '5 days a week' to 'never'. The frequency of vegetables served during a week was calculated by first recoding the 7-point scale: 5 days a week = 5, 4 days a week = 4, 3 days a week = 3, 2 days a week = 2, 1 day a week = 1, 1–3 times a month = 0.5, never = 0. Second, these values were added together to obtain the measure for vegetables served for breakfast, lunch and the afternoon meal per week. For **paper I** only lunch and the afternoon meal were added together; for **papers II** and **III** breakfast, lunch and the afternoon meal were added together. The reason why only lunch and the afternoon meal were included in **paper I** was that these are the most common meals provided by the kindergarten. When the baseline data were reviewed, almost no kindergarten served vegetables at breakfast. As **paper II** evaluated the intervention effect on the secondary outcomes, all three meals needed to be included because the intervention recommended increasing the frequency of vegetables served beyond lunch and the afternoon meal, and breakfast was included because this meal offers a potential occasion to increase the frequency. As **paper III** explores potential mediators between factors in the workplace climate and culture, and the secondary outcome measures for the intervention, it was important to include the same outcome measures as **paper II**. For **papers I** and **III** the total score was aggregated to the kindergarten level. *Variety of vegetables* served for breakfast

(papers II and III), lunch (papers I–III) and the afternoon meal (papers I–III) was assessed through three separate questions: 'How often does your department offer these vegetables for breakfast/lunch/afternoon meal?' They were given 12 vegetable alternatives with the same response categories as for frequency, and the same recordings of the answers were applied. If a vegetable had been served (regardless of how many times) the value 1 was given and if it had not been served the value 0 was given. For the same reasons as stated above, in **paper I** only lunch and the afternoon meal were added together, and in **papers II** and **III** breakfast, lunch and the afternoon meal were added together. For **papers I** and **III** the total score was aggregated to the kindergarten level.

Assessment of staff's food-related practices

Staff's food-related practices were assessed in Questionnaires B and C (papers II and III; see Appendix IV). This measure consisted of eight different factors; these and the items included in each factor are presented in **paper II**. The eight factors were: *modelling* (five items), *initial encouragement* (five items), *child involvement* (four items), *reactive encouragement* (three items), *strictness* (three items), *rewarding* (three items), *accessibility* (four items) and *availability* (three items) (Vellinga, 2016). Details on how the factors were extracted are published elsewhere (Vellinga, 2016). The questions used were formulated as: 'How do you agree with the following statements?', with 5-point Likert scales ranging from 'totally disagree' to 'totally agree' with a neutral midpoint. Reversed scores were used for the items included in the factors labelled *strictness* and *rewarding*. A change in each factor from baseline to follow-up I was explored, but, as no change was detected, the changes are presented as one overall score labelled 'staff's food-related practices'. The mean score of each of the eight factors was added together and then divided by eight to give the mean score for 'Staff's food-related practice' (papers II and III). This score was aggregated to the department level in **paper II** and the kindergarten level in **paper III**.

Assessment of kindergarten characteristics and environmental factors

Kindergarten characteristics (papers I–III) and environmental factors (paper I) were assessed in Questionnaire A (Appendix V). The kindergarten characteristics assessed are: kindergarten ownership (private or public), number of children, number of full-time equivalents, number of full-time equivalents with the formal education to work as an pedagogical leader (question nos 6, 9, 12 and 13 in Appendix V), and information about which kindergartens were registered as a 5-a-day kindergarten, which was provided by the Norwegian Fruit and Vegetable Marketing Bureau. Four different aspects of the kindergarten environment were measured through several questions (paper I): (1) the *economic environment* was assessed through five questions (question nos 26–29 in Appendix V); (2) the *political environment* was assessed through four questions (question nos 16, 18, 22 and 23 in Appendix V); (3) the *physical environment* was assessed through three questions (question nos 14, 15 and 30 in Appendix V); and (4) the *sociocultural environment* was assessed through two questions (question nos 21 and 24 in Appendix V).

Assessment of workplace climate and culture

As mentioned earlier, environmental conditions include social and structural influences (Bartholomew et al., 2011), which in turn include factors that are recognized as essential factors in the working environment and associated with motivation and organizational learning (Lindström et al., 2000). These factors are understudied with regard to the organizational food environment in the kindergarten setting. In an attempt to fill this research gap, social and psychological factors in the kindergarten's workplace climate and culture were assessed as part of the organizational food environment. The General Nordic questionnaire for psychological and social factors at work (QPS_{Nordic}) is a validated, thoroughly psychometrically tested instrument, which has been used in

many different organizations (Dallner et al., 2000). However, despite the quality of this instrument, it has never previously been used to measure the organizational food environment in the kindergarten setting. The scales used from QPS_{Nordic} were: *role clarity* (three items), *support from a superior* (three items), *support from co-workers* (two items), *support from friends and relatives* (two items), *social climate* (three items), *innovative climate* (three items) and *commitment to organization* (three items) (Lindström et al., 2000). Workplace climate and culture (paper III) were assessed in Questionnaires A, B and C (Appendix VI). Calculation of the scales was done according to the description in the QPS_{Nordic}'s user guide (Lindström et al., 2000).

The intervention – setting and components

The intervention components were developed based on 1.5 years of formative evaluation work, which consisted of reviewing the literature, interviews with experts in children's eating development, concept mapping (Kane, 2007) conducted with kindergarten staff, initiated by the focus prompt 'Think of a usual day in the kindergarten – what makes the children eat vegetables?' (Nybakken, 2014; Utne, 2014), and observation of meals in two kindergartens for 1 week; each was done to develop core messages and components, followed by pretesting of these with staff in two other kindergartens (Ekeberg-Sande, 2015; Eng, 2015). Also, the Norwegian Information Bureau for Fruit and Vegetables was included as a partner in the project. Relevant material from the Bureau's '5-a-day' kindergarten concept was used in the BRA intervention and new products were developed to be evaluated through the intervention. The '5-a-day' kindergarten concept promotes both fruit and vegetable consumption, but, for the BRA study, primarily the vegetable-related material was used. The intervention components are described in Appendix VIII. Intervention components were planned, and implemented from September 2015 onwards, to ensure that all children and employees were present, and to give the kindergarten time to ensure a calm and stable start for all children after the summer holiday. No new material was provided after February 2016 to ensure that

implementation of intervention components was feasible before follow-up I data collection in April 2016. Briefly, an inspirational day (kitchen practice and theory) was held in September 2015 for kindergarten employees in the intervention group. The kindergartens were asked to participate with a minimum of one person from each kindergarten. This person then had the responsibility of disseminating the information received on the inspirational day to the rest of the employees in the kindergartens who worked at departments participating in the BRA study. The cook responsible for the kitchen practice observed and rehearsed the practical session developed by the Geitmyra culinary centre for children (Geitmyra matkultursenter for barn, 2019) before conducting the practical part of the Inspirational day. The theoretical part was conducted by one principal investigator, accompanied by either the postdoctorate student in our research team or the PhD candidate. The inspirational day ended with the participants putting together action plans in which the content from the day was applied to the needs and possibilities of each kindergarten, with a deadline for submitting their action plan to the research team of 4 weeks later. Finally, we handed out a 'welcome pack' for the employees to bring back to the kindergartens and participating departments. There were additional materials sent out as 'Boost 1' in November 2015 and 'Boost 2' in February 2016. Both the inspirational day's 'Welcome pack', and 'Boost 1' and 'Boost 2', targeted the four key determinants, which were availability, accessibility, encouragement and role modelling (see Figure 2). A log-in-protected website containing all the materials, as well as additional information about 45 different vegetables and small articles about the determinants, was available for the intervention kindergartens. In addition, all kindergarten staff were invited to join a closed Facebook group set up for the study, to share tips and inspiration with the other intervention kindergartens. In August 2016 an email was sent out to encourage maintenance of any changes achieved and continue improving practices related to serving vegetables.

All kindergartens (both intervention and control) completing all questionnaires in 2015 and 2016 received a gift card of the value of 2000 NOK (approximately €223). The control kindergartens participated only by providing data and were offered access to the website in September 2017.

Statistical analyses

In **paper I**, data on the kindergarten environment were collected at the institutional level (Questionnaire A) and not at the department level, so there was no issue with kindergarten clustering. Data on frequency and variety of vegetables served (Questionnaire B) and amount of vegetables eaten (5-day, weighted vegetable diary) were aggregated to the kindergarten level. To test for associations between environmental factors in the kindergarten, and frequency and variety of vegetables served and amount of vegetables eaten, Mann–Whitney *U*-tests and Kruskal–Wallis tests were used. These non-parametric tests were chosen due to the data not being normally distributed.

Independent sample Student's *t*-test and Pearson's χ^2 test were used to test for differences between the control and intervention groups for baseline characteristics in **paper II**. A meaningful difference among groups (intraclass correlation >5%) was found when quantifying the degree of clustering (Tabachnick and Fidell, 2018), and the clustering effect of the data was accounted for by using mixed model analysis (Veierød et al., 2012). Only complete data, with measures from both baseline and follow-up I, were included in the mixed-model analysis of the effect of the intervention on differences between amount, frequency and variety of vegetables served, and staff's food-related practices in the intervention and control groups. The data were structured in a wide format for the analysis. The intervention/control was the primary covariate of interest and analyses were adjusted for baseline measures. Random inhomogeneity between kindergartens was accounted for by using

the kindergarten as a random effect. Residuals and Q–Q plots were used to inspect the models that indicated a roughly normal distribution of the data.

For the QPS_{Nordic} scores used in **paper III**, the median with minimum and maximum scores was calculated, and Cronbach's α values were presented to show internal consistency of the items included in the scales. Spearman's ρ was used when calculating the bivariate correlations, due to some of the scales from the QPS_{Nordic} not being normally distributed. To assess the mediating role of the staff's food-related practices, six mediation models were set up to measure the interrelationship of commitment to organization and frequency of vegetables served (model 1), variety of vegetables served (model 2), amount of vegetables served (model 3), support from a superior, and frequency of vegetables served (model 4), variety of vegetables served (model 5) and amount of vegetables served (model 6). Simple mediation analyses were investigated using the PROCESS SPSS macro provided by Hayes (2018; model 4). For small sample sizes, it is recommended that the bootstrapping method be used (Hayes, 2018).Thus, 5000 bootstrap resamples with 95% bias-corrected confidence intervals were conducted for the indirect effect. The assumptions were investigated and considered acceptable. Also, the residuals for the mediation models were inspected and confirmed as normally distributed. Kindergarten ownership (public or private) was adjusted for in all analyses.

Results

Summary of findings

An overview of the most important results in this thesis are presented in Figure 4, and described further in this section. The results indicated that several factors from the economic environment were positively associated with the vegetables served and eaten in the kindergartens (**paper I**). In addition, factors in the political environment were found to be positively associated with the vegetables served and eaten in the kindergartens, indicating that these might also be important (**paper I**). Furthermore, the results indicate that *commitment to organization* and *support from a superior*, as factors of the workplace climate and culture, may be important to target as part of the development or implementation of kindergarten-based interventions aimed at increasing the frequency and variety of vegetables served, because they were related to more favourable food-related practices among the staff (**paper III**). In addition, the results showed that the BRA study was successful in increasing the variety and amount of vegetables served in the intervention kindergartens, but no effects were found for frequency of vegetables served or staff's food-related practices (**paper II**).

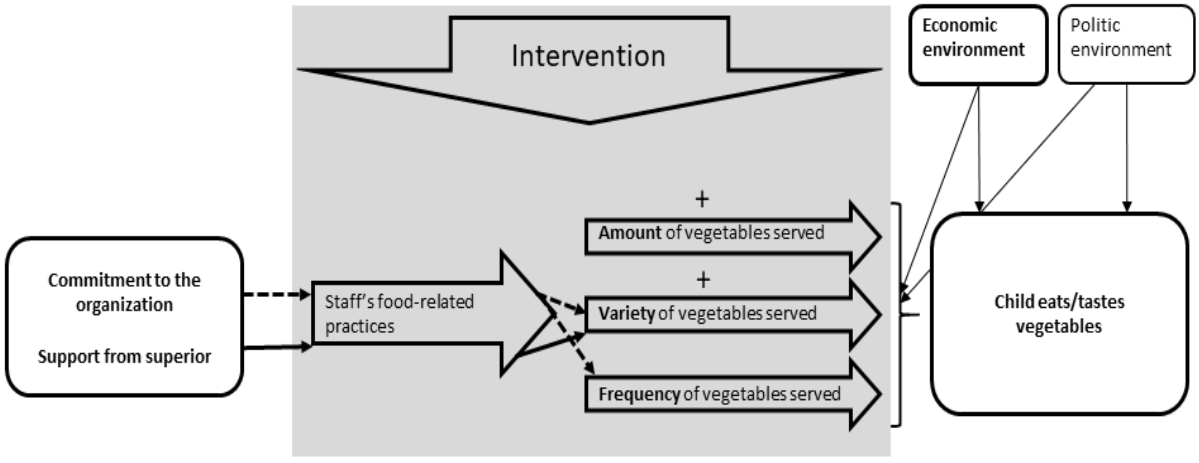

Figure 4 Overview of the main findings of the associations and effects of the BRA study on vegetables served and the staff's food-related practices. The arrows illustrate the positive associations. The dotted line is used to make it easier visually to see the different factor paths. The + represents an increase caused by the intervention.

Kindergartens in the BRA study

There was a similar distribution of private and public kindergartens in the BRA study sample (55% private, 45% public) to the overall distribution in the counties of Vestfold and Buskerud (59% private, 41% public). The mean number of full-time equivalents per kindergartens in the BRA study was 13.9, and the mean number of employees with formal education was 5.9; these were both a little higher than the overall numbers for Vestfold and Buskerud counties (12.5 full-time equivalents, 4.1 employees with formal education).

At baseline there was a median of eight different types of vegetables served per month, with a median frequency of vegetables being served of 6.3 times per week, and a median intake of vegetables of 36 grams per person per day. Vegetables were served more frequently in kindergartens where consumption of vegetables was ≥30.1 grams per person per day, compared with those kindergartens with a consumption of ≤30 grams per person per day ($P = 0.021$).

Associations between the food environment and vegetables served and eaten, and the staff's food-related practices (papers I and III)

The aims for **papers I** and **III** was to: (1) explore the associations between the economic, political, sociocultural and physical environments in the kindergartens, and the frequency and variety of vegetables served and amount of vegetables eaten; (2) explore the associations between workplace climate and culture in the kindergarten setting, and staff's food-related practices and vegetables served; and (3) investigate the possible mediating role of the staff's food-related practices.

Three of nine factors in the *economic environment* (**paper I**) were positively associated with the variety of *vegetables served*. These factors were: covered food supplies through the maximum parental fee ($P = 0.046$); did not ask for additional payment for food and beverages ($P = 0.045$); and answered 'agree' or 'neither' to questions of whether they had freedom within the food budget

(*P* = 0.033). One of nine economic factors was positively associated with *frequency of vegetables served,* and this was for kindergartens that asked for an additional parental payment of >251 NOK a month (*P* = 0.014). Three of nine economic factors were positively associated with the amount of vegetables eaten. These factors were: asked for additional payment of >251 NOK a month (*P* = 0.027); answered 'agree' to the question of whether they had freedom within the food budget (*P* = 0.010); and asked their employees to pay a monthly fee for food and beverages (*P* = 0.017).

One of six factors in the *political environment* (**paper I**) was negatively associated with *frequency of vegetables served,* and this was for kindergartens that had written guidelines for food and beverages brought from home (*P* = 0.001). One of six factors was positively associated with the *amount of vegetables eaten*, and this was for kindergartens that had written guidelines for food and beverages offered (*P* = 0.046). One of 10 factors in the *physical environment* (**paper I**) was associated with the *frequency of vegetables served*, and this was for those who answered 'agree' or 'disagree' to the statement about not buying vegetables because they are too expensive (*P* = 0.008). No significant associations were found between factors in the *sociocultural environment* and frequency or variety of vegetables served or amount of vegetables eaten, in **paper I**. However, in **paper III**, which measures sociocultural factors in the workplace climate and culture, a significant positive association was found between *commitment to the organization* (r_s = 0.33) and staff's food-related practices (*P* = 0.001). Also, single mediation analyses revealed a significant total and direct effect (*P* <0.05) for *support from a superior* on the frequency of vegetables served (*c* = 2.37, *c*' = 1.80). In addition, a significant mediation effect (*P* <0.05) of the staff's food-related practices was found for the relationships between *commitment to the organization* and frequency of vegetables served (*ab* = 0.77, confidence interval [CI] = 0.05, 1.48) (*a* path × *b* path) and variety of vegetables served (*ab* = 0.71, CI = 0.01, 1.44) (*a* path × *b* path). Finally, a significant mediation effect (*P* <0.05) of the staff's food-related practices was found for the relationship between *support from a superior* and variety of vegetables served (*ab* = 0.66, CI = 0.10, 1.32) (*a* path × *b* path).

Evaluation of the intervention (paper II)

The aim of **paper II** was to evaluate the effect of the BRA intervention on frequency, variety and amount of vegetables served and the staff's food-related practices in the kindergarten.

No differences between the intervention and control groups were found for the following baseline characteristics: ownership (public/private) (*P* = 0.4); number of children (*P* = 0.6); full-time equivalents (*P* = 0.5); full-time equivalent educated as kindergarten teacher (*P* = 0.4); additional payment for food and beverages (*P* = 0.2); employees pay a monthly fee for food and beverages (yes) (*P* = 0.5); and written guidelines for food provided by the kindergarten (yes) (*P* = 0.5). The results from the mixed-model analyses showed an increase in the variety of type of vegetables used per month with 1.5 type in favour of the intervention group (*P* = 0.014). An increase in the amount of vegetables served, by approximately 20 grams more vegetables per person per day, was observed in the intervention group compared with the control group (*P* = 0.002). No significant effects were found for the frequency of vegetables served during a week. Also, no significant effects were found on the staff's food-related practices assumed to be related to vegetable intake.

The BRA study was successful in increasing the variety and amount of vegetables served in the intervention kindergartens, but no effects were found for frequency of vegetables served or staff's food-related practices.

Impact of the results (papers I–III)

The results showed that economic and political factors in the kindergartens' food environment might be important in the promotion of vegetables and increasing intake of vegetables in kindergartens.

This is of high public health relevance and important in informing policy, because vegetable consumption is an important factor in reducing the risk of NCDs. Furthermore, the BRA study showed that a multicomponent intervention was successful in increasing the variety and amount of vegetables served. This indicates that implementation of the intervention components within the kindergarten system could have an impact on public health and contribute to reduce social inequalities in health because children from all social classes attend kindergarten. However, as the intervention did not have an effect on the frequency of vegetables served or the staff's food-related practices, future intervention studies should explore further the effect of targeting *commitment to organization* and *support from a superior*, because these factors seem to be important for increasing the frequency and variety of vegetables served through more favourable food-related practices.

Discussion

The aims for this thesis were to investigate whether factors in the kindergarten environment and measures of kindergarten workplace climate and culture were associated with vegetables served (papers I and III) and eaten (paper I), and the staff's food-related practices (paper III), and whether the intervention had an effect on the vegetables served and the staff's food-related practices (paper II). The results in **paper I** indicated that the economic environment in the kindergartens had most factors associated with vegetables served and eaten, as well as some factors in the political environment. Only one significant association was found for the physical environment and vegetables served. The results in **paper III** showed that commitment to the organization was significantly positively associated with the staff's food-related practices. Furthermore, the simple mediation analyses in **paper III** showed that the relationship between the kindergarten's workplace climate and culture and vegetables served was mediated through the staff's food-related practices. The results in **paper II** showed that the intervention was successful in affecting the amount and variety of vegetables served. No effects were found for the frequency of vegetables served or the staff's food-related practices.

Discussion of the results

Associations between factors in the organizational and interpersonal layers of the kindergarten

The kindergarten setting is a setting with both social and physical factors, in which many children can be reached simultaneously. The social factors in the kindergarten's organizational layer may affect the physical availability, in addition to the social interaction, within the interpersonal layer. These social interactions may then affect the meal-time situations, which could affect the children's preference and habits over food. By implementing health-promoting strategies in the kindergarten setting, such as repeated exposure to vegetables, many children may benefit from them. The

importance of making vegetables available and accessible to children, to affect their food preferences and eating behaviour, has previously been recommended. However, little is known about which factors in a kindergarten's food environment affect the availability and accessibility to vegetables of children, or how sustainable changes can be created in kindergartens' food environment. The results from this thesis have contributed towards filling some of the research gaps in this field. The food environment definition of Swinburn et al. (2013) was applied, and factors measured within those four aspects of environment have been assessed as factors in the organizational layer of the food environment, which represents the most distal layer of the ecological model investigated in this thesis (see Figure 1). Several factors that may affect the availability of vegetables served to the children and eaten by the children were assessed, and the results will be discussed here, whereas the assessment is discussed under Methodological considerations.

Swinburn and colleagues (1999) defined factors within the economic environment as being related to the cost of making healthy or unhealthy choices about food. Children learn to accept greater variety in tastes through repeated exposure (Birch et al., 1987; Nekitsing et al., 2018), and also greater availability and accessibility of vegetables have been shown to have a positive effect on children's vegetable consumption (Cullen et al., 2003; Blanchette and Brug, 2005; Brug et al., 2008). As vegetables need to be bought for the kindergarten, and the cost of the vegetables may affect their availability, it is important to know how and whether economic resources are associated with the availability of vegetables. The BRA study assessed several factors within the economic environment, with potential effects on both the availability and the consumption of vegetables (paper I). Interestingly, the results from the economic environment showed that the variety of vegetables served was not associated with a larger food budget (paper I). A qualitative Dutch study found that childcare workers thought that their organizations were unable to increase the variety of vegetables and fruit due to financial limitations (van de Kolk et al., 2018). In addition to using different

methodologies, the differences in these results may be due to differences in economic environments between countries, because the financing of kindergartens might differ. Furthermore, having a more extensive food budget or the perception of budgetary freedom has been associated with kindergartens buying and serving more vegetables in Norway (Norwegian Directorate of Health, 2012a). In line with these findings, the results presented in **paper I** showed that kindergartens that asked for an additional payment of >251 NOK served vegetables more frequently, and that the children and employees in these kindergartens ate a significantly larger amount of vegetables per person per day. In addition, the results in **paper I** showed that greater budgetary freedom seemed to have a positive association with the variety of vegetables served and the amount eaten. This indicates that not only the absolute cost, but also the freedom to prioritize food in the budget, can influence the availability of vegetables. Finally, in kindergartens where the employees paid a monthly fee for food and beverages, this was associated with a larger amount of vegetables eaten. The higher intake of vegetables in these kindergartens may then be a direct effect of the adults eating more than the children, and that this was planned for because the employees had paid for it. However, as children's eating habits develop through social factors such as social interaction (Ventura and Worobey, 2013), the children could also have been encouraged to eat more vegetables with employees being present and eating the same food.

In total, these associations show that factors within the economic environment may contribute to an increase in variety, frequency and amount of vegetables served and eaten in Norwegian kindergartens. In addition, these factors could also contribute to increasing differences between kindergartens because some have the possibility of a larger food budget. Despite the government's action to level out social differences by setting a maximum parental fee, the kindergarten has permission to ask for an additional payment to cover food and beverages. This permission may contribute not only to families opting for other kindergartens, but also to an increase in the difference in quality of the food provided. This, in turn, may increase differences in food served and

eaten, and consequently in health. There could be a need for a discussion of this practice to give all kindergartens an equal opportunity to purchase healthy foods and make them available and accessible for all children attending kindergarten, but this is a longer process of change. However, there is a message to kindergartens that could start to solve this problem, namely that perceptions of the budget are a barrier that could be overcome by planning the overall use and purchase of foods differently. This message was given as part of the BRA intervention based on the formative evaluation.

The political environment, which is called policy in the definition of the food environment, is defined by the ANGELO framework as 'rules, regulations, laws and formal or informal policies'; in this case this would have a profound effect on the organization or the individuals in relation to food (Swinburn et al., 1999). The results in **paper I** showed that written guidelines for meals served in the kindergarten had a positive association with vegetable consumption (**paper I**). This is in line with the latest national survey of food and meals in Norwegian kindergartens, where more fresh vegetables were served in kindergartens with written guidelines for food and meals served (Norwegian Directorate of Health, 2012a). However, a review from 2011 found that guidelines or policies for serving nutritious food are not equivalent to serving an adequate amount of fruit and vegetables (Larson et al., 2011). An explanation for these different results may be that the guidelines and policies investigated by Larson et al. (2011) were state regulations and guidelines for programmes that follow federal performance standards, and were thus within the policy layer of the ecological framework, which is a more distal layer than the organizational layer (see Figure 1). This may have caused a larger gap between policy and practice. In the BRA study, the guidelines investigated were developed and embedded in the kindergarten's annual plan or the kindergarten's own written guidelines. Almost 70% of the kindergartens based these guidelines to a large degree on the national guidelines for food and meals in kindergartens (Norwegian Directorate of Health, 2007). Similarly, a recent Finnish study found that kindergartens with a larger number of food-related policies (the

kindergarten's own or municipal/national) was associated with a higher vegetable intake by the children (Lehto et al., 2019). This may indicate that guidelines are more influential on practice when developed and adapted to local conditions, and this adaptation of guidelines may be important in increasing the availability of vegetables to children in the interpersonal layer.

More peculiar was the result that vegetables were served more frequently in kindergartens that did not have written guidelines for food and beverages brought from home (paper I). However, as it could be more important to have guidelines concerning the kindergarten's own practice, it seems logical that a kindergarten that does not require children to bring lunch from home does not need guidelines for such food. In addition, a kindergarten that does not require children to bring lunch from home serves food more often, and may therefore serve vegetables more often. This is supported by a Dutch study, which found that childcare facilities that provided food more often had more elaborate food policies than those that served food occasionally (i.e. only for birthdays or other celebrations) (van de Kolk et al., 2018). Based on these results, Norwegian kindergartens should be requested to spend more time on interpreting and adapting national guidelines to local conditions, because vegetable intake was higher in kindergartens with their own written guidelines for food and beverages (paper I).

Within the ANGELO framework, the physical environment refers to the availability of healthy or unhealthy food (Swinburn et al., 1999; Brug et al., 2008). In the BRA study, the factors assessed within this aspect of the environment were primarily barriers to and facilitators of serving vegetables because the availability was in itself seen as the outcome of these environmental factors. **Paper I** revealed an unexpected finding that kindergartens that perceived the cost of buying vegetables as a barrier still served vegetables more frequently than those that responded with 'neither agree nor disagree' or 'disagree' to the statement 'I do not buy vegetables because they are too expensive'. An explanation for this finding could be that kindergartens that buy vegetables more frequently are more aware of the cost. Furthermore, even though vegetables were available more often in these

kindergartens, they could have purchased a smaller amount of vegetables per meal than the recommended amount because the cost was seen as a barrier. However, the main impression from the results was that kindergarten leaders did not experience many barriers related to vegetables. Yet, this again stresses the possibility of providing Norwegian kindergartens with tips on how to prioritize and maximize the food budget to buy sufficient vegetables, or that the Norwegian government should establish a higher designated sum for food per child.

The fourth environment in the ANGELO framework is the sociocultural environment (Swinburn et al., 1999), which regards cultural and social norms related to food (Brug et al., 2008). An important sociocultural aspect of the BRA study was the intervention components developed to guide the encouragement of children to eat/taste vegetables. General ideas were given and experiences shared at the inspirational day, but it was recommended that this should be tailored, based on the child's eating abilities and potential psychological barriers (neophobic or picky/fussy eaters). Several factors assessing this environment have been investigated in **papers I** and **III**. The sociocultural factors investigated in **paper I** were not associated with the availability or consumption of vegetables. However, previously conducted studies have found associations between factors in the sociocultural environment and vegetable consumption by children (Gubbels et al., 2010, 2015; Ray et al., 2016). A possible explanation could be that the sociocultural environment was assessed within different layers of the environment using different methodologies to previous studies (Gubbels et al., 2010, 2015; Ray et al., 2016). This is discussed further under Methodological considerations (p. 65).

In **paper III**, factors in the workplace climate and culture of the kindergarten were assessed using social and psychological factors. Few studies have previously investigated factors in the workplace climate and culture in relation to nutrition or the food environment in the kindergarten setting (Seward et al., 2017). The results in **paper III** showed that the workplace climate and culture in the kindergarten could influence the availability of vegetables through the staff's food-related practices.

A possible explanation for these associations might be that the workplace climate and culture are associated with job performance, as has been shown for teachers (Tsui and Cheng, 1999; Park, 2005; Nguni et al., 2006; Werang et al., 2017). Job performance is how employees conduct their work in general, and may also relate to how they conduct the work related to food, referred to as *staff's food-related practices* in the BRA study. Thus, Norwegian kindergartens might benefit from targeting workplace climate and culture factors as part of the sociocultural environment within the kindergarten's organizational layer, because this may affect the performance of the staff's food-related practices, i.e. it may affect how kindergarten employees encourage the children to eat/taste vegetables, and the availability and accessibility of vegetables in the sociocultural environment of the children's interpersonal layer. However, as the sample size of the BRA study was relatively small, these results should be interpreted with caution and researched further.

The results from the BRA study have identified several factors within the kindergarten setting that may affect availability and accessibility of vegetables. However, it is important to know more about the role of kindergarten staff's food-related practices and how these may affect availability and accessibility of vegetables, and increased intake of vegetables through encouraging children to eat/taste vegetables. These factors should be investigated further because they may affect the possibility for children to learn to accept a greater variety of vegetables, and thus increase their intake and establish lifelong habits that can prevent NCDs.

Changing the factors in the interpersonal layer of the kindergarten

The results from **paper II** showed that the BRA intervention had a positive effect, with an increase of 1.5 in variety of vegetables served per month, and an increase of approximately 20 grams of vegetables served per person per day. These different aspects of availability of vegetables related to the meal-times could be viewed as being within the interpersonal layer. The intervention described in this thesis was aimed at changing the vegetable intake of 3- to 5-year-old children attending

kindergartens through a change in their environmental determinants. Thus, based on determinants for children's vegetable consumption (Cullen et al., 2000; Blanchette and Brug, 2005; Rasmussen et al. 2006; Brug et al., 2008a, 2008b; Krølne et al., 2011), intervention components were developed to teach kindergarten employees the importance of modelling and encouraging the eating of vegetables (sociocultural environment), and making vegetables available and accessible (physical environment) at table during kindergarten meal-times. The previously mentioned ToyBox study had several similarities in how the intervention targeted the kindergarten environment (i.e. teacher training, creating a supportive environment, making snack plates, reminding the children to eat a healthy snack, conducting activities related to the target behaviour) (Pinket et al., 2017). However, similar to the BRA intervention, the ToyBox study was successful only in affecting some of the targeted dietary outcomes, and no effect on the children's vegetable intake was found (Pinket et al., 2017). Several interventions have targeted food-related practices and/or parts of the kindergarten environment (Vereecken et al., 2009; De Bock et al., 2012; De Coen et al., 2012. Brouwer and Neelon, 2013; Natale et al., 2014), but they vary in how the environments were targeted; also the effects on vegetable intake of the target groups are mixed. These differences make it difficult to know how to make sustainable changes in the kindergarten environment. More importantly, interventions that found increased vegetable intake in the target group (De Bock et al., 2012; Natale et al., 2014) did not measure or report results of changes in the kindergarten environment and, thus, these new results of the BRA study cannot yet be compared with others. However, recently promising results have been published from the online version of the NAP SACC intervention, which has been called Go NAP SACC (Dev et al., 2018). The NAP SACC intervention was a big inspiration in the development of the BRA study and, similar to the NAP SACC intervention (Benjamin et al., 2007; Ward et al., 2008b), the BRA study used self-assessment because the kindergarten employees could choose which intervention components they thought they would benefit from most, and what aspect of the logic model they needed to work on. As the Go NAP SACC is fully self-assessment based and the BRA study is to some

degree self-assessment based, and both interventions have shown promising results on changing the food environment within childcare facilities, the self-assessment approach may be effective and should be further explored by researchers and practitioners because it seems to improve the health-promoting role of childcare settings.

Our results showed no difference between the intervention and the control groups in the frequency of vegetables served; this may be due to an increase in the frequency of vegetables served in both groups. Also, the previous version of the national guidelines for food and meals served in Norwegian kindergartens (Norwegian Directorate of Health, 2007) emphasized that the kindergarten should provide two meals during the day. In the context of Norwegian kindergartens this means two meals each day for 5 days a week. This could have caused an upper limit of 10 potential servings of vegetables per week, and the high frequency of vegetables served at baseline (approximately seven times a week) supports this. The potential to significantly increase the frequency of vegetables served was further limited by the knowledge that not many kindergartens provide all the meals during a week because some meals are brought from home (lunch box). However, the revised version of the national guidelines for food and meals served in kindergartens strongly recommends that they should provide three meals during the day, either served by the kindergarten or brought from home, and further recommends that fruit and *vegetables should be served at each meal* (Norwegian Directorate of Health, 2018). These recommendations may increase the potential of vegetables being served to 15 times a week. A recent report published by the Norwegian Consumer Council and the Norwegian Diet and Nutrition Association (2018) found that one of three kindergartens served vegetables only twice a week or less often. This highlights the importance of further investigations of how kindergartens can integrate vegetables into their daily provision of food and meals served to the children. In addition, in the revised version of the national guidelines, each of the recommendations has been categorized into *strongly recommended* or *requirements of the law* (Norwegian Directorate of Health, 2007); this wording was not used in the previous version. One

of the things that has been strongly recommended is that vegetables should be served every day (Norwegian Directorate of Health, 2007). As such, this new wording may have an impact on how these revised guidelines are received and used in Norwegian kindergartens. However, no reports have yet documented the use of the revised guidelines, although they should be implemented in the light of local conditions in Norwegian kindergartens, because this was found to be positively associated with higher vegetable intake by children both in the BRA study (paper I) and in a Finnish study (Lehto et al., 2019).

Our intervention was not successful in changing the staff's food-related practices that are assumed to be related to vegetable intake. This is in line with the NAP SACC intervention in the USA (Ward et al., 2008b) and an Australian intervention (Bell et al., 2015), both targeting environmental changes such as change in foods provided, feeding environment, role modelling, feeding practices, menus, education and professional development of employees, their own written food policy (Ward et al., 2008b), staff training in nutrition, policy guiding the content of foods provided to children by the childcare facility, policy guiding the content of foods packed for the children by parents and provision of foods to children that were consistent with the dietary guidelines (Bell et al., 2015). However, a more recently published study conducted in family childcare homes in Nebraska was successful in improving practices (Dev et al., 2018), through the online self-assessment tool Go NAP SACC (Ward et al., 2017). The practices that improved through the Go NAP SACC intervention were: *provider helps children determine if they are still hungry before serving more food*; *provider rarely or never requires children to sit at the table until they clean their plates*; *provider uses an authoritative feeding style*; *provider rarely or never uses children's preferred foods to encourage appropriate behaviour*; *provider most or all of the time eats and drinks the same foods and beverages as the children*; *provider rarely or never eats or drinks unhealthy foods or beverages in front of children*; and *provider most or all of the time talks informally with children about trying and enjoying healthy foods* (Dev et al., 2018).

By affecting a positive change in staff's food-related practices, this change could be beneficial for children's vegetable consumption, because previous studies have found positive relationships between parental practices and intake of vegetables and children's vegetable consumption (Rasmussen et al., 2006; Zeinstra et al., 2010; Sweetman et al., 2011; Wroten et al., 2012), and some studies have found positive associations between childcare staff's food-related practices and children's food (Gubbels et al., 2010) and vegetable intake (Gubbels et al., 2015), as well as food acceptance (Hendy and Raudenbush, 2000). These findings were important in the development of the intervention components in the BRA study, because it was important for our intervention to suggest how the kindergarten employees could encourage and model vegetable consumption. However, the results showed that the overall scores for staff's food-related practices reported at baseline, for both the control and the intervention groups, were relatively high, with a baseline score at approximately four out of a maximum of five. An explanation for the lack of change might be that the employees felt that they were already conducting these practices and, as baseline scores were relatively high, this could have limited the possibility of measuring a further increase in this practice.

It may seem that multicomponent interventions that are to a large degree based on self-assessment could be the solution to increase the serving of more healthy foods in kindergartens. This solution may be more intrinsically motivating due to the variation between kindergartens, because the employees may get demotivated if the interventions are too ambitious or they do not see their relevance. As, now, it is strongly recommended that Norwegian kindergartens provide three meals during the day, they could plan for an incremental improvement to serve or have parents include vegetables at all three meals.

Methodological considerations

Design of the study

This study was designed as a kindergarten-based, cluster RCT. As the intervention targeted the environment within the kindergartens, an individual allocation to the intervention and control groups would not have suited the purpose of the present study, and therefore a cluster allocation was applied. Cluster RCTs are often used to avoid 'contamination' between intervention and control groups (Puffer et al., 2005) within the clustering unit. However, even though kindergartens in the intervention group were told not to share information with the control group, there is a possibility that this may have occurred because several of the kindergartens were localized within the same municipalities, and had already collaborated on several aspects of running the kindergartens. Even though cluster RCTs are considered the most robust method for evaluating the effect of these types of interventions, there are factors that can bias the results (Puffer et al., 2005; Taljaard et al., 2013). First, a bias of allocation may occur if randomization has not been undertaken carefully and preferably independently (Puffer et al., 2005). In the BRA study, a statistician not involved in the project ensured that the randomization was undertaken carefully and independently of the research team. For the BRA study, the participant recruitment and baseline data were conducted before cluster allocation. Also, the randomization procedure ensured an even distribution of public and private ownership and number of children in the intervention and control groups. In this way, the possibility of allocation and selection bias was avoided. Although ownership and number of participating children were evenly distributed, there were differences between the kindergartens in size (total number of departments, children and employees) and resources. However, the randomization was considered to be successful because no differences were found across kindergarten characteristics in **paper II**.

Sample size

The sample size of 73 kindergartens in the BRA study was slightly lower compared with that in the NAP SACC study, with 84 childcare centres. An accurate estimation of the sample size is vital in research studies because small sample sizes may contribute to the wrong conclusions. In addition, the analyses are more vulnerable as a result of missing data, because missing data can further decrease sample size. However, based on the calculations for the detectable effect size, we needed 30 kindergartens in each group, so this size was achieved. These calculations were based on what sample size was needed to detect the effect of the intervention on the outcome measures presented in **paper II**, and not to assure power for the mediation analysis. The bootstrapping method has been recommended for use in small sample sizes (Hayes, 2018), and so it was used when conducting the simple mediation analyses in **paper III**, because this can reduce the risk of type 2 error**.** However, future studies should include larger sample sizes to avoid the risk of type 2 error. In addition, the consequence that the sample size was not calculated for mediation analyses could have affected the power of the analyses, which could lead to the wrong conclusions. Thus, future studies should include all planned analyses in the calculation of the sample size.

Generalizability

Only 15.2% of the invited kindergartens accepted the invitation to participate in the BRA study. The sample of participating kindergartens could have had more interest in food and nutrition or been more engaged in projects and/or research participation than the remaining 84.8%. However, there were a higher number of kindergartens in the whole kindergarten population in Vestfold, and Buskerud counties registered as 5-a-day kindergartens compared with those in the BRA study (paper I), indicating that the non-participating kindergartens also had an interest in the fruit and vegetables provided by the kindergarten. The share of private and public kindergartens was almost the same for the kindergartens in these two counties overall, compared with those in the BRA study sample

(paper I). However, the numbers of mean full-time equivalents and employees with formal education for work as a pedagogical leader were a little higher for the kindergartens in the BRA study, compared with the total number of kindergartens in the Vestfold and Buskerud counties. Therefore, the kindergartens in the BRA study could have had more resources due to a higher number of employees with and without the formal education; this could decrease the generalizability to some degree, although the study included both rural and semi-urban kindergartens, which in turn could increase the generalizability of our findings to several parts of Norway.

The quality of the measurement instruments used

Data were collected using three paper-based questionnaires. No previously validated or reliability-tested questionnaires suited the purposes of the BRA study. Therefore, modified items from statements and questions used in the last Norwegian dietary survey of kindergartens (Norwegian Directorate of Health, 2012), the last dietary survey among Norwegian 2 year olds (Kristiansen et al., 2009), previous international studies of parents (Musher-Eizenman and Holub, 2007; Zeinstra et al., 2010; Baranowski et al., 2013; Haszard et al., 2013) and the QPS_{Nordic} (Dallner et al., 2000) were used. Some of these previously used questionnaires have been tested for validity and reliability (Dallner et al., 2000; Musher-Eizenman and Holub, 2007; Baranowski et al., 2013). The use of statements and questions from questionnaires previously tested for reliability or validity is preferred to developing new questionnaires because comparability between studies is ensured, although the reliability and validity of questions for use in the present study cannot necessarily be based on these previous studies. In particular, the statements and questions from the international studies were not checked beyond the face validity of their cultural sensitivity. As such, validation and reliability testing would have enhanced the quality of the measurements. The lack of time and resources was a crucial factor when considering whether or not to conduct these tests. However, the questionnaires were piloted

with kindergarten employees not working within the counties included in the study, and the feedback led to just small adjustments. Factor analysis was conducted by Vellinga (2016) of the subcategories on which the staff's food-related practice measure was based. The factor analysis showed that Cronbach's α was acceptable for most scales (>0.70) (Vellinga, 2016). As these data were planned and included in **papers II** and **III**, the factor analyses were repeated and confirmed by the PhD candidate (data not shown). In addition, Cronbach's α was calculated for the measures used from the QPS_{Nordic}, which showed that the internal consistencies of the scales were comparable with the results for the original QPS_{Nordic} (Lindström et al., 2000). These results are positive indications of the quality of these measures, even though the questionnaires were not thoroughly validated.

The decision to use paper-based rather than web-based questionnaires was made to accommodate lack of access to computers by most staff in the kindergartens. However, the use of web-based questionnaires may have been more appropriate to secure anonymity. As the employees may have filled in the questionnaires at different times due to working different shifts or having a lunch break at different times, so that someone always attended to the children, the respondents may have worried about how the questionnaires were handled before being returned together in the prepaid envelope. This may have affected how they responded to the more sensitive questions such as those on workplace culture and climate. In hindsight, providing an envelope so that each person could seal it straight after filling in the questionnaire, or even a pre-paid envelope, would have been better at securing the respondent's anonymity.

Furthermore, the questions used in our questionnaire assessing the staff's food-related practices were formulated in a way that could have caused social desirability bias by staff answering in favour of what they thought was the correct practice, regardless of actual practice. As the staff's food-related practices were not observed, it is uncertain whether this is how they conducted their work or just what they knew they should be doing. Another limitation with regard to the data collected was

that pre- and post-questionnaires were not matched at the individual level. However, as the respondents filled out which department they worked at, the questionnaires from the same department pre- and post-implementation of the intervention were matched, and the purpose of the questionnaires was primarily to assess the environment and not factors at the individual level. Yet, in kindergartens with a high turnover of employees or a large degree of rotation of personnel between departments within the kindergartens, changes could be due to different perceptions and practices by different individuals at the two time points. However, as the results from the different time points show small or no change, this could show that it was, to a large degree, the same employees who responded, or they had similar opinions.

The 5-day, weighted vegetable diary was developed based on knowledge of what meals are usually served over a day in the kindergarten, and that weighted registration was a useful method for collecting these types of data. This instrument was developed for self-reporting, and anyone working in the department could fill it in. This could have impacted on the consistency of how the data were reported. Also, the amount of vegetables left on the children's plate or that had fallen on to the floor was not included in the amount left after the meals. This may have contributed to an overestimation of the amount of vegetables eaten in **paper I**. Another factor that could have led to an overestimation in **paper I**, with regard to amount of vegetables eaten, is that we only know how many people were present at the table and could have eaten, but not how many actually ate, so a mean score was calculated on intake per person per day. This contributes to uncertainty about this estimation, so this outcome measure was not used further in **papers II** and **III**. For **papers II** and **III** the data collected with the 5-day, weighted vegetable diary were used to assess the amount of vegetables *served* per person per day. This amount was also divided by the total number of children and employees present who ate. Compared with the assessment of the amount of vegetables eaten, this measure could be more accurate because it measures only what was available, on average, and

not what was eaten, on average. However, as the employees who prepared the meals probably knew that one or several of the employees were going to eat as well, they might have served a larger amount than if it was just for the children, because in general adults eat more, so the availability for the children could be overestimated.

Assessment of the economic, political, physical and sociocultural environments

Several factors that may affect the availability of vegetables served and eaten by the children were assessed in **papers I** and **III**. After these factors had been assessed, the factors were categorized into the four environments defined by the ANGELO framework (Swinburn et al., 1999; Brug et al., 2008): the economic, political (subsequently named policy by Swinburn and colleagues), physical and sociocultural environments. This was done with the purpose of structuring the results. Therefore, the questionnaire that assessed the factors included in these four environments was not specifically developed to measure the economic, political, physical and sociocultural environments defined by the ANGELO framework. As such, we did not consider how many factors we should assess within each of them. Thus, the number of factors assessed may not be sufficient to cover all the important aspects within each of the four environments. Even though the factors assessed were sorted into the economic environment, they are not entirely in line with how the ANGELO framework defines it.

More in line with the definition by Swinburn and colleagues, a review of the theory and evidence for environmental determinants of health behaviours, such as nutrition and physical activity, found that, within the economic environment, the affordability of unhealthy foods was studied the most (Brug et al., 2008). No recommendations were given on how to assess other aspects within the economic environment, and no studies investigating the economic environment in kindergartens were included (Brug et al., 2008), so the factors assessed in paper I were considered by us to be potentially important factors of the economic environment in kindergartens. Subsequently, a review including

observational and intervention studies that used the ANGELO framework found no other studies assessing the economic environment of 4- to 8-year-old children (Johnson et al., 2016). This review included childcare settings; however, these studies assessed family food budgeting, canteen or vending machines, and the development of fast-food outlets, which is more in line with the ANGELO framework, although these factors would not be relevant in the Norwegian kindergarten context. The economic environment was assessed through nine factors, and this may not be sufficient to measure the whole environment.

The factors assessed through the BRA study were: *how the kindergarten covers expenses for food and beverages*; *whether the kindergarten receives any additional payments/support to cover expenses for food and beverages*; and *to what degree the kindergarten has freedom in how to distribute the budget*; these are different factors from those assessed by previous studies (Brug et al., 2008; Johnson et al., 2016). However, what one is supposed to measure within the economic environment does not come across as uniquely defined, so what was measured in the BRA study within the economic environment could be relevant within the Norwegian kindergarten context. Furthermore, in **paper I** the physical environment was assessed within the organizational layer, through the kindergarten leader's perception of barriers to making vegetables available. Even though we have not measured the physical environment according to the ANGELO framework (Swinburn et al., 1999), we chose to categorize the barriers as belonging to the physical environment, because it is important to know about these barriers to understand what is challenging about increasing the availability of vegetables in kindergartens. Barriers could not have provided the best assessment of factors within the physical environment. However, unless these obstacles are reduced, they may negatively influence the physical environment by reducing the availability of vegetables.

In **paper I**, the sociocultural environment was also assessed within the kindergarten's organizational layer. The previous studies assessed the sociocultural environment (Gubbels et al., 2010, 2015; Ray et al., 2016) through observations and focus group interviews, and questionnaires assessing

sociocultural factors in the interpersonal layer, such as staff behaviour, supervision practice and style of serving food (Gubbels et al., 2010), and the staff's practices (Gubbels et al., 2015). In contrast, the BRA study assessed factors such as *to what degree the employees learn how to interact with the children during meals* and *to what degree does the kindergarten leader think he or she needs to improve the practical part regarding meals, food and beverages, if he or she feels competent to guide the employees in what is a healthy diet for children and thinks this is important*. As these factors are the kindergarten leader's perceptions of what type of competence has already been implemented or needs strengthening, and what he or she finds important to focus on, it may be debatable whether the factors assessed in **paper I** should even have been categorized as belonging to the sociocultural environment. However, my colleagues and I felt that the factors indirectly belonged to the sociocultural environment, so they were sorted into this category.

Choices made with regard to the statistical analysis

In the BRA study, the kindergartens were recruited, whereas departments with children aged 3–5 years were targeted by the intervention. There is a possibility that departments within the same kindergarten were more similar compared with departments in a different kindergarten. As the data analysed in **papers I**–**III** were collected through a cluster RCT, it was essential to take into account the data's clustering effect when conducting the analysis (Bland, 2004). To quantify the degree of clustering of departments at the kindergarten level, the intraclass correlation coefficient (ICC) was used. As the ICC was >5% when quantifying the degree of clustering, there was a meaningful difference among the groups (Tabachnick and Fidell, 2018), so mixed-model analyses were used to evaluate the effect of the intervention in **paper II**. The mixed-model analysis uses a hierarchical structure and nests the data within the departmental and the kindergarten level (Field, 2013). However, for **papers I** and **III**, the data were aggregated to the kindergarten level, because these papers addressed the kindergarten's organizational level. The initial goal was to recruit a department

with 10 participating children from each kindergarten. For several kindergartens, this was impossible because children attended different departments within the same kindergarten, or the number of 3- to 5-year-old children was too low. Therefore, several departments within the same kindergarten were included, and the final number of departments within one kindergarten varied from one to six. Based on this variation, it was decided to aggregate the data to the kindergarten level to ensure better comparability between the kindergartens in **paper I**. For **paper III** the reason why we conducted the mediation analyses was to explore whether there were distal factors that should have been considered before implementing an intervention targeting vegetables served. As the intervention was aimed at the kindergarten, we wanted to explore the kindergarten's workplace climate and culture. By conducting the analyses at the departmental level, the results would not give an assessment of the kindergarten's workplace climate and culture, but rather the department's workplace climate and culture.

Handling of missing data. As previously mentioned, outcome measures and the different factors were assessed using three different questionnaires and one 5-day, weighted vegetable diary. In **paper I** the factors and measures used were assessed using two different questionnaires and a 5-day, weighted vegetable diary. Kindergartens included in the analysis should have provided data from the kindergarten leader questionnaire on factors at the organizational level, and one of the outcome measures: frequency or variety served (Questionnaire B) or amount of vegetables eaten (the 5-day, weighted vegetable diary) (paper I). Some kindergartens did not return questionnaires assessing outcome measures, and some did not return the questionnaires answered by the kindergarten leader. Thus, available case analysis was considered to be the best alternative because this provides the possibility of including all available cases for each analysis. However, the disadvantage of this type of analysis is that the sample size will differ between analyses, and may be difficult to interpret, because one may wonder whether the results were caused by different participants in different

analyses. In addition, one of the alternatives to available case analyses would have been complete case analysis, but this would have reduced the sample size even more.

In **paper III** we conducted a complete case analysis because we wanted to base all the analyses on the same data sample, and only kindergartens with complete data on the workplace climate and culture, staff's food-related practices and vegetables served were included. This decision resulted in an exclusion of six kindergartens. For both **papers I** and **III** the sample sizes were reduced by almost 10%; it has previously been debated whether, if incomplete cases comprise only ≤5%, then both complete case and available case analyses should be a reasonable solution to handling missing data (Schafer, 1997), but this was not the case for **papers I** and **III.** However, such rules are problematic to create because it depends on several other aspects, such as if the cases are missing at random and the total sample size (Veierød et al., 2012). It is difficult to establish whether or not cases are missing at random. Data missing for **papers I** and **III** were due to participants not returning questionnaires or the 5-day, weighted vegetable diary. As such we had no data on kindergarten characteristics for the missing kindergartens, which made it difficult to establish whether cases were missing randomly.

An *intention-to-treat* (ITT) analysis was considered with regard to evaluation of the intervention effect. The positive aspect of using an ITT is that it can prevent bias caused by loss of participants (Gupta, 2011). As the BRA study experienced a relatively small loss of participating kindergartens, the main reason for conducting an ITT analysis was due to missing data at the department or kindergarten level for outcome measures at baseline, follow-up I or both. The CONSORT statement on reporting RCTs originally emphasized the necessity and appropriateness of using the ITT approach (Hollis and Campbell, 1999). However, it was later revised because of the misuse of the term 'intention to treat', and replaced by emphasizing a more explicit request for information on how participants are kept in their original groups (Schulz et al., 2010). Thus, a per-protocol analysis was conducted, with only complete datasets and a thorough description of which kindergartens and

departments were included. In general, when conducting a per-protocol analysis all participants who did not adhere to treatment, switched groups or missed measurements were excluded from the analyses (Sainani, 2010). Both ITT and per-protocol analyses were conducted to explore whether there were any major differences in effects, which there were not.

Fidelity of the intervention programme delivered

The BRA intervention aimed to be a programme that was easy to implement and sustainable, based on recommendations from previously conducted, school-based interventions (Han and Weiss, 2005). This was especially important because each kindergarten is free to organize their food and meals very differently. Furthermore, the departments are dependent on the employees being present to conduct the educational planned activities, and also to ensure a safe and healthy environment for the children during opening hours. Therefore, the kindergartens decided which and how many employees would attend the inspirational day to receive the intervention components and be responsible for disseminating this information to the rest of the relevant employees on their return, and ensure implementation based on their action plans. However, we did not measure the quality or fidelity of the train-the-trainer strategy of the intervention delivered, and this led to uncertainty about the quality of the information disseminated to the rest of the employees. This limits the knowledge of whether the intervention was adopted, as planned, by the employees who did not attend the inspirational day, although guided practice is the method of ensuring common practice in daily tasks in Norwegian kindergartens. However, this guided practice in the kindergartens is led by the pedagogical leaders, and not all kindergartens sent an pedagogical leader to the inspirational day. Moreover, the inspirational day consisted of theoretical and practical parts, based on the logic model (see Figure 2) developed for the BRA study, which were presented to the kindergarten employees who attended the inspirational day. The employees were introduced to the critical aspects of the different steps of the model and told to adapt the intervention components to local

needs. At the end of the inspirational day, the employees were given the assignment to make a plan of which components they would apply, to achieve the intervention's intention based on the logic model presented. Thus, the BRA intervention consisted, to a considerably larger degree, of adaptability rather than faithful reproduction.

No other measure of fidelity of the intervention components delivered to the kindergartens was assessed. Even though the intervention was systematically developed and evidence based, the lack of fidelity assessment is a limitation because a detailed description of the integrity of the intervention programme cannot be given. This means that the results presented in **paper II** cannot be interpreted in the light of the information about the implementation. With regard to adaptation, Durlak and Dupre (2008) emphasize, in their review, that the focus should be on finding the right mix between fidelity and adaptability, not in terms of either–or. Even though this intervention has several limitations with regard to fidelity, the concept behind the logic model and the emphasis on adaptability could have been factors that were crucial for the effect of the intervention, because flexibility and adaptability have been emphasized as important factors in developing sustainable programmes (Han and Weiss, 2005).

Conclusions and implications for practice and research

The following conclusions can be drawn based on this thesis and the results from **papers I–III**.

The results from the BRA study indicate that, within the kindergarten's food environment, there are several economic factors that seem to be positively associated with availability and consumption of vegetables. Also, the political factors may seem to be important for availability of vegetables. In addition, some sociocultural factors seem to be important as a target when developing kindergarten-based interventions aimed at increasing the availability of vegetables served, because these were associated with more favourable food-related practices among staff. There was a lack of associations with physical factors, but this may be due to factors being assessed in different ways and in different layers of the kindergarten food environment than in previously conducted studies.

The results from the BRA study intervention showed that a feasible multicomponent kindergarten intervention can be successful in affecting availability of vegetables within the kindergarten's food environment. No intervention effects were found for the frequency of vegetables served or the staff's food-related practices. However, both the intervention and the control groups increased the frequency of vegetables served from baseline to follow-up I, but this change cannot be attributed to the intervention.

These different aspects of the kindergarten food environment should be further investigated to understand how to make sustainable changes in the kindergarten's food environment. Based on this conclusion there are implications for future research and practice as follows.

Implications for research

- Based on our limited variation in the measure of the staff's food-related practices, future studies should develop the questionnaire further to assess the staff's food-related practices and validate it through observation.
- Based on the experience of including only selected departments within the kindergartens, future intervention studies should include the whole kindergarten to ease the implementation of intervention components.
- Further studies are needed to understand how environmental factors in the higher levels of the ecological model interact or are mediated by each other and how they influence the kindergarten's food environment and vegetables served.
- Future studies should assess fidelity and adaptability of intervention components, to understand how to strike the right balance between prescribing and creating ownership of the required changes in practice, and to achieve the purpose of the intervention.

Implications for practice

- The most important implication for practitioners is that the amount and variety of vegetables served must be increased to meet the recommendations for vegetable intake.
- Second, it is possible to increase vegetable availability in the kindergarten within the existing budget; however, this may not be sufficient to ensure that *enough* vegetables will be served, so it may be necessary to increase the designated sum for food per child within the budget, and ensure an equal food budget for all kindergartens so as not to increase differences in the food environment.

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Paper I - Is the environment in the kindergarten associated with the vegetables served and eaten? The BRA study.

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ORIGINAL ARTICLE

Is the environment in kindergarten associated with the vegetables served and eaten? The BRA Study

ANNE HIMBERG-SUNDET[1], ANNE LENE KRISTIANSEN[1], MONA BJELLAND[1], THOMAS MOSER[2], ASLE HOLTHE[3], LENE F. ANDERSEN[1] & NANNA LIEN[1]

[1]Department of Nutrition, Faculty of Medicine, University of Oslo, Oslo, Norway, [2]Department of Educational Science, Faculty of Humanities, Sports and Educational Science, University College of Southeast Norway, Horten, Norway, and [3]Faculty of Education, Western Norway University of Applied Science, Bergen, Norway

Abstract

Aim: The aim of the present study was to explore the associations between the economic, political, sociocultural and physical environments in kindergartens, along with the frequency and variety of vegetables served, and the amount of vegetables eaten. *Method:* The BRA Study collected data through two paper-based questionnaires answered by the kindergarten leader and pedagogical leader of each selected kindergarten, and a five-day vegetable diary from kindergartens (n = 73) in Vestfold and Buskerud Counties, Norway. The questionnaires assessed environmental factors, and the frequency and variety of vegetables served. The non-parametric Mann–Whitney U and Kruskal–Wallis tests were used to explore the associations between factors in the kindergarten environments and vegetables served and eaten. *Results:* Kindergartens that included expenditures for food and beverages in the parental fees served a larger variety of vegetables (p = 0.046). A higher frequency of served vegetables (p = 0.014) and a larger amount (p = 0.027) of vegetables eaten were found in kindergartens where parents paid a monthly fee of 251 NOK or more. Similarly, the amount of vegetables eaten was higher (p = 0.017) in kindergartens where the employees paid a monthly fee to eat at work. Furthermore, a larger amount (p = 0.046) of vegetables was eaten in kindergartens that had written guidelines for food and beverages that were offered. ***Conclusions:*** **This study indicates that the economic environment in a kindergarten seems to be positively associated with the vegetables served and eaten there. This is of high relevance for public health policy as vegetable consumption is an important factor in reducing the risk of non-communicable diseases.**

Keywords: *Kindergarten, vegetables, preschool children, BRA Study, environment, Norway, political, economic, sociocultural, physical*

Introduction

Vegetable consumption is an important factor in reducing the risk of non-communicable diseases (NCDs) such as type-2 diabetes, cardiovascular diseases and cancer [1]. The inadequate intake of vegetables is a public health problem and can be a contributive factor to increased morbidity [2]. According to the Organization for Economic Co-operation and Development (OECD), only 63% of the European population ate vegetables daily in 2008, and availability was the major determinant of consumption [2]. This highlights the importance of improved access to vegetables in the different daily contexts for both children and adults. Early prevention of NCDs is important and emphasized by health authorities at all levels [3–5]. The national recommendation for adults in Norway is 250 g of vegetables per day [6]. Among Norwegian two- and four-year-olds, the intake is roughly 50–70 g daily [7,8].

Correspondence: Anne Himberg-Sundet, Department of Nutrition, Faculty of Medicine, University of Oslo, PO Box 1046 Blindern, Oslo N-0316, Norway. E-mail: Anne.Himberg-Sundet@medisin.uio.no

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Obesity-related behaviors such as dietary intake seem to carry over from childhood into adulthood [9]. Children learn by observing others and their surroundings, they are constantly developing and adapting, and the people and environment that surround them will have influence on their development [10]. Food preferences appear to be more modifiable during early childhood [11]; hence, targeting children's dietary habits during this period is important. Norwegian kindergartens are institutions for all children in the age group 1–5 years. The kindergartens are regulated by law and have a framework plan for the content and tasks [10]. Formal education is required in order to be employed as a pedagogical or kindergarten leader. In general, kindergartens are open from approximately 7:30 a.m. until 5:00 p.m. from Monday through Friday. Meals are either brought from home (lunch box), provided by the kindergarten or else a combination. There are normative national guidelines for food and meals served in kindergarten, which specify that the kindergarten should serve or provide for at least two meals a day that are in line with national dietary guidelines [12]. According to the guidelines for food and meals, the kindergarten has a responsibility to contribute to teaching children healthy dietary habits [10]. National dietary surveys in Norwegian kindergartens conducted in 2005 and 2011 [13,14] reported low availability of vegetables in the kindergartens. However, with a 91% attendance rate [15] kindergartens have the potential to reach many children and their families.

According to the analysis grid for environments linked to obesity (ANGELO) framework, factors within the kindergarten environment can be characterized as economic (i.e. resources related to buying vegetables), political (i.e. guidelines and rules related to vegetables), sociocultural (i.e. values and behavior related to vegetables) and physical (i.e. factors that can hinder or enable the availability of vegetables) [16]. With regard to economic resources, a review including observational and intervention studies focusing on children aged 4–8 years and using the ANGELO framework, found no results of studies assessing economic factors [17]. As for the political factors, policy recommendations and written guidelines are not necessarily sufficient to ensure adequate nutrition in the child care settings [18]. However, Norwegian kindergarten leaders have previously reported that the two most important factors to secure healthy meals in kindergarten are to follow the national dietary guidelines and include them in their annual plans [12,14]. Finally, regarding the sociocultural and physical factors, a previous study has found positive associations between the sociocultural and physical environments and the mealtime setting in child care services in the Netherlands [19]. In addition, a review conducted by Holley et al. [20] found a positive effect of repeated exposure to increase vegetable intake in children aged 2–5 years, while for social factors the results were contradictory. A small Norwegian qualitative case study found that the physical environment was of great importance for the quality of the food and meals served by the kindergartens [21].

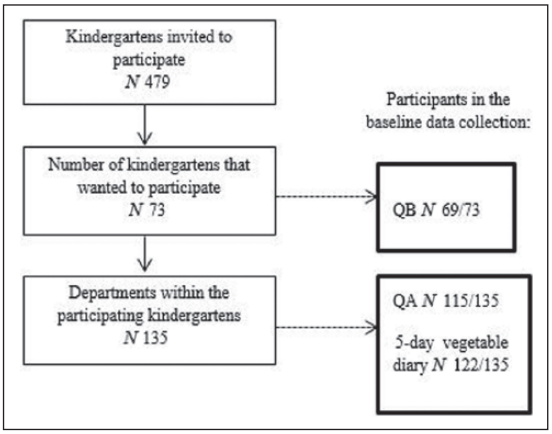

Figure 1. Flow chart of participants.

The aim of the present study was to explore the associations between economic, political, sociocultural and physical environmental factors in kindergartens, and the frequency and variety of vegetables served, as well as the amount of vegetables eaten.

Method

Study design and subjects

Baseline data from the BRA Study (*Barnehage* (kindergarten), *gRønnsaker* (vegetables) and *fAmilie* (family)) are used in the present study. The BRA Study is a cluster randomized controlled intervention study with an overall aim to improve vegetable intake among preschool children (3–5 years at baseline) through changing the food environment and dietary practices in the kindergarten and at home. More specifically, the aim is to increase the daily frequency of vegetable intake, the variety of vegetables eaten over a month and the daily amount of vegetables consumed. The target group for the BRA Study is preschool children born in 2010 and 2011, attending public or private kindergartens in the counties of Vestfold and Buskerud, Norway. In fall and winter 2014/2015, all 479 public and private kindergartens in these two counties were invited by letter to participate in the study, of which 73 kindergartens accepted (15.2% response rate). Within the 73 kindergartens, departments with children born in 2010 or 2011 were eligible for the study and 135 departments agreed to participate (Figure 1).

Data were collected using several instruments: 1) a paper-based questionnaire (Questionnaire A) assessing frequency and variety of vegetables served was answered by pedagogical leaders in 115 of the 135 departments (86%); 2) a paper-based questionnaire (Questionnaire B) assessing the kindergarten environment was filled in by the kindergarten leaders, where 69 of 73 leaders responded (95%); and 3) the amount of vegetables eaten was assessed using a five-day vegetable diary completed by employees in 122 of the 135 departments (90%) (Figure 1). Few instruments have focused solely on factors affecting vegetables served and the frequency and variety of vegetables served to preschool children, and no instrument was identified suiting the purpose of this study. Therefore, modified items from statements and questions used in the last national dietary survey in kindergartens [14] and the last dietary survey among Norwegian two-year-olds [7] were included in the BRA questionnaires. The questions are not tested for reliability or validity.

Data collection

(1) Vegetables served and eaten: Questionnaire A and five-day vegetable diary

Questionnaire A was piloted among 11 pedagogical leaders. Small adjustments were made after feedback. In March 2015, Questionnaire A was mailed to all the participating kindergartens (n = 73) and returned in a pre-paid envelope. One mailed reminder was sent with the questionnaire enclosed.

Frequency of served vegetables for lunch and the afternoon meal was assessed through two separate questions: "How often does your department offer vegetables for lunch/the afternoon meal?". The response alternatives were on a seven-point scale ranging from "five days a week" to "never". The variety of vegetables served for lunch and afternoon meal was assessed through two separate questions: "How often does your department offer these vegetables for lunch/afternoon meal?". A total of 12 vegetable alternatives were given with the same response categories as mentioned above.

For the five-day vegetable diary, all kindergartens were given a digital kitchen scale (capacity = 5 kg, graduation = 1 g). One employee from each department received face-to-face instruction on how to measure and report the amount of vegetables eaten in the five-day vegetable diary. The employees were asked to weigh the vegetables before each meal and to weigh the leftovers after the meal, and to report the number of children and employees eating at each meal. They were encouraged to report five consecutive days in order to assess a typical week. Data from the lunch and the afternoon meals are presented as amount of vegetables consumed per person per day. A protocol was developed on how to interpret missing data. The two main types of missing data were the number of children and employee eating, and whether the vegetables were "ready-to-eat" or not. If the diaries had data from 50% of the meals regarding number of children and employee eating, then a mean number was calculated to replace missing data. Diaries with data of less than 50% were registered as missing. Diaries with missing data for "Are the vegetables ready-to-eat?" were assumed to be "ready-to-eat".

(2) Factors in the kindergarten environment: Questionnaire B

Questionnaire B was piloted with two kindergarten leaders. Only minor revisions were made after the pilot test. Most of the questions were from the last national dietary survey in Norwegian kindergartens [14]. In this paper, questions describing four aspects of the kindergarten environment were used: the economic, political, sociocultural and physical environments. In all questions where a five-point Likert scale was used, the scale is collapsed into three categories: "agree, neither, disagree" or "small, neither, large", and two of "small/neither, large". The economic environment was assessed through five questions as shown in Table III, the political environment through four questions as shown in Table IV, while the sociocultural environment was evaluated through two questions shown in Table VI. In Table VI the factor that covers "to what degree different mealtime pedagogics are emphasized in the training of new employees" is based on eight items summed from one to eight and thereafter grouped into "low" (0–3), "average" (4–5) and "high" (6–8).

Statistical analysis

Statistical analyses were performed using the statistical software package SPSS® Statistics Version 24.0. Data on frequency and variety (Questionnaire A), in addition to data on amount of vegetables served (five-day vegetable diary), were aggregated to the kindergarten level as the data on the kindergarten environment were collected at an institutional level and not at the department level (Questionnaire B). The Shapiro–Wilk test was used to test for normality. Due to data not being normally distributed, the non-parametric Mann–Whitney U and Kruskal–Wallis tests were used to test for differences between groups.

Results

According to Statistics Norway, there were a total of 568 [15] kindergartens in Vestfold and Buskerud Counties in 2014 (Table I), of which 41% were public and 59% were private kindergartens. In the BRA Study, 45% were public and 55% were private kindergartens. Kindergartens in Vestfold and Buskerud had a mean of 12.5 full-time equivalents, and a mean of 4.1 employees with the formal education to work as a pedagogical or kindergarten leader. In the kindergartens in the BRA Study, the means were 13.9 full-time equivalents and 5.9 with formal education. Furthermore, 47% of kindergartens in these counties were registered as five-a-day fruit and vegetable kindergartens compared with 41% of the BRA kindergartens. Only full-time public and private kindergartens were included due to these being the most common child care institutions in Norway. Therefore, the invitation to participate was sent to 479 of the 568 kindergartens.

The number of kindergartens providing data from the pedagogical leader (Questionnaire A) and the kindergarten leader (Questionnaire B) was 66, while 66 kindergartens had data from the kindergarten leader (Questionnaire B) and the five-day vegetable diary. The number of kindergartens with data from all three sources (Questionnaire A, Questionnaire B and five-day vegetable diary) was 63 (86% of the 73 kindergartens).

Vegetables served and eaten

The median variety of served vegetables was eight per month, the median frequency of vegetables served was 6.3 times per week and the median intake of vegetables consumed per person per day was 36 g (Table II). A higher frequency of vegetables served was found in kindergartens where children consumed 30.1 g vegetables or more per day, compared to those kindergartens where children consumed 30 g or less per day (Table II).

Associations between the kindergarten environment and vegetables served and eaten

In the economic environment, three out of nine factors were associated with the variety of vegetables served, one out of nine factors was associated with the frequency of vegetables served and three out of nine factors were associated with the amount of vegetables eaten (Table III). Kindergartens with food and beverages covered by a parental fee had a larger variety of vegetables served per month. However, the variety was also larger in the seven kindergartens that did not ask for any additional payment from the parents to cover food and beverage expenses. In kindergartens where parents paid an additional amount of >251 NOK to cover food supplies, a higher frequency of vegetables served and a larger amount of vegetables consumed were observed. In kindergartens where the leaders agreed that they could use the budget as they wished, a larger amount of vegetables consumed was observed compared to kindergartens where leaders answered "neither" or "disagree". Those who answered "agree" or "neither" to the same question had a larger variety of vegetables compared to those who answered "disagree". In the kindergartens where the employees paid a monthly fee for food and beverages, a larger amount of vegetables was consumed (Table III).

For the political environment, one out of six factors was associated with the frequency of vegetables served, and one out of six factors was associated with the amount of vegetables eaten (Table IV). In kindergartens that had written guidelines for food and beverages offered, the children consumed a larger amount of vegetables. However, kindergartens with "written guidelines for food and beverages brought *from home*" had lower frequency of vegetables served. For the physical environment, one out of 10 factors was associated with the frequency of vegetables served. Frequency of served vegetables was highest among those who "agreed" to the statement, "I do not buy vegetables because they are too expensive", compared to those that "disagreed" or answered "neither" (Table V). No significant associations were found with the sociocultural environment (Table VI).

Discussion

This study indicates that more factors within the economic environment were important for the vegetables served and eaten in the kindergartens than factors in the political, physical and sociocultural environments.

The economic environment

The Norwegian government has established a maximum parental fee, independent of whether the kindergarten is under public or private ownership [23]. However, most kindergartens ask for additional payment to cover expenses for food and beverages [14]. This was also shown for 59 out of 66 kindergartens in our study. In line with previous research [14], our results showed that having a larger food budget or perceiving to have budgetary freedom contributed to kindergartens buying and serving more vegetables.

Table I. Descriptive data of the kindergartens in the BRA Study and the kindergarten population in Vestfold and Buskerud counties.

	Kindergartens in the BRA Study (N = 69)[c]	Kindergartens in Vestfold and Buskerud counties (N = 568)[a]
	Number of kindergartens (percent)	Number of kindergartens (percent)
Public kindergartens	31 (44.9)	235 (41.4)
Private kindergartens	38 (55.1)	333 (58.6)
Five-a-day-kindergartens[b]	28 (41.1)	266 (46.8)
	Mean ± SD	Mean
Full-time equivalent	13.9 ± 6.4	12.5
Full-time equivalent educated as kindergarten teacher	5.9 ± 3.1	4.1

[a]Statistics Norway (2014), includes all kindergartens in Vestfold and Buskerud, including those that did not meet the criteria.
[b]Five-a-day kindergartens is a concept created by the Norwegian Fruit and Vegetable Marketing eBoard and provides supporting material to the kindergartens for the promotion of fruit and vegetable consumption.
[c]Based on answers from the kindergarten leader.
SD: standard deviation.

Table II. The dependent variables: variation, frequency and amount of vegetables served in the kindergartens in the BRA Study (n = 66).

	Median (percentiles)[a]		Normality test[b] p-value
Variation per month	8 (6.5;10)		.098
Frequency per week	6.3 (5;8)		**.005**
Amount per person per day (g)	36.4 (25.6;48.9)		.045
	Amount per person per day (g)		
	≤ 30 g	30.1–59 g	60 g >
N	23	33	7
Variation median (percentiles)[a]	8 (5.5;9.5)	7.8 (6.7;10)	10 (7.7;10.5)
p-value			.352
Frequency median (percentiles)[a]	5 (2.3;7.1)	6.8 (6;8)	6.8 (5.5;7)
p-value			**.021**

[a]Tukey's hinges.
[b]Shapiro–Wilk test.
[c]Statistics Norway (2014), includes all kindergartens in Vestfold and Buskerud, including those that did not meet the criteria [22].
[d]Five-a-day kindergartens is a concept created by the Norwegian Fruit and Vegetable Marketing eBoard and provides supporting material to the kindergartens for the promotion of fruit and vegetable consumption.
[e]Based on answers from the kindergarten leader.
[f]Children are attending kindergarten five days a week – frequency given in the table is for times per week.

Kindergartens with more than NOK 251 in additional payments had a larger frequency of vegetables served and a higher amount of vegetables eaten compared to those with additional payment of less than NOK 251. Unexpectedly, those kindergartens that did not ask for such additional payment had a larger variety in vegetables served compared to those that did ask for additional payment. This may indicate that it is not only the economic resources that matter when buying and serving vegetables. Our results showed that in 53 out of 62 kindergartens, the employees paid a monthly fee for food and beverages, and a larger amount of vegetables was eaten. The higher amount of vegetables eaten may be explained by adults eating with the children, thus contributing to a larger average amount of vegetables eaten. Another explanation might be the positive effect of modelling [20], or by children eating more when the staff eat together with them [19].

For the associations found in the economic environment, one may conclude that increasing the additional payment for food might be a good strategy. On the other hand, this strategy might increase social inequalities by lower socioeconomic groups opting for kindergartens with a lower additional payment for food. Taking into consideration experience from other

Table III. Factors in the economic food environment in the kindergarten, and vegetables served or eaten (n = 66).

	Variation			Frequency		Amount		
	N	Median (percentiles)[b]	*p*-value	Median (percentiles)[b]	*p*-value	*N*	Median (percentiles)[b]	*p*-value
1) Food supplies are covered through: maximum parents' fees	Yes 11	10 (8;11.8)		5.3 (5;9)		12	36.2 (31;52)	
	No 55	7.7 (6;10)	**.046[a]**	6.3 (5;7.5)	.945[a]	54	36.8 (24.3;50.7)	.690[a]
Additional parental payment to cover expenses for food and beverages	Yes 59	7.8 (6;10)		6.2 (5;7.5)		58	36.8 (24;51.3)	
	No 7	10 (8.5;11.8)	**.045[a]**	6.3 (5.1;9)	.552[a]	8	36.2 (32.3;44.5)	.651[a]
2) Additional parental payment to cover expenses for food and beverages	≤ 250 NOK[d] 29	8 (6;10)		5 (3.5;7)		30	27 (15;57.7)	
	> 251 NOK[d] 36	8 (7;10)	.450[a]	6.8 (6;8)	**.014[a]**	34	39.9 (31.8;50.7)	**.027[a]**
3) Freedom within the food budget: I can use the budget as I wish	Agree 29	9 (7;10)		7 (5.5;9)		30	45.2 (29.5;57.7)	
	Neither 12	9 (7;10.5)		5.8 (4.5;6.8)		11	41.8 (27.5;46.2)	
	Disagree 25	7 (5;9)	**.033[c]**	6.2 (4;7.3)	.166[c]	25	31.3 (15.2;37)	**.010[c]**
There are rules for how I distribute the budget	Agree 27	8 (6.8;10)		6 (5;7)		25	36.5 (24.5;47.9)	
	Neither 12	6.8 (6;7.9)		6.2 (2.5;7.1)		13	42.7 (24.3;46.3)	
	Disagree 26	9 (7;10)	.248[c]	7 (5;8)	.291[c]	27	36.4 (27.5;53.5)	.759[c]
The budget covers the kind of food we want to offer	Agree 36	8 (6;10)		6.1 (5;7.3)		35	41.8 (29.5;53.6)	
	Neither 5	10 (7;12)		5 (4;6.8)	.668[c]	5	39.8 (14.9;45.8)	
	Disagree 24	7.7 (6.8;10)	.409[c]	6.6 (3.3;8.5)		25	31.8 (23.7;42.7)	.150[c]
I am free to use other budgets on food	Agree 40	8.8 (6.6;10)		6.1 (5;8)		38	36.4 (24.1;51.6)	
	Neither 13	7.7 (6;9.6)		7.1(5;8)		13	33.4 (30.8;42.6)	
	Disagree 13	7 (6.5;10)	.500[c]	6 (5;6.8)	.672[c]	15	41.8 (27.1;55.8)	.508[c]
4) Employees pay a monthly fee for food and beverages	Yes 53	8 (7;10)		6.5 (5.3;8)		52	39.9 (30.3;51.5)	
	No 9	6 (5;9)	.079[a]	4 (2.5;7.3)	.113[a]	10	27 (9;30.8)	**.017[a]**
5) Monthly fee for employees (food and beverages)	≤ 250 NOK[d] 37	8.5 (7;10)		6.3 (5;8)		36	36.7 (25.5;48.5)	
	> 251 NOK[d] 13	7.5 (6.5;9)	.375[a]	7 (6;7.8)	.527[a]	13	40 (36.4;51.3)	.287[a]

[a]Asymp. Sig. (two-tailed) Mann–Whitney U test.
[b]Tukey's hinges.
[c]Asymp. Sig. Kruskal–Wallis H test.
[d]Norwegian kroner.
Note: ≤ 3 missing within the variation and frequency data; ≤ 4 missing within the amount data.

Table IV. Factors in the political food environment in the kindergarten, and vegetables served or eaten (n = 66).

	N	Variation		Frequency		Amount		
		Median (percentiles)[b]	*p*-value	Median (percentiles)[b]	*p*-value	*N*	Median (percentiles)[b]	*p*-value
1) Written guidelines: food and beverages brought from home	Yes 42	7.5 (6;10)	.197[a]	5.8 (4;7)		42	38.9 (24.3;51.6)	
	No 22	9 (7;11) 8		7.5 (6.3;8)	**.001[a]**	22	36.2 (29.5;46.3)	.562[a]
Food and beverage that's offered	Yes 55	(6.5;10)		6 (5;8)		54	38.9 (27;51.6)	
	No 9	9 (7;9)	.635[a]	6.8 (6.3;7.8)	.373[a]	10	32.8 (9;40)	**.046[a]**
Mealtime setting	Yes 41	7.5 (6;9)		6 (4.3;8)		41	39.8 (29.4;51.6)	
	No 21	9 (7;11)	.072[a]	6.3 (5.5;7.8)	.479[a]	21	31.2 (24;41.8)	.091[a]
2) Who has developed the guidelines: the entire staff group?	Yes 19	8 (6.6;10)		6 (5.5;7.5)		18	39.2 (30.8;51.3)	
	No 47	8 (6.3;10)	.955[a]	6.3 (4.6;7.9)	.645[a]	48	36.2 (23.9;49.9)	.536[a]
3) Knowledge of national guidelines	Yes 61	8 (6.5;10)		6.3 (5;8)		59	36.4 (25.6;48.4)	
	No 5	8 (7;11)	.653[a]	6 (5.5;7)	.827[a]	7	51.3 (41.3;72.1)	.075[a]
4) To what degree are the national guidelines used in developing own guidelines?	Small 7	10 (9;11)		6 (5.3;6.6)		8	42 (25.6;72.1)	
	Neither 12	9 (6.8;9.5)		6.8 (4.8;9)		13	38.5 (36;51.3)	
	Large 44	7.7 (6;10)	.259[c]	6.2 (5;7.9)	.576[c]	41	36.5 (24.3;47.9)	.568[c]

[a]Asymp. Sig. (two-tailed) Mann–Whitney U test.
[b]Tukey's hinges.
[c]Asymp. Sig. Kruskal–Wallis H test.
Note: ≤ 4 missing within variation and frequency data; ≤ 4 missing within the amount data.

Table V. Factors in the physical food environment in the kindergarten, and vegetables served and eaten (n = 66).

	N	Variation		Frequency		Amount		
		Median (percentiles)[b]	*p*-value	Median (percentiles)[b]	*p*-value	*N*	Median (percentiles)[b]	*p*-value
1) Barriers for using vegetables: I do not buy vegetables because they are too expensive	Agree 16	8.5 (7.3;10)		7.3 (6.7;9)		17	31.8 (23.7;41.8)	
	Neither 13	7 (6;8)		5 (3;6)		14	43.1 (27.1;49)	
	Disagree 37	8.5 (6;10)	.335[c]	6.2 (5;7.8)	**.008**[c]	35	36.4 (27.4;53.2)	.404[c]
I do not buy vegetables because they do not look fresh	Agree 10	8 (6.7;10)		6 (5.5;9)		11	44.7 (33.2;48.5)	
	Neither 15	7.8 (7;9.3)		7.1 (6.7;8)		15	36.7 (28.3;48.6)	
	Disagree 41	8 (6;10)	.979[c]	6 (4;7.3)	.070[c]	40	34.7 (24.2;51.2)	.819[c]
I do not buy vegetables because they are hard to keep fresh	Agree 17	7 (7;10)		6 (5.5;7.3)		18	36.2 (26.9;44.7)	
	Neither 10	7.4 (6;9)		6.2 (5;7.3)		11	29.5 (19.3;44.9)	
	Disagree 39	8.5 (6.3;10)	.821[c]	6.3 (5;8)	.961[c]	37	39.3 (29.4;54.9)	.219[c]
I do not use vegetables because they are too time consuming to use in my daily cooking	Agree 7	6 (5.5;8.5)		6.2 (4.3;8)		7	25.7 (26;42.9)	
	Neither 5	8 (5.5;10)		7.3 (5.5;7.8)		5	31.8 (17.3;49)	
	Disagree 54	8.3 (7;10)	.465[c]	6.2 (5;8)	.895[c]	54	37.6 (27;51.3)	.799[c]
I do not use vegetables because they are difficult to include in my daily cooking	Agree 3	11 (9.5;11.5)		7.8 (6.9;8.9)		3	31.3 (21.2;40)	
	Neither 3	5.5 (5.3;6.8)		2.5 (1.5;6.3)		3	27 (22.2;38.1)	
	Disagree 60	8 (6.5;10)	.093[c]	6.2 (5;7.6)	.341[c]	60	36.8 (27;51.3)	.658[c]
2) How many staff have the primary responsibility to:								
Determine the food and beverage offer	1 person: 9	8.5 (7;10.5)		6 (5;9)		17	33.4 (27;51.3)	
	> 1 person: 47	7.8 (6;10)	.235	6.3 (5;7.3)	.383	49	36.7 (24.3;48.8)	.753
Plan the food and beverage offer	1 person:	8.5 (6.3;10.5)		6.3 (4.6;8.5)		18	30.4 (24.1;54.8)	
	> 1 person: 47	8 (6.5;10)	.555	6.2 (5;7.5)	.681	48	37.8 (27.5;49.9)	.481
Order food and beverages	1 person: 15	10 (7.2;11.3)		5.3 (5;6.8)		13	29.4 (16.3;45.8)	
	> 1 person: 51	7.7 (6;9.8)	.090	6.4 (5.1;8)	.263	53	37 (27.9;50.7)	.249
Prepare the food	1 person: 43	8 (6;10)		6 (4.1;7.9)		43	33.4 (23.9;44.2)	
	> 1 person: 23	8.5 (7.2;10)	.341	6.4 (5.8;7.6)	.462	23	44.7 (31;51.5)	.091
3) Dedicated kitchen staff	Yes 11	10 (7.7;11.3)		5.3 (5;7)		9	31.8 (29.5;54.8)	
	No 55	7.8 (6;10)	.078[a]	6.3 (5;8)	.262[a]	57	36.7 (26.9;48.8)	.661[a]

[a]Asymp. Sig. (two-tailed) Mann–Whitney U test.
[b]Tukey's hinges.
[c]Asymp. Sig. Kruskal–Wallis H test.
Note: 0 missing within variation and frequency data; 0 missing within the amount data.

Nordic countries, the Finnish kindergarten setting is quite unique [24] with both nutrition-specific guidelines and all meals included in the maximum parental fee [25]. Still, research points to low vegetable intake among children in kindergartens in Finland [24,26]. These findings can imply that vegetable consumption may also be affected by factors other than the economy [24,25]. Freedom when setting up the food budget was also associated with a larger variety of vegetables served and a larger amount of vegetables eaten. An explanation for this might be that the kindergarten leaders participating in this study are more personally interested in providing healthy food and this budgetary freedom enables them to act upon it.

The political environment

In the present study, having written guidelines for meals served in the kindergartens was positively associated with vegetable consumption. This is in line with the national survey, where more fresh vegetables were served in kindergartens with written guidelines for the mealtime setting [14]. However, a review conducted in 2011 found that four out of 11 studies explored guidelines and recommendations related to the environment affecting nutrition and food served in child care settings [18]. Moreover, two of these found an insufficient intake of vegetables and only one of the four found an adequate serving of fruit and vegetables, despite having food-specific recommendations, policies or written guidelines to follow [18]. We also found associations indicating a higher frequency of vegetables served in kindergartens without written guidelines for food and beverages brought from home. This might be explained by a lack of need for such guidelines in kindergartens that serve a higher frequency of meals and, thus, also vegetables. This hypothesis was tested, and we found that kindergartens serving meals more frequently, compared to those kindergartens with food brought from home, also served vegetables more frequently (data not shown).

Table VI. Factors in the sociocultural food environment in the kindergarten, and vegetables served and eaten (n = 66).

	Variation			Frequency			Amount	
	N	Median (percentiles)[b]	*p*-value	Median (percentiles)[b]	*p*-value	*N*	Median (percentiles)[b]	*p*-value
1) To what degree do new employees learn how to interact with the children in mealtime situations?	Low: 14	8 (6.5;9.6)		6 (4;7.3)		17	36.4 (26.9;44.7)	
	Average: 15	7.7 (6;8.8)		6.3 (5.3;7)		15	36.7 (28.3;53.7)	
	High: 34	8.8 (6.7;11)	.287[c]	6.4 (5;8)	.813[c]	34	37.5 (24.3;51.3)	.777[c]
2) To what degree do you think…								
you need to improve the practical part regarding meals, food and beverages in your kindergarten?	Small/neither: 48	8 (6.8;10)		6.3 (5;7.9)		49	36.5 (27;51.6)	
	Large: 18	7.3 (5.5;10)	.386[a]	6.1 (4;8)	.708[a]	17	36.7 (20.5;42.7)	.281[a]
you are *competent* to guide the employees in what a healthy diet for children is?	Small/neither: 25	8 (7;10)		6 (4.3;8)		26	36.5 (26.9;47.9)	
	Large: 41	8 (6;10)	.952[a]	6.3 (5;7.3)	.638[a]	40	36.7 (25.3;54.9)	.646[a]
it's *important* for you to guide the employees in what a healthy diet for children is?	Small/neither: 13	8 (6.5;9)		6 (4;8)		12	33.6 (20.8;36.8)	
Large: 53		8 (6.6;10)	.871[a]	6.3 (5;7.3)	.872[a]	54	39.6 (27;51.6)	.130[a]

[a]Asymp. Sig. (two-tailed) Mann–Whitney U test.
[b]Tukey's hinges.
[c]Asymp. Sig. Kruskal–Wallis H test.
Note: < 3 missing within variation and frequency data; < 1 missing within the amount data.

The physical environment

Previous studies have shown that availability is positively associated with children's consumption of vegetables [20,25,27]. This study assessed the physical environment through barriers for serving vegetables in kindergarten, and, unexpectedly, those that agreed to the statement "I do not buy vegetables because they are too expensive" had the highest frequency of serving vegetables. A potential explanation might be that the Norwegian population is more concerned about eating healthily than the associated costs. However, the costs are also an important factor [28]. A Norwegian case study found that the physical structures, such as who is organizing and planning the meals, were important factors for the food and meals provided by the kindergarten [21], but in our study we did not find an association with the number of people involved in various parts of this process. The physical environment was assessed through three questions, as shown in Table V. The item pool used to assess barriers was composed of modified versions of statements used in an American study among parents of preschool children [29]. For the question regarding "How many have the primary responsibility to…" in Table V, the number of persons for each task was collapsed into "one person" or "more than one person". In this study, the physical environment has not measured the availability of vegetables, but rather the barriers to serving vegetables and how many employees are responsible for planning and organizing the food.

The sociocultural environment

Contrary to previous research [19,20,27], we did not find any significant associations between the sociocultural environment and vegetables served and eaten. In this study, data were collected at a higher institutional level compared to previous studies [19,20,27]. Moreover, different methodologies when assessing this environment may also have contributed to such discrepancies. In the present study we assessed this environment by questionnaires, but others have assessed this environment through, for example, direct observations [19]. In addition, previous environmental studies have measured other factors in this environment, such as staff behavior, supervision practice and food serving style [19], nutrition education and support for healthy eating [30], and parenting styles and practices [27].

Strengths and weaknesses of the study

This study was conducted in an understudied age group and context. Furthermore, the sample of kindergartens represented in this study was almost the same share of public, private and five-a-day kindergartens as the total kindergarten population in the

two participating counties. Information about vegetable consumption and the environment was collected with three instruments and answered by staff working at different levels in the kindergarten, giving a more holistic dataset.

However, the sample of kindergartens presented in this study might have had a greater interest in food and nutrition or been more engaged in projects and/or research participation. The measurement instruments were piloted, but not tested for reliability and validity. The amount of vegetables eaten was collected by a five-day vegetable diary, which could be filled in by anyone working in the department. This could have impacted the consistency of how the data were reported. Additionally, the amount of vegetables weighed after the meal did not include vegetables that were left on the children's plates or that had fallen onto the floor. This might have contributed to an overestimation of the amount of vegetables eaten. Moreover, when adults eat the vegetables served, they potentially eat larger portions compared to the children, which contributes to a higher amount of vegetables eaten in total. The questionnaires used were primarily based on items used in the last national dietary survey in kindergartens [14], ensuring comparability across studies in Norway. However, since the ANGELO framework was not applied in developing the questionnaire, limited aspects of each environment were covered.

Conclusion

This study indicates that the economic environment in kindergartens seems to be positively associated with the vegetables served and eaten in those kindergartens. Also, the political environment seems to be important for the servings and intake of vegetables in kindergartens. This is of high relevance for public health policy as vegetable consumption is an important factor in reducing the risk of NCDs. The lack of associations within the sociocultural and physical environments may be explained by factors being assessed at a more distal level of the organization. Furthermore, studies of how environmental factors interact or are mediated by one another may also be necessary in order to better understand their influence on the variety, frequency and intake of vegetables.

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Paper II - Effects of a kindergarten intervention on vegetables served and staff's food-related practices: results of a cluster randomised controlled trial – the BRA-study.

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Effects of a kindergarten intervention on vegetables served and staff's food-related practices: results of a cluster randomised controlled trial – the BRA study

Anne Himberg-Sundet*, Anne Lene Kristiansen, Lene Frost Andersen, Mona Bjelland and Nanna Lien

Department of Nutrition, Institute of basic medical Sciences, Faculty of Medicine, University of Oslo, Norway

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Abstract

Objective: The aim of the current study was to evaluate the effect on frequency, variety and amount of vegetables served and staff's food-related practices in the multicomponent BRA intervention.

Design: Cluster randomised controlled trial, conducted between Spring 2015 and Spring 2016. For allocation of the kindergartens, a stratified block randomisation was used. Data were collected in three ways: (i) a questionnaire for pedagogical leaders assessing the variety and frequency of vegetables served, including staff's food-related practices assumed to be related to vegetable intake; (ii) a questionnaire for kindergarten assistants assessing staff's food-related practices; (iii) a 5-d weighted vegetable diary assessing amount of vegetables served in a department.

Setting: The target group for this study was public and private kindergartens in the counties of Vestfold and Buskerud, Norway.

Participants: A total of seventy-three kindergartens participated.

Results: At follow-up I, the amount of vegetables served increased by approximately 20 g per person per day ($P = 0{\cdot}002$), and the variety in served vegetables increased by one-and-a-half kind per month ($P = 0{\cdot}014$) in the intervention group compared to the control group. No effects on the frequency of vegetables served or on staff's food-related practices were found.

Conclusions: The BRA intervention was successful in increasing the amount and variety of vegetables served within intervention kindergartens. Further research is needed to understand the mechanisms that can affect the staff's food-related practices.

Keywords
Pre-school children
Kindergarten
Vegetables
Food-related practices

Vegetables are an important part of a balanced and healthy diet, and evidence supports a positive association between a higher intake of vegetables and health benefits[1]. Despite this evidence, the recommended vegetable intake is still not met in many countries[2]. Therefore, increasing daily vegetable intake in the population is of high public health importance and has been highlighted by health authorities at all levels[1,3,4]. Evidence suggests that dietary behaviours established early in life track into adulthood[5–8], which makes childhood a critical period for establishing long-lasting dietary habits[7].

The food provided or made available for children is greatly influenced by adults, both at home and in various types of childcare. Vegetables available in the home/childcare facility and the accessibility (vegetables in a ready-to-eat form) of vegetables seems to be important determinants for increasing vegetable intake in school-aged children and youth[9–11]. In addition, evidence shows that parents play a crucial role in encouraging and supporting their children in eating healthy through modelling healthy habits[11]. For children too young to attend school (Norwegian children attend school in the autumn the year they turn 6), the use of out-of-home childcare has rapidly increased over the years, and parents are now sharing the responsibility for their children's diet with childcare providers. Limited research has examined the role of childcare staff's modelling behaviour; however, studies have shown positive associations between food-related practices in childcare and children's food[12] and vegetable intake[13]. Childcare staff is, to a large extent, in control

*Corresponding author: Email Anne.Himberg-Sundet@medisin.uio.no

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of the children's food environment during the day, and it seems important to ensure a supportive environment to increase children's vegetable intake.

Several interventions have been conducted to better understand what increases children's vegetable intake among children below 5 years[14,15]. However, interventions focusing on increasing vegetable intake among children in childcare settings are limited. The latest review of interventions for increasing fruit and vegetable consumption targeting children up to 5 years found little consistent evidence across studies[15]. In addition, multicomponent studies were more successful in increasing vegetable consumption than single-exposure strategies[14]. A severe amount of research has been conducted on the primary outcome – vegetable intake in/among children[14,15], but very few studies report on the secondary outcome – vegetable/dietary changes in the kindergarten environment.

The present study was conducted in Norway, where 91 % of all children aged 1–5 years are attending kindergarten, and the majority of these children spend ≥41 h per week in the kindergarten[16]. There are normative national guidelines for food and meals served in Norwegian kindergartens[17]. These guidelines specify that vegetables and fruit/berries should be included in each meal and that kindergartens should provide for at least two nutritional full meals a day[17]. In addition, kindergartens have a framework plan for their content and tasks, which underlines that the kindergarten has a responsibility to contribute to teaching children about healthy dietary habits[18]. Meals are either brought from home (lunch box) or provided by the kindergarten, or a combination of both. The kindergarten food procurement system differs between municipalities and ownership. Kindergartens in Norway are either public or private, where private kindergartens are run by companies and public kindergartens are run by municipalities. However, the kindergarten law and associated guidelines apply to all kindergartens despite ownership.

The aim of the current study was to evaluate the effect of an intervention study to increase frequency, variety and amount of vegetables served in the kindergarten setting, and to evaluate the effect of the intervention on changes in staff's food-related practices in the kindergarten from baseline to follow-up I.

Methods

Study design

The BRA study (an acronym for the Norwegian words *Barnehage* (kindergarten), *gRønnsaker* (vegetables) and *fAmilie* (family)) is a cluster randomised controlled trial with an overall aim to improve vegetable intake (primary outcome) among preschool children (3–5 years at baseline) through changing the food environment and food-related practices both in the kindergarten and at home (secondary outcomes), with immediate follow-up. More specifically, the secondary outcome in the kindergarten was to increase the weekly frequency and daily amount of vegetables served in this setting and to increase the variety of vegetables served over a month. In addition, to change the staff's food-related practices towards being more supportive of children tasting and eating vegetables. Baseline and follow-up I data from the kindergartens were used in the present study.

Subjects

The primary target group for the BRA study was preschool children born in 2010 and 2011, attending public or private kindergartens in the counties of Vestfold and Buskerud, Norway. All 479 public and private kindergartens were firstly invited by letter to participate in the BRA study. Then, all kindergartens were called to inform about the study and to motivate for participation. Seventy-three kindergartens chose to participate (response rate 15·2 %) (Fig. 1). These were randomised into intervention (*n* 37) and control (*n* 36) groups (Fig. 1). The kindergarten employees were the secondary target group for the intervention. Norwegian kindergartens often include multiple departments. These departments consist of approximately eighteen children, either children of the same age or children of mixed age. Each department is usually staffed with one pedagogical leader with the formal responsibility for the department, in addition to two or more assistants. The following study presents data collected from pedagogical leaders and assistants in departments where children born between 2010 and 2011 attended. Originally there were 135 departments participating in the BRA study; however, a total of seventeen departments were lost to follow-up I. Ten were lost due to incomplete data at baseline, and seven were lost due to reorganisation in the kindergarten (Fig. 1). In addition, some departments were excluded from analyses due to missing data on outcome measures (Fig. 1). This resulted in 96 (variety and frequency of vegetables), 86 (amount of vegetables) and 102 (staff's food-related practices) departments having complete data at baseline and follow-up I. This study was conducted according to the guidelines laid down in the Declaration of Helsinki, and all procedures involving human subjects were approved by the Norwegian Center for Research Data. All kindergartens agreed to participate in the BRA study by the kindergarten leader signing a written informed consent (*n* 73).

Randomisation

For allocation of the enrolled kindergartens, stratified block randomisation was used based on ownership and number of participating children. Stratum one and two were public and private kindergarten, respectively. Stratum three and four was ≤10 children and >10 children, respectively. Randomisation was conducted by a statistician not involved in the project, using the statistical software program R.

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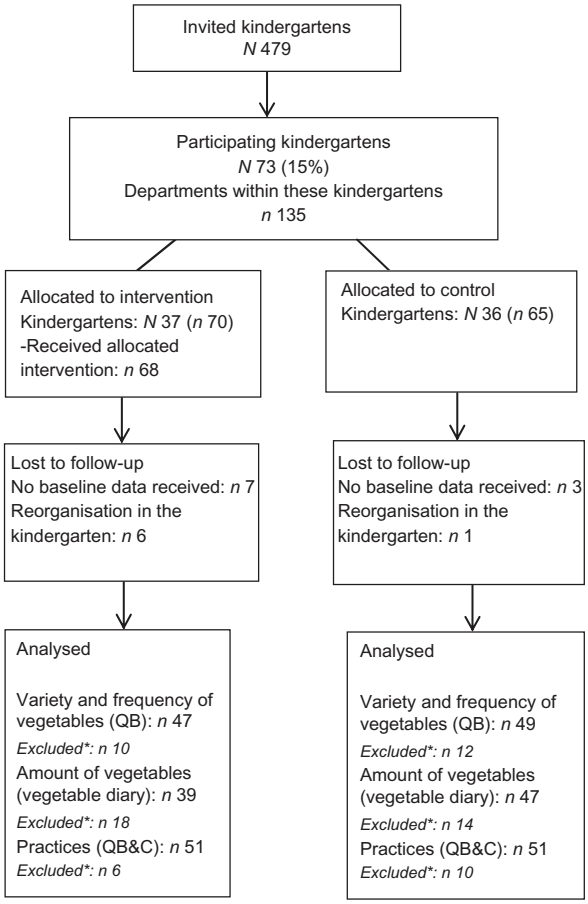

Fig. 1 CONSORT flowchart of recruitment, randomisation and participation of kindergarten and number of departments. *N* = kindergartens; *n* = departments
*Missing outcome measures

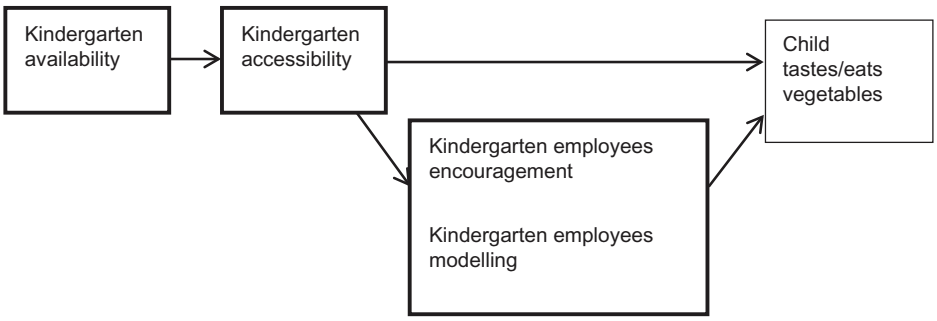

Fig. 2 The logic model of intervention in the kindergartens, the BRA study

Intervention/control

We hypothesised that the multicomponent intervention would make (i) staff change the availability and accessibility of vegetables in the departments, as well as their food-related practices (role modelling and encouragement) and through this (ii) vegetable intake among the 3–5-year-olds would increase (Fig. 2).

The intervention is described in accordance with the TIDieR guidelines[19]. Additionally, the TIDieR checklist (online supplementary material, Supplemental file 1) and the CONSORT checklist for cluster randomised controlled trials have been completed (online supplementary material, Supplemental file 2). Briefly, the intervention consisted of a 1-d inspirational course (kitchen practice and theory) for

kindergarten staff and material for the kindergartens. The cook responsible for the kitchen practice observed and rehearsed the practical session developed by the Geitmyra culinary centre for children. The theoretical part was conducted by one principal investigator (NL) accompanied by either the post-doc (ALK) or the PhD student (AHS). The staff attending the course was responsible for informing and training the relevant personnel in their kindergarten. The kindergarten staff received a welcome package at the inspirational day, which included one large poster with photos of vegetables, six small posters made for the project with ideas of 'what to do' for each of the four determinants (availability, accessibility, encouragement and role modelling), aprons, brochures about the project, the Norwegian national guidelines for food and meals in the kindergartens[17], the Norwegian dietary guidelines[31] and one hand-blender per kindergarten. The implementation of the intervention by kindergarten staff was supported by developing their own action plans within 4 weeks after the inspirational day. Moreover, a login-protected website containing all materials, as well as additional information about forty-five vegetables and small articles about the four determinants, had been developed and was available for intervention kindergartens. The kindergarten staff was also invited to attend a closed Facebook group set up for the study. Booster activities were sent to the kindergartens, 2 and 5 months after the inspirational course. Booster activity 1 included a booklet with recipes on cabbage, a vegetable card/poster to register when and which vegetables were served for 3 d with potential for winning a gift card by sending it to the project group, a sheet with suggestions on how to play tasting games with the children. Booster activity 2 included a booklet with spring recipes like different vegetables to be included in salads and suggestions of activities to grow vegetables at three levels of difficulty.

The intervention components were delivered between September 2015 and February 2016, but the kindergartens were encouraged to implement and change their practices in accordance with their own plans. In August 2016 the kindergartens were e-mailed to encourage them to maintain any changes achieved and to continue to work on improving their practices around serving vegetables. Control kindergartens participated only by providing data and were offered access to the website in September 2017.

Both intervention and control kindergartens completing all questionnaires both in 2015 and in 2016 received a gift card with a value of 2000 NOK (approx. 223 EUR).

Data collection

Baseline data were collected during Spring 2015, and follow-up I data were collected during Spring 2016. A detailed description of data collection has been published previously[20]. In brief, data were collected by paper-based questionnaires (one for kindergarten leaders, one for pedagogical leaders and one for assistants), and a 5-d weighted vegetable diary (filled in by anyone working at the department). Modified items from statements and questions used in the last national dietary survey in kindergartens[21] and the last dietary survey among Norwegian 2-year-olds[22] were used in questionnaires A, B and C. These modified questions have not been tested for reliability or validity. Questions assessing kindergarten staff's food related-practices were measured by item pools composed of modified versions of statements used in previous international studies among parents[23–26], and used in questionnaires B and C. Translation and back-translation of statements and questions available in English were conducted by fluent speakers of English and Norwegian languages. As descriptive data were collected at the kindergarten level through kindergarten leaders, and the outcome measures were collected at the department level through pedagogical leaders and assistants, these results are presented at two different levels.

Measures

Questionnaire A: characteristics of kindergartens

Questions used from Questionnaire A were: 'Is the kindergarten public or private?', with two response alternatives: 'public' and 'private'. Four open-ended questions were included as well: 'What is the total number of children in the kindergarten?', 'How many full-time equivalents do the kindergarten have?', 'How many full-time equivalents educated as kindergarten teacher do the kindergarten have?' and 'How much do the parents pay each month for food and beverages per child?' Kindergartens having 'written guidelines for food provided by the kindergarten' (Table 1) were those who reported having included this in 'the annual plan', 'in written guidelines' or 'in both the annual plan and written guidelines'.

Questionnaire B: frequency and variety of vegetables served

The weekly frequency of served vegetables for breakfast, lunch and afternoon meal was assessed through three separate questions: 'How often does your department offer vegetables for breakfast/lunch/the afternoon meal?' The response alternatives were on a seven-point scale ranging from '5 d a week' to 'never'. The monthly variety of vegetables served for lunch and for afternoon meal was assessed through two separate questions: 'How often does your department offer these vegetables for breakfast/lunch/the afternoon meal?' Twelve vegetable alternatives (cucumber, tomato, bell pepper, sugar snap peas, salad, carrot, corn, broccoli, cauliflower, rutabaga, cabbage, peas) were given with the same response alternatives as mentioned above.

5-d weighted vegetable diary: amount of vegetables served

A detailed description of the 5-d weighted vegetable diary has been published previously[20]. Briefly, the kindergarten

Table 1 Baseline characteristics of kindergartens who participated in the BRA study by condition

	Control (*n* 35)			Intervention (*n* 34)			
	Mean	%	SD	Mean	%	SD	*P*
Private kindergartens	14	40		17	50		0·404*
Public kindergartens	21	60		17	50		
Number of children	54		22·5	57		30·1	0·586†
Full-time equivalent	13		6·1	14		6·8	0·508†
Full-time equivalent educated as kindergarten teacher	6		3·0	6		3·4	0·419†
Additional payment for food and beverages	266‡		92·2	290‡		61·0	0·216†
Employees pay a monthly fee for food and beverages: 'Yes'	29	82·9		26	76·5		0·467†
Written guidelines for food provided by the kindergarten: 'Yes'	28	80		29	85·3		0·526*

*Person's Chi-square test.
†Independent sample *t*-test.
‡Norwegian kroner, 266 NOK = 29·03 EUR and 290 NOK = 31·65 EUR.

staff was instructed to weigh vegetables served for five consecutive days, both before and after each meal, and to report the number of children and adults present during the meal. This provided a measure of the amount of vegetables in grams served per person per day, through a typical week for breakfast, lunch and afternoon meal in the kindergarten.

Questionnaires B and C: kindergarten staff's food-related practices

The score labelled 'staff's food related practices' consisted of eight different factors, and items included in each factor are presented in Table 2. A detailed description on how the factors were extracted is published elsewhere[27]. The eight factors were: *modelling* (five items), *initial encouragement* (five items), *child involvement* (four items), *reactive encouragement* (three items), *strictness* (three items), *rewarding* (three items), *accessibility* (four items) and *availability* (three items)[27]. Response to each item were given on a five-point scale ranging from 'totally disagree' (= 1) to 'totally agree' (= 5), with a neutral midpoint. Reversed score was used for the items included in the factors labelled *strictness* and *rewarding*. Change in each factor from baseline to follow-up I was explored, but since no change was detected, they are presented as one overall score labelled 'staff's food-related practices'. Mean scores of each of the eight factors were added and then divided by eight to give the mean score for 'staff's food-related practice', and the overall score is presented in Table 2. Finally, this score was aggregated to the department level.

Detectable effect sizes

For the secondary outcome of detecting changes in kindergarten practices, SD's from the most relevant survey tools were used for the frequency of serving vegetables (days per week)[21] and food-related practices[28], respectively. With thirty kindergartens in each group, type 1 cut-point was $z_{alpha} = 1{\cdot}96$ for $P = 0{\cdot}05$ and type 2 cut-point was $z_{beta} = 0{\cdot}84$ for $P = 0{\cdot}2$, so the detectable effect size for 80 % power was $1{\cdot}96 + 0{\cdot}84 = 2{\cdot}8$ times the SE of the mean difference in outcome measure between groups ($SE_{trt\ diff}$). The SD for serving vegetables was 1·9, and thus with 80 % power, it would be possible to detect a difference in serving vegetables of $2{\cdot}8 * SE_{trt\ diff} = 2{\cdot}8 * \sqrt{2} * (SD^2/m) = 2{\cdot}8\sqrt{2} * (1{\cdot}9^2/30) = 1{\cdot}4$ days per week. With an SD of 1·7 from the nutrition score in the NAP SACC study[28], and with 80 % power, it would be possible to detect a difference in nutrition score of 1·23. This is right on the border of the effect that was detected in the per-protocol analysis from NAP SACC[28].

Data analysis

Statistical analyses were performed using the statistical software package IBM® SPSS® Statistics, version 24.0. Descriptive statistics were used to describe the study sample at baseline, and independent sample *t*-test and Person's Chi-square test was used to test for differences between the control and intervention groups at baseline. Since the intra-class correlation was >5 % when quantifying the degree of clustering, there was a meaningful difference among the groups[29]. The effect of intervention from baseline to follow-up I was explored by mixed-model analysis on differences between amount, frequency and variety of vegetables served and staff's food-related practices in the intervention and control groups on follow-up I values, adjusted for baseline measures and using intervention/control as the primary covariate of interest. Kindergarten was used as a random effect to account for random inhomogeneity between kindergartens. The models were inspected by looking at the residuals and Q-Q plots, which indicated a roughly normal distribution of data. Random intercept models were fitted, with group allocation and baseline measures as fixed effects. Only complete data, with measures from both baseline and follow-up I, were included in the analyses. The significance level for the analysis was set to $P < 0{\cdot}05$.

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Table 2 Items and factors that were added to the total score for 'staff's food-related practices'

	Baseline	
	Mean*	SD
Modelling	4·21	0·50
I show the children how much I enjoy eating vegetables	4·37	0·67
I try to show enthusiasm about eating vegetables	4·22	0·67
I model vegetable eating for the children by eating vegetables myself	4·72	0·40
I try to eat vegetables in front of the children, even if they are not my favourite	3·52	0·96
I show the children how to eat vegetables (mix with other foods, use as garnish, etc.)	4·20	0·67
Initial encouragement	3·38	0·59
I describe the consistency and/or taste of new vegetables for the children	3·32	0·85
I show the children how they can explore vegetables with their senses	3·41	0·79
I tell the children what kind of vegetables we are to eat	4·00	0·72
I allow the children to play with vegetables (make figures, use as tusk, etc.)	3·17	0·84
I refer to characters the children are familiar with from TV/books/plays that eat vegetables	3·00	0·83
Child involvement	3·17	0·59
I ask the children to choose vegetables for meals	3·15	0·85
I ask the children to help select vegetables at the grocery store	2·87	0·84
I let the children assist in preparing vegetables (peeling, cutting, put on plates, etc.)	4·27	0·66
I add something to make vegetables taste better	2·41	0·86
Reactive encouragement	4·37	0·69
I tell the children that vegetables taste good	4·49	0·58
I encourage the children to eat vegetables to become strong and healthy	4·47	0·50
I encourage the children to try a few bites of vegetables	4·72	0·48
I praise the children when I see them eating vegetables	4·08	0·76
I offer the children vegetables they like	4·09	0·57
Strictness†	4·12	0·62
The children should always eat all the vegetables on their plates	4·36	0·67
I insist that the children should sit at the table until all vegetables on their plate are eaten	4·33	0·76
I am strict with the children concerning eating of vegetables	3·60	0·79
Rewarding†	4·13	0·53
I offer the children their favourite foods in exchange for vegetable consumption	4·32	0·61
I reward the children with something they like (not food) if they finish their plate with vegetables	4·54	0·50
I tell the children to be just as good as other children when it comes to eating vegetables	3·53	0·88
Accessibility at kindergarten	4·16	0·65
I send the plate/bowl of vegetables around the table	4·38	0·74
I place the plate/bowl of vegetables within the reach of children	4·17	0·82
We usually have more than one kind of vegetables at the table so the children can choose	4·32	0·82
We usually serve vegetables separately so the children can choose which one they want	3·77	0·86
Availability at kindergarten	4·15	0·92
In our unit we usually vary the kinds of vegetables served for hot lunch	4·03	0·76
In our unit we usually vary the preparation method (raw, boiled, etc.) according to the types of vegetables served for hot lunch	4·09	0·78
In our unit we usually have vegetables at hot lunch every day	4·32	0·71
Staff's food-related practices	3·90	0·29

*Responses were given on five-point scales, ranging from 'totally disagree' (= 1) to 'totally agree' (= 5), with a neutral midpoint.
†Reversed score.

Results

From an eligible pool of 479 kindergartens, seventy-three kindergartens and 135 of their departments participated in the study. The BRA study had almost the same share of public and private kindergartens, compared to kindergartens in Vestfold and Buskerud counties. Furthermore, kindergartens in these counties had a mean of 12·5 full-time equivalents, and a mean of 4·1 employees with formal education, compared to the kindergartens in the BRA study, which had a mean of 13·9 full-time equivalents and 5·9 with formal education[20]. No significant differences in baseline characteristics were detected between control and intervention groups at the kindergarten level (Table 1). As previously mentioned, some departments were lost to follow-up I, leaving 118 departments to be analysed (fifty-seven departments in the intervention group and sixty-one departments in the control group) (Fig. 1).

At the department level, the mean score for each of the eight different factors included in 'staff's food-related practices' and the score for 'staff's food-related practices' are presented in Table 2.

Scores for intervention and control groups at the department level for frequency, variety and amount of vegetables served, and staff's food-related practices are presented in Table 3. Results from the mixed-model analyses showed an increased variety of one-and-a-half type of vegetables used per month in favour of the intervention group. An estimated increase in the amount of vegetables served, by serving approximately 20 g more vegetables per person per day, was observed in the intervention group compared

Table 3 Intervention and control kindergartens at department level at baseline and follow-up I, including the estimated effect of the intervention in the BRA study*

	Intervention				Control				Intervention effect†		
	Baseline	SD	Follow-up I	SD	Baseline	SD	Follow-up I	SD	Estimate	CI	*P*
Frequency‡	7·5	3·1	10·4	2·3	6·8	4·2	9·2	3·0	0·9	−2·0, 0·1	0·101
Variety‡	8·3	2·6	9·3	2·3	7·1	3·3	7·3	3·5	1·5	0·3, 2·6	**0·014**
Amount§	47·3	18·8	64·2	27·4	41·2	28·2	40·9	27·0	20·5	8·1, 33·0	**0·002**
Practices‖	4·0	0·2	4·1	0·2	3·9	0·3	3·9	0·2	0·05	−0·1, 0·0	0·235

The significant *P* values are in bold.
*Weekly frequency, monthly variety and daily amount of served vegetables and staff's food-related practices scores.
†Effect analyses were adjusted for kindergarten clustering and baseline measures.
‡Intervention (*n* 47), control (*n* 49).
§Intervention (*n* 39), control (*n* 47).
‖Intervention (*n* 51), control (*n* 51).

to the control group (Table 3). No significant associations were found for the frequency of vegetables served during a week or for change in staff's food-related practices.

Discussion

This study showed a significant positive effect of the intervention on the variety and amount of vegetables served in the kindergarten. No significant effects were observed for the frequency of vegetables served during a week or for changes in staff's food-related practices.

Effect of the intervention on amount, variety and frequency of vegetables served

The availability of vegetables is one of the most important factors associated with increasing vegetable intake[9–11,30]. The positive effect of the intervention according to the variety and amount of vegetables served in the kindergarten might be a result of increased availability of vegetables in the kindergarten setting. The intervention components suggested how the kindergarten could increase the availability and accessibility of vegetables in the kindergarten setting. One example was how vegetables could be bought within the kindergartens' food budget, since the economy was a known barrier for providing healthy food in the kindergarten setting[21], and this barrier was often supported by examples from some of the kindergartens present at the inspiration days. Further, as there are no specific recommendations for daily amount of vegetables for children in Norway, we chose to use a total daily intake of 180 g vegetables as the goal for children's vegetable intake. This is about 70 % of the recommended intake for Norwegian adults[31]. To reach this goal, the intervention components provided visual examples of what a portion size of 45 g vegetables per meal per child could look like. Furthermore, it was stressed that vegetables should be served at each meal. Together, these intervention components seem to have enabled the kindergartens to increase the availability and accessibility of vegetables. However, the intervention group increased the amount of vegetables served with only approximately 20 g per child per day. With a baseline average of approximately 40 g per child per day, there is still a potential to increase this amount further. The kindergarten should, at least, serve a portion size of 45 g two times per day to each child (90 g of vegetables a day per child) in terms of trying to reach the recommended intake of vegetables. We have not found comparable interventions with the aim to increase the amount of vegetables served in the kindergarten setting to discuss this result against.

According to the Norwegian information bureau for fruit and vegetables[32], in addition to our own data (not shown), there are four commonly used vegetables in Norwegian kindergartens – cucumber, tomato, bell pepper and carrots. Both intervention and control groups had a high mean score at baseline for the variety of vegetables served. Still, a positive effect on increased variety of vegetables was seen in favour of the intervention group. This might be explained by the intervention components focusing on the importance of variation at the inspiration day and in booster activities 1 and 2 as well. Further, the majority of kindergarten leaders in the present study had knowledge of the national guidelines for food and meals in the kindergartens[20], which promotes serving and eating a variety of foods[17]. Finally, a Belgium process evaluation study found that childcare staff thought it was very important to serve a variety of foods to promote children's taste development[33]. Thus, the message of variety along with the core message of the importance of encouraging the children to taste different/new vegetables might have resonated well with the staff in our study.

The frequency of serving vegetables did not increase significantly in intervention kindergartens compared to control kindergartens. The control group was encouraged to follow their usual routines; however, a significant increase in the frequency of served vegetables for both groups was confirmed by a paired samples *t*-test (data not shown). Such an increase in the control group might be explained by increased awareness in the control group through data collection in the BRA study. In particular, the weighing of vegetables could have contributed to this; moreover, control kindergartens could also have

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participated in other studies/projects focusing on vegetables or healthy eating. For the present study, the intervention components recommended the kindergartens to increase the frequency of served vegetables to three meals per day (breakfast, lunch and afternoon meal), which gives a possibility of fifteen vegetable servings per week. However, in the Norwegian guidelines for food and meals in the kindergartens[17], it is stated that the kindergarten should provide for at least two nutritional full meals per day, which adds up to ten meals per week. Given that the baseline frequency was approximately seven servings per week, which is relatively high, this could have limited intervention kindergartens in increasing the frequency of served vegetables significantly.

Effect of the intervention on staff's food-related practices

Staff's food-related practices related to vegetable intake were not significantly different between the intervention and control groups at follow-up I. This is in accordance with the American NAP SACC intervention[28] and an Australian intervention[34], targeting environmental changes of childcare centres, which did not find any effects for the nutrition part of their interventions[28,34]. However, the overall score on staff's food-related practices reported at baseline were relatively high, with a baseline score at approximately 4. The range for this score was 1–5, where a high score was assumed to be related with increased vegetable offer. An explanation for the lack of change might be that the employees felt that they were already conducting these practices, and since the baseline score was relatively high, this could have limited the possibility to increase this score further. However, two previously published cross-sectional studies[13,35] found an association between childcare staff's modelling and children's vegetable intake. This emphasises the importance of continuing to study the role of staff's food-related practices and to understand the mechanisms that can affect the staff's food-related practices in childcare settings.

Strengths and weaknesses of the study

This study has several strengths. First of all, it was conducted in an understudied context, as few previous studies have investigated changes in the kindergarten food environment. Furthermore, there were no differences between the intervention and control groups for the baseline characteristics of the kindergartens, indicating that the randomisation was successful. We included three different outcomes of vegetables served (amount, frequency and variety), giving a broader picture of kindergarten vegetable practices compared to what has previously been reported. In addition, we used two different methods (questionnaires and the 5-d weighted vegetable diary), which were conducted by kindergarten staff working at all levels, giving a more complete picture of the practices. The multiple component intervention was developed based on 1·5 years of formative evaluation work and the logic model (Fig. 2). By using a multiple-component intervention, the kindergartens were given the opportunity to choose which adjustments they needed by developing their own action plans to change existing practices. A wide range of different kindergartens (in terms of size and how they were organised) participated, which may indicate that the intervention has a scalability potential for Norwegian kindergartens. How these might fit in the kindergartens in other countries will have to be assessed based on local knowledge.

However, the study also has some weaknesses. Even though the questionnaires were developed based on statements and questions used in previous studies and pilot-tested with small groups of staff from different kindergartens, they were not tested for reliability or validity due to a lack of time and resources. In addition, the questionnaires may not have been responsive enough to detect changes in staff's food-related practices despite tapping into many different practices. The 5-d weighted vegetable diary could be filled in by anyone working in the department, and this could have caused a lack of consistency in how these data were reported both at baseline and follow-up I. However, it was important to make data collection easy for the staff to complete, and because the staff worked different shifts and were associated with different tasks, we decided that it would be more feasible for anyone working at the department to fill in the 5-d vegetable diary. In addition, the employees knew the purpose of the intervention, which may have affected the reporting of vegetables. Finally, missing data at baseline, reorganisation in kindergartens and missing outcome data reduced the number of kindergartens available for the analyses.

Conclusion

The multicomponent intervention was successful in increasing the variety and amount of vegetables served within intervention kindergartens. This study is one of few randomised controlled trials that have targeted the kindergarten environment to increase vegetables served to children. The results from the BRA study indicate that it is possible to increase the amount and variety of vegetables served without providing additional economic or staffing resources. An implementation of the intervention components in the kindergarten system may have a beneficial effect on public health. Such an intervention might also contribute to reduce social inequalities in health as children from all social classes attend kindergarten. Future research should seek to understand the mechanisms that can generate change in staff's food-related practices in the kindergarten setting, as well as the responsiveness of such measures in assessing these practices.

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Supplementary material

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Public Health Nutrition

Paper III - Exploring the workplace climate and culture in relation to staff's food-related-practices and vegetables served. The BRA-study.

PLOS ONE

RESEARCH ARTICLE

Exploring the workplace climate and culture in relation to food environment-related factors in Norwegian kindergartens: The BRA-study

Anne Himberg-Sundet[1]*, Anne Lene Kristiansen[1], Mekdes K. Gebremariam[1], Thomas Moser[2], Lene Frost Andersen[1], Mona Bjelland[1], Nanna Lien[1]

1 Department of Nutrition, Institute of Basic Medical Sciences, Faculty of Medicine, University of Oslo, Norway, **2** Department of Educational Science, Faculty of Humanities, Sports and Educational Science, University of South-Eastern Norway, Norway

* Anne.Himberg-Sundet@medisin.uio.no

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Abstract

Background

Kindergartens represent an important arena for promoting vegetable intake when it is essential to establish healthy dietary behaviours early in life. To develop and implement successful interventions targeting dietary behaviours in kindergartens, a good understanding of the factors influencing their food environment and the interplay between these factors is essential. The present study aimed to explore associations between workplace climate and culture in the kindergarten setting and the staff's food-related practices, vegetables served and the possible mediating role of staff's food-related practices.

Method

Vegetables served, staff's food-related practices, and data on workplace climate and culture were collected using a 5-day, weighted, vegetable diary and three paper-based questionnaires. Seventy-three kindergartens in the Norwegian counties of Vestfold and Buskerud participated in the study. Spearman's rho was used to assess the association between workplace climate and culture, and staff's food-related practices and vegetables served. Mediation analyses were conducted to assess the mediating role of staff's food-related practices in the relationship between workplace climate and culture and vegetables served in this setting.

Results

There was one significant positive correlation between factors in the workplace climate and culture, and staff's food-related practices and vegetables served. The staff's food-related practices were found to mediate the association between *support from superior* and the variety of vegetables served. They also mediated the association between *commitment to the organization* and the frequency, as well as the variety, of vegetables served.

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Conclusion

The results identified *commitment to the organization* and *support from superior* as two important factors in the workplace climate and culture. Furthermore, these two factors seems to be important to target when developing kindergarten-based interventions aimed at increasing the variety and frequency of vegetables served as they were associated with more favourable food-related practices among staff.

Background

Nutrition has been highlighted as one of the most critical factors for improving health and reducing the risk of non-communicable diseases [1–3], and environmental factors are emphasized as essential in their influence on diet-related behaviours [4]. Research into dietary habits in early childhood is important because it targets a crucial phase in a child's development [1], given that dietary behaviours established early in life may carry on into adulthood [5,6]. Several interventions have aimed to increase intake of vegetables in children aged 5 years and younger [7,8]. However, only a few have been conducted in the kindergarten setting with the aim of changing the food environment. Thus, there is a lack of evidence on how to make sustainable changes in the food environment of kindergartens [8]. Workplace climate and culture in kindergartens may indirectly affect their food environment through the staff's food-related practices, and such factors should be investigated in this setting. Workplace climate and culture consist of different psychological and social factors, which may affect the employees' working environment [9]. These factors are distal factors including *role clarity*, *support from superior*, *support from co-workers*, *innovative climate*, *support from friends and relatives*, *commitment to the organization* and *social climate*, which are some of the relevant factors that may affect health and job performance in the workplaces [9].

In Norway, the term kindergarten' describes an educational service for children aged 0–5 years because compulsory school starts in the year a child turns 6. Every child has a legal right to a place in a kindergarten and more than 90% of all children aged 1–5 years attend kindergartens in Norway, with the vast majority attending for 40 hours or more per week [10]. The national guidelines for food and meals in kindergartens emphasize that the kindergarten should facilitate at least three meals each day [11]. Meals are either brought from home (lunch box) or provided by the kindergarten, or a combination of the two. Few kindergartens have kitchen staff or a cook [12]. The high attendance rate makes it possible to reach many children and their families through this setting. Moreover, as kindergartens should facilitate at least three meals per day, it is essential to explore how they can provide a supportive environment for vegetable consumption.

Availability and accessibility of vegetables have been found to be important correlates for vegetable intake in school-aged children and youth [13–16], which in general are children older than the children in Norwegian kindergartens (age 1–6). In addition, a review of the evidence on how to influence younger children's food preferences has indicated that availability, accessibility, familiarity and parental modelling are essential factors [17]. Reviews among children aged up to 18 years point to parental intake, parental modelling and parental encouragement as important factors that are positively associated with children's fruit and vegetable consumption [14,16,18–19]. Therefore, it could be assumed that child-care staff also play an important role with regard to children's food and vegetable intake. Three studies have examined the role of child-care staff's modelling behaviour and shown positive associations with

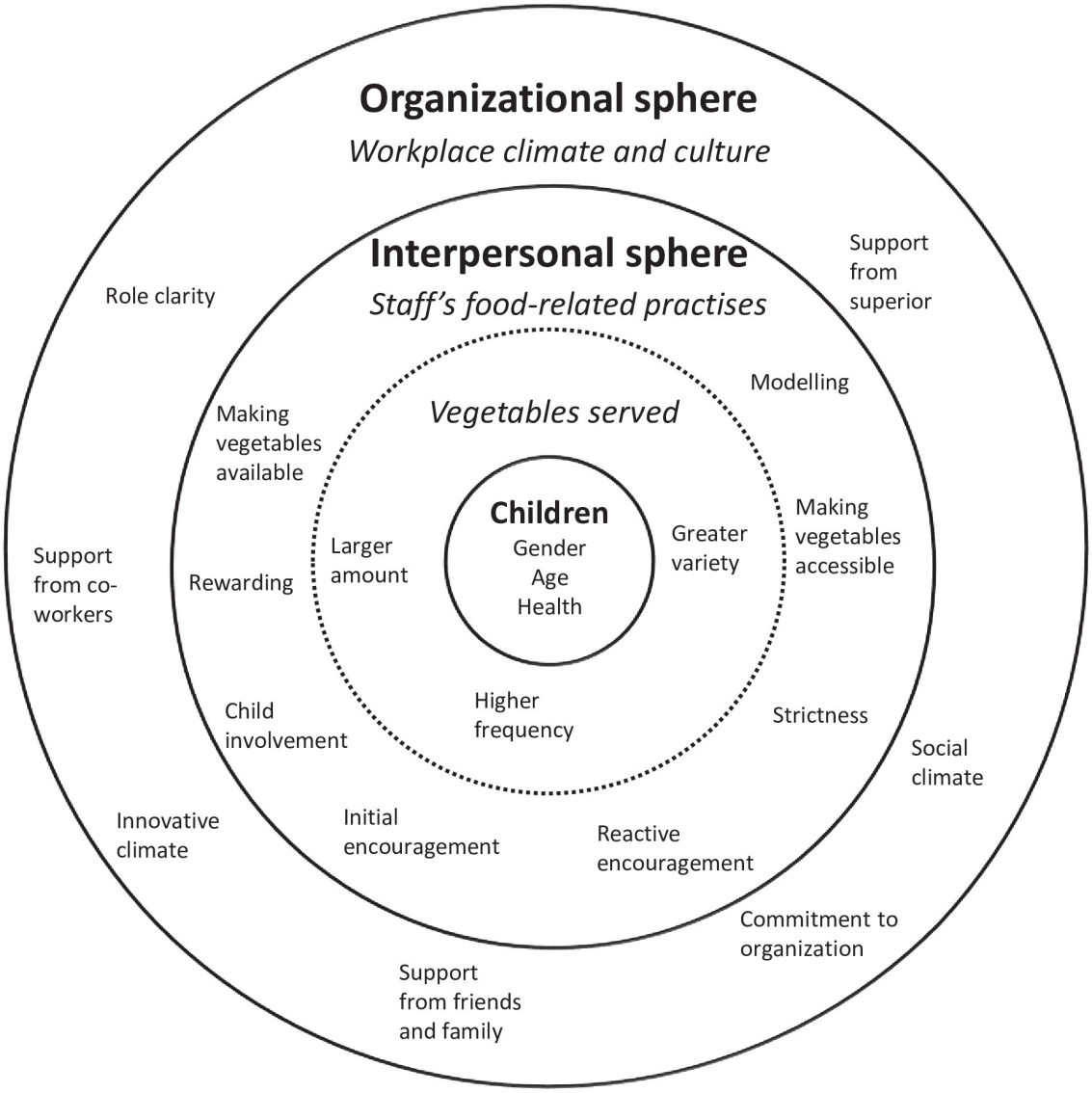

Fig 1. Social ecological model illustrating the different layers of factors that may affect vegetables served to children in kindergartens. (Adapted from Bartholomew et al. [24].).

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food-related practices and children's food [20] and vegetable intake [21], and food acceptance [22]. In the Norwegian national guidelines for food and meals in kindergartens, it is emphasized that child-care staff should take an active role during meals, because they are important role models for the children [11].

More distal factors related to children's food environment, such as workplace climate and culture in the kindergarten, may also be important in the development of successful interventions aimed at influencing the proximal factors illustrated in Fig 1. However, there is a lack of kindergarten-based studies investigating how distal factors, such as the organizational culture/climate, leadership or organizational commitment, can affect implementation [23]. It has been emphasized that it is the individuals who make up an organization who affect implementation,

so there is a need to understand the social systems and structures of the organization before an intervention can be successfully implemented [24].

Following a social ecological model [24] with four layers (Fig 1), the workplace climate and culture [9] lie within the fourth layer, which makes up the organizational sphere. The distal factors of the model, such as social climate, may both limit and enable the proximal factors of the model, such as staff's food-related practices, which in turn may limit or enable vegetables being served [24]. Illustrated in the third layer of the model (Fig 1) are *staff's food-related practices*, which consist of *availability*, *accessibility*, *modelling*, *strictness*, *initial encouragement*, *reactive encouragement*, *child involvement* and *rewarding* [25,26]. Staff's food-related practices are considered to be important factors in affecting children's food environment, and are also important in terms of serving larger amounts and a greater variety of vegetables at a higher frequency to the children; this is illustrated in the second layer of Fig 1. The dotted line illustrates that staff's food-related practices and vegetables served are both within the interpersonal sphere.

Data on how pre-school employees experience their workplace climate and culture has previously been used for comparison with child welfare workers in a Swedish study [27], which included 377 employees in pre-schools. The results for the pre-school employees were considered to be positive because the pre-school employees had high scores on *role clarity*, *support from superior*, *support from co-workers*, *social climate* and *innovative climate* [27], and such high scores may positively affect these employees' job performance. Furthermore, a Canadian qualitative study conducted in kindergartens, with children aged 3 months up to 6 years, found that a critical determinant for organizational behaviour was the director's strong leadership, and that leadership, health champions, organizational culture, and networking and knowledge brokering were factors that positively influenced the adoption of nutritional guidelines [28]. However, as distal factors such as workplace climate and culture might be difficult to change by intervention, it might be easier to target more proximal factors such as staff's food-related practices.

The aim of the present study was, therefore, (1) to explore associations between workplace climate and culture in the kindergarten and staff's food-related practices and vegetables served, and (2) to investigate the possible mediating role of staff's food-related practices in the relationship between the workplace climate and culture and vegetables served.

Method

Study design and subjects

Baseline data from the BRA-study (*Barnehage* [kindergarten], *gRønnsaker* [vegetables] and *fAmilie* [family]) were used. The BRA-study is a clustered, randomized controlled, intervention study with an overall aim to improve vegetable intake among children (aged 3–5 years at baseline) through changing the food environment and dietary practices in the kindergarten and at home. In the autumn and winter 2014–2015, all 479 public and private kindergartens in Vestfold and Buskerud counties were invited to participate in the study; of these 73 kindergartens accepted (15.2% response rate). Within the 73 kindergartens, departments with children born in 2010 or 2011 were eligible for the study and 135 departments agreed to participate. Norwegian kindergartens are generally organized into different departments within each kindergarten. Each department is usually staffed by one pedagogical leader with formal responsibility for the department, in addition to two or more assistants, and consists of a wardrobe, bathroom facilities, and one or more activity/play rooms; some departments also contain some kitchen facilities (e.g. kitchen counter with sink, refrigerator).

Baseline data were collected in the spring of 2015, and a detailed description of this has previously been published [29]. In Norway, kindergarten leaders have full responsibility for the administrative tasks and ensuring the quality of the kindergarten's pedagogical activities. Pedagogical leaders are responsible for planning and conducting the pedagogical activities within the departments, and guide the kindergarten assistants in their pedagogical work. Kindergarten assistants support the pedagogical leaders to ensure that the pedagogical activities are conducted and to care for the children. In the following, the term 'staff' includes employees within one kindergarten department, namely the pedagogical leader and kindergarten assistants. Data on vegetables served, staff's food-related practices and the organization were collected using several instruments. A paper-based questionnaire, answered by the kindergarten leader, was used to assess workplace climate and culture. A paper-based questionnaire, answered by the pedagogical leaders, was used to assess the frequency and variety of vegetables served, the workplace climate and culture, and the staff's food-related practices. A paper-based questionnaire, answered by the kindergarten assistants, was used to assess the workplace climate and culture and the staff's food-related practices. All three groups of staff answered the same questions about the workplace climate and culture, and leaders and assistants answered the same questions about the staff's food-related practices. The instruments differed across the three groups with regard to the number and content of additional questions, according to what was considered relevant for each group of employees.

A paper-based, 5-day weighted vegetable diary, filled in by kindergarten staff working at the participating departments, was used to assess the amount of vegetables served.

Measurements

Workplace climate and culture

Workplace climate and culture were assessed using scales from the validated General Nordic Questionnaire for Psychological and Social Factors at Work (QPS_{Nordic}) [9]. The original QPS_{Nordic} contains 26 different scales measured by 123 items [9]. Based on consultation with one of the developers of the QPS_{Nordic}, we chose to include the 8 most relevant scales, which consisted of 19 items. The scales used were: *Role clarity* (three items), *Support from superior* (three items), *Support from co-workers* (two items), *Support from friends and relatives* (two items), *Social climate* (three items), *Innovative climate* (three items) and *Commitment to the organization* (three items) (Table 1). Calculation of the scales followed the QPS_{Nordic}'s user guide [9]. The response to each item was given on a 5-point scale with 5 as the highest value and 3 as a neutral midpoint. Before items were calculated, a reversed score was calculated for one item, *distrustful and superstitious*, included in the scale called *Social climate*. Measurements of kindergarten climate and culture were collected from the kindergarten leader, the pedagogical leader and the kindergarten assistants (n = 428); this was then aggregated to the kindergarten level (n = 67).

Kindergarten staff's food-related practices

Using a previous paper from the BRA-study [26], we used the score labelled 'staff's food-related practices', which consisted of eight factors containing three to five items each. A detailed description of how the factors were extracted has been published elsewhere [25]. The description of how this score was calculated has also been published previously [Himberg-Sundet et al, accepted]. The eight factors were: *modelling* (five items), *initial encouragement* (five items), *child involvement* (four items), *reactive encouragement* (three items), *strictness* (three items), *rewarding* (three items), *accessibility* (four items) and *availability* (three items) [25].

Table 1. Scales from QPS_{Nordic} used to measure kindergarten climate and culture: the BRA-study (n = 428).

Scales and items included	Cronbach's α	Baseline Median (min., max.)
Role clarity[a]	0.83	4.67 (3.75, 5.00)
Have clear, planned goals and objectives been defined for your job?		
Do you know what your responsibilities are?		
Do you know exactly what is expected of you at work?		
Support from superior[a]	0.86	4.49 (3.05,5.00)
If necessary, can you get support and help with your work from your immediate superior?		
If necessary, is your immediate superior willing to listen to your work-related problems?		
Are your work achievements appreciated by your immediate superior?		
Support from co-workers[a]	0.78	4.60 (3.75, 5.00)
If necessary, can you get support and help with your work from your co-workers?		
If necessary, are your co-workers willing to listen to your work-related problems?		
Support from friends and relatives[a]	0.79	3.61 (1.67, 5.00)
If necessary, can you talk with your friends about your work-related problems?		
If necessary, can you talk with your spouse or any other close person about your work-related problems?		
Social climate[b]	0.67	4.07 (2.92, 4.92)
What is the climate like in your work unit? - Encouraging and supportive - Distrustful and suspicious[e] - Relaxed and comfortable		
Innovative climate[a]	0.71	4.28 (3.33, 4.92)
Do workers take initiatives at your workplace?		
Are workers encouraged to think of ways to do things better at your workplace?		
Is there sufficient communication in your department?		
Commitment to the organization[c]	0.86	4.69 (3.08, 5.00)
To my friends I praise this organization as a great place to work		
My values are very similar to the organization's values		
This organization really inspires me to give my very best job performance		

[a]Precoded answer categories: *very seldom or never*, *quite seldom*, *sometimes*, *quite often*, *very often or always*.

[b]Precoded answer categories: *very little or not at all*, *quite little*, *somewhat*, *quite a lot*, *a great deal*.

[c]Precoded answer categories: *disagree totally*, *disagree to some extent*, *indifferent*, *agree to some extent*, *agree totally*.

[e]Reversed score.

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Measurements of staff's food-related practices were collected from assistants and leaders (n = 373), and then aggregated to the kindergarten level (n = 67).

Frequency and variety of vegetables served

A detailed description of data collection in terms of the measurements of frequency, variety and amount of vegetables served has been published previously [26]. The frequency of served

vegetables for breakfast, lunch and the afternoon meal was assessed through three separate questions: 'How often does your department offer vegetables for breakfast/lunch/afternoon meal?' The response alternatives were on a 7-point scale ranging from '5 days a week' to '1–3 times per month' and 'never'. The variety of vegetables served for lunch and the afternoon meal was also assessed through three separate questions: 'How often does your department offer these vegetables for breakfast/lunch/afternoon meal?' Twelve kinds of vegetables were given as response alternatives, using the same 7-point scale mentioned above. From these data the monthly variety of vegetables served was calculated, by first recoding the 7-point scale: 5 days a week = 5, 4 days a week = 4, 3 days a week = 3, 2 days a week = 2, 1 day a week = 1, 1–3 times a month = 0.5, never = 0. If a vegetable had been served (regardless of how many times per week/month) a value of 1 was given, whereas, if a vegetable had not been served, a value of 0 was given. Then the variety of vegetables served for breakfast, lunch and the afternoon meal was calculated. Measurements of frequency and variety of vegetables served were collected from 110 pedagogical leaders, and then aggregated to the kindergarten level (n = 67).

Amount of vegetables served

A detailed description of the 5-day weighted vegetable diary used to assess the amount of vegetables served has been published previously [29]. Briefly, the kindergarten staff were instructed to weigh vegetables served for 5 consecutive days before each meal, and to note the number of children and adults present. This provided a measure of the amount of vegetables, in grams, served per person per day. Measurements of the amount of vegetables served were collected from 109 kindergarten departments, and then aggregated to the kindergarten level (n = 67).

Data analysis

All analyses were conducted after aggregating the data to the kindergarten level. To base all analyses on the same sample, only kindergartens with complete data about the workplace climate and culture, the staff's food-related practices and vegetables served were included (n = 67). Median, minimum and maximum scores were calculated and presented for the scales and the single items used from the scale. As some of the measures were slightly skewed, we chose to use median scores. Cronbach's alpha was calculated to assess the internal consistency of the items included in the scales. As some of the scales and items measuring workplace climate and culture were not normally distributed, Spearman's rho was used in the calculation of bivariate correlations between climate and culture in the kindergarten and staff's food-related practices and vegetables served.

Based on the logic model for the intervention, the secondary outcomes for the BRA-study [26], and Cohen's guidelines for interpretation of correlation coefficients by the inclusion of correlation >0.3, six mediation models were used (Fig 2). These six mediation models assessed the mediating role of staff's food-related practices, exploring the role of staff's food-related practices in the association across: (1) *commitment to the organization* and frequency of vegetables served, (2) *commitment to the organization* and variety of vegetables served, (3) *commitment to the organization* and amount of vegetables served, (4) *support from superior* and frequency of vegetables served, (5) *support from superior* and variety of vegetables served and (6) *support from superior* and amount of vegetables served. Mediation analyses were conducted using the PROCESS SPSS macro provided by Hayes [30], and non-standardized beta coefficients are presented. For small sample sizes, it is recommended that the bootstrapping method be used [30]. Furthermore, the PROCESS macro provides percentile bootstrap confidence intervals that have been shown to be more robust with regard to small sample sizes [30]. Therefore, 5000 bootstrap re-samples, with 95% bias-corrected confidence intervals for the indirect

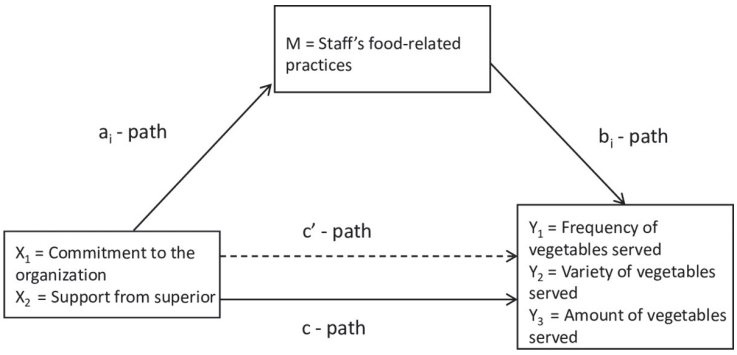

Fig 2. Simple mediation models for the association between (1) *commitment to the organization* and (2) *support from superior*, and the frequency, variety and amount of vegetables served.

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effect, were conducted [30]. The assumptions of linearity, normality and homoscedasticity were investigated and considered acceptable. The residuals for the mediation models were inspected and confirmed as normally distributed. Fig 2 shows the steps followed in the mediation analyses: (1) the c-path measures the total effect of climate and culture in the kindergarten (*commitment to the organization* and *support from superior*) on vegetables served (frequency, variety and amount). (2) The a-path measures the relationship of climate and culture in the kindergarten (*commitment to the organization* and *support from superior*) with the possible mediator staff's food-related practices, in all six models. (3) The b-path measures the relationship between the mediator staff's food-related practices and vegetables served (frequency, variety and amount). (4) The c′-path measures the direct effect of climate and culture in the kindergarten on vegetables served (frequency, variety and amount) when adjusting for the staff's food-related practices. Eventually, the indirect effect of the possible mediating variable (a-path × b-path) was investigated for each of the models [31,32]. Statistical analyses were conducted using SPSS® version 24.0.

Results

The descriptive statistics of the kindergartens at baseline has been previously published [29]. The baseline mean score (standard deviation [SD]) for the variety of vegetables served was 7.7 (3) times per month, the frequency of vegetables served had a mean score of 7.2 (3.7) times per week, whereas the mean score for the amount of vegetables served was 44 (24) grams per person per day [26]. The mean score for staff's food-related practices at baseline was 4.0. (0.5); more descriptive statistics for this score can be found elsewhere [26]. The baseline median scores for the different scales from the QPS_{Nordic} are presented in Table 1. The internal consistency of the scales (Cronbach's alpha) varied between 0.67 and 0.86 (Table 1), which is comparable to the results from the original QPS_{Nordic} questionnaire [9] of 0.71–0.83.

Correlations between the scales that measure the workplace climate and culture and staff's food-related practices and vegetables served are presented in Table 2. *Commitment to the organization* (r_s = 0.39) was significantly positively correlated with the staff's food-related practices. *Support from superior* (r_s = 0.33) was positively correlated with the staff's food-related practices. Further, *support from superior* (r_s = 0.33), *support from co-workers* (r_s = 0.31) and *commitment to the organization* (r = 0.32) were positively correlated with the frequency of vegetables served.

Even though only one significant correlation was found using Bonferroni's correction (p = 0.002), we decided to explore factors with correlations >0.3 in mediation analysis. As

Table 2. Correlation of QPS_{Nordic} scales and staff's food-related practices and vegetables served ($n = 67$).

Measure	Staff's food-related practices Spearman's rho (p)	Frequency[a] of vegetables served Spearman's rho (p)	Variety[b] of vegetables served Spearman's rho (p)	Amount[c] of vegetables served Spearman's rho (p)
Role clarity	0.18 (0.136)	0.21 (0.088)	0.05 (0.711)	–0.07 (0.564)
Support from superior	0.33 (0.006)	0.33 (0.006)	0.03 (0.833)	0.20 (0.104)
Support from co-workers	0.23 (0.058)	0.31 (0.011)	0.13 (0.301)	0.11 (0.355)
Support from friends and relatives	–0.00 (0.984)	0.08 (0.522)	0.05 (0.665)	0.08 (0.524)
Social climate	0.17 (0.169)	0.26 (0.034)	0.19 (0.132)	–0.07 (0.564)
Innovative climate	0.18 (0.137)	0.26 (0.031)	0.20 (0.109)	–0.08 (0.951)
Commitment to the organization	0.39 (0.001)*	0.32 (0.008)	0.23 (0.058)	0.12 (0.333)

Statistical significance at $^{*}p < 0.002$, set using Bonferroni's correction.

[a]Frequency of vegetables served over a week.

[b]Variety of vegetables served over a month.

[c]Amount of vegetables served per person per day.

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there can be mediation without a significant main effect [30], we proceeded with mediation analysis. Single mediation analyses revealed no significant effect of *commitment to the organization* on the frequency, variety and amount of vegetables served (c-path and c′-path) (Table 3). A significant total and direct effect ($p < 0.05$) was found only for *support from superior* on the frequency of vegetables served (c = 2.37, c′ = 1.80). A significant mediation effect ($p < 0.05$) of the staff's food-related practices was found on the relationship between *support from superior* and variety of vegetables served (ab = 0.66, confidence interval [CI] = 0.10, 1.32) (a-path × b-path) (Table 3). In addition, a significant mediation effect ($p < 0.05$) of the staff's food-related practices was found for the relationship between *commitment to the organization* and frequency of vegetables served (ab = 0.77, CI = 0.05, 1.48) (a-path × b-path) and variety of vegetables served (ab = 0.71, CI = 0.01, 1.44) (a-path × b-path).

Discussion

The present study has explored associations between workplace climate and culture in the kindergarten and the staff's food-related practices, and the frequency, variety and amount of vegetables served. It also explored the mediating role of the staff's food-related practices in the

Table 3. Mediation effect of the staff's food-related practices in the association between climate and culture in the kindergarten and vegetables served ($n = 67$).

Measurement	c-path (SE)	c′-path (SE)	a-path (SE)	b-path (SE)	ab[a]	95% CI
Outcome: frequency of vegetables served (per week)						
Commitment to the organization	1.68* (0.82)	0.91 (0.85)	0.24** (0.08)	3.24** (1.29)	0.77	0.05, 1.48
Support from superior	2.37** (0.80)	1.80* (0.81)	0.20** (0.08)	2.91* (1.23)	0.58	–0.03, 1.16
Outcome: variety of vegetables served (per month)						
Commitment to the organization	1.03 (0.67)	0.33 (0.68)	0.24** (0.08)	2.98** (1.03)	0.71	0.10, 1.32
Support from superior	0.27 (0.68)	–0.39 (0.70)	0.20** (0.08)	3.33** (1.02)	0.66	0.10, 1.32
Outcome: amount of vegetables served (grams per person per day)						
Commitment to the organization	7.88 (6.70)	3.67 (7.10)	0.24** (0.08)	17.75 (10.77)	4.21	–1.05, 9.76
Support from superior	10.69 (6.62)	7.45 (6.87)	0.20** (0.08)	16.32 (10.46)	3.24	–0.78, 8.54

CI, confidence interval; SE, standard error.

Statistical significance at $^{*}p<0.05$ and $^{**}p<0.01$.

[a]Indirect effect calculated as a-path × b-path

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relationship between workplace climate and culture in the kindergarten and vegetables served. Results showed one significantly positive correlation ($p = 0.001$) between *commitment to the organization* and the staff's food-related practices. The results showed moderate positive correlations between *commitment to the organization* and frequency of vegetables served, and *support from superior* with the staff's food-related practices and frequency of vegetables served, although the associations did not reach statistical significance at the *p* value set after Bonferroni's correction. The staff's food-related practices were found to mediate the association between *support from superior* and the variety of vegetables served. Staff's food-related practices also mediated the association between *commitment to the organization* and the frequency, as well as the variety, of vegetables served.

Workplace climate and culture in kindergartens

Previously conducted studies on psychological and social factors in the kindergarten setting have mostly focused on the burden of stress in this field of work [33,34]; other distal factors have not previously been explored in this context. Compared with results from a study of social workers in Sweden, which included pre-school teachers as a comparison group [27], our results revealed that the kindergartens included in the present study had a favourable workplace climate and culture. This may be partly due to the kindergartens participating in the present study having a more engaged group of employees.

Associations between workplace climate and culture, staff's food-related practices and vegetables served

The results showed only one significantly positive association between factors in the workplace climate and culture and the staff's food-related practices and vegetables served. Even though they were not significant, the results showed moderate positive correlations between *commitment to the organization* and frequency of vegetables served, and *support from superior* with staff's food-related practices and frequency of vegetables served. To the authors' knowledge, no studies have been conducted on associations between these specific organizational factors in the kindergarten and the staff's food-related practices, and vegetables served. Several school-based studies have shown how some of these distal factors might affect job performance [35–38], pointing to organizational commitment promoting organizational effectiveness within the educational system [35,36] and job performance among teachers [38]. Thus, the positive correlation between *commitment to the organization* and the staff's food-related practices may be a result of the kindergarten employees' high degree of commitment to the workplace. Also, a servant leadership style (e.g. praise and support, listening to people and caring about their needs) may be useful in enhancing a teacher's job satisfaction [39], which in turn improves effective work [40]. As a servant leadership style has several similarities to social support (listening to, praise and support others), this may explain why support from superior correlates positively with the staff's food-related practices, and frequency of vegetables served, because this leadership style may improve effective work and enhance teachers' job satisfaction.

Several of the factors measuring workplace climate and culture in the kindergarten were not associated with the staff's food-related practices or vegetables served. The lack of associations for *support from friends and relatives* may be explained by the confidentiality agreement that kindergarten employees must sign before starting to work in the kindergarten, and thus could lead to kindergarten employees not seeking support from friends and relatives with regard to work. This was also mentioned by a number of respondents.

The mediating role of staff's food-related practices on the relationship between workplace climate and culture and vegetables served

Although a direct relationship was not observed, the mediation analyses showed significant mediation effects of the staff's food-related practices on the relationship between *commitment to the organization* and the frequency and variety of vegetables served, and between *support from superior* and the variety of vegetables served. These results from the mediation analyses indicate that factors in the workplace climate and culture may affect vegetables served through staff's food-related practices. This is supported by a Canadian study [28] which found that both leadership and organizational culture might be important factors for the implementation of nutritional guidelines in kindergartens. Based on this knowledge one should address factors in the workplace climate and culture in future interventions to facilitate change in staff's food-related practices, since previous results from the BRA-study have found that targeting the staff's food-related practices directly through training did not result in change [26]. The mediation results, points to the importance of leaders being supportive during the intervention, by listening to, praising and supporting the kindergarten employees. In addition, a supportive leader might engage the employees early in the process of the development of an intervention, to ensure commitment throughout the implementation. However, as *commitment to the organization* and *support from superior* showed relatively high scores for the kindergartens participating in the BRA-study, an increase in this score might be challenging.

As these mechanisms between distal and more proximal factors in the kindergarten environment seem complex, further studies are needed to explore how these factors interact or are mediated by each other to develop more successful interventions in this setting.

Strengths and limitations

The present study has a number of strengths. First, few studies have investigated factors in the kindergarten environment. Second, this was the first study to highlight factors in the kindergarten workplace climate and culture, and that these factors may be of importance in developing interventions aimed at increasing the variety and amount of vegetables served in this setting. To our knowledge, questions from the QPS_{Nordic} have never previously been used in a kindergarten setting. The present study revealed that the internal consistency of the scales, as measured by Cronbach's alpha, was comparable with the results from the original QPS_{Nordic} questionnaire [9]. Even though the response rate was low, the kindergartens included in the BRA-study did not appear to differ from the other kindergartens in the two counties from which we recruited participants [26].

The present study also has a number of limitations. All questionnaires were paper based, including enquiries about age and gender, and the department in which the employees worked. As mentioned by a few responders, if questionnaires were compiled before being sent from the kindergarten in one prepaid envelope, this information could make it possible for other employees within the same kindergarten to identify the respondents. This perception of a lack of anonymity may have affected their answers–especially with regard to the questions used from the QPS_{Nordic}. Responses to each item in the QPS_{Nordic} were given on a 5-point scale, so this might have contributed to a ceiling effect. In addition, the present study was conducted using a small sample size of kindergartens, which limits the power of the mediation analyses, and the results should be interpreted with caution.

Conclusion

The present study showed a significantly positive correlation between *commitment to the organization* and the staff's food-related practices. The staff's food-related practices mediated the

association between *commitment to the organization* on frequency and variety of vegetables served, and the association between *support from superior* and the variety of vegetables served. These results indicate that *commitment to organization* and *support from superior* as factors in workplace climate and culture seems to be important to target when developing kindergarten-based interventions aimed at increasing the frequency and variety of vegetables served as they related to more favourable food-related practices among staff.

Supporting information

S1 Dataset.
(SAV)

Author Contributions

Conceptualization: Anne Himberg-Sundet, Thomas Moser, Nanna Lien.

Data curation: Anne Lene Kristiansen.

Formal analysis: Anne Himberg-Sundet.

Methodology: Anne Lene Kristiansen, Mekdes K. Gebremariam, Mona Bjelland.

Project administration: Anne Lene Kristiansen, Lene Frost Andersen, Nanna Lien.

Supervision: Mekdes K. Gebremariam, Lene Frost Andersen, Nanna Lien.

Writing – original draft: Anne Himberg-Sundet.

Writing – review & editing: Anne Himberg-Sundet, Anne Lene Kristiansen, Mekdes K. Gebremariam, Thomas Moser, Lene Frost Andersen, Mona Bjelland, Nanna Lien.

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Appendix I

UiO : Universitetet i Oslo

Oslo, november 2014

Til styrer - Forespørsel om deltagelse i en forskningsstudie

BAKGRUNN OG FORMÅL

Forskning har vist at inntaket av grønnsaker blant barn i barnehagealder er lavt, samtidig vet vi at et høyt inntak av grønnsaker er forbundet med bedre helse. Grunnlaget for god helse legges tidlig i livet. I dag tilbringer 90 % av norske 1-5 åringer store deler av dagen i barnehagen. Det betyr at mange av ukens måltider spises der, noe som gjør barnehagen til en viktig arena for etableringen av gode matvaner.

Universitetet i Oslo, Avdeling for ernæringsvitenskap, skal i samarbeid med Høgskolen i Buskerud og Vestfold gjennomføre studien «BRA – med grønnsaker» blant barnehagebarn i Vestfold fylke. Målet med studien er å finne frem til effektive og kunnskapsbaserte tiltak som øker inntaket av grønnsaker blant barnehagebarn i 3-5 års alder.

Barnehagens arbeid med kosthold er forankret i barnehageloven og i rammeplanen. Ved å delta i studien kan din barnehage bidra til økt kunnskap om hvordan barnehager kan styrke sin rolle som en helsefremmende og forebyggende arena. Dessuten kan studien bidra til å redusere sosiale forskjeller i kostholdet fordi barn fra alle sosiale lag går i barnehage.

HVORDAN KAN DIN BARNEHAGE DELTA?

Vi trenger positivt svar fra minst 90 av de forspurte barnehagene i Vestfold fylke. Alle barnehager som har 10 eller flere barn født i 2010 og 2011 kan delta. Vi trenger at minst 7 barn fra hver barnehage deltar, men vil også vurdere om barnehager med færre barn kan delta. For en mer detaljert beskrivelse av studien og hva deltagelse innebærer, se baksiden. Bruk gjerne den vedlagte brosyren til å informere dine ansatte om BRA-studien. Dersom dere som barnehage ønsker å delta i studien, besvarer dere den vedlagte **svarslippen.** Vi ber om tilbakemelding så snart som mulig og senest innen **mandag 8. desember.** Alle barnehager vil bli oppringt av en prosjektmedarbeider om en ukes tid. Dersom du ikke ønsker at barnehagen skal delta og vil reservere deg mot å bli oppringt, svarer du «Nei» til deltagelse i den vedlagte svarslippen og returnerer den snarest.

Det er frivillig å delta i studien, og barnehagen kan når som helst trekke sitt samtykke uten å oppgi noen grunn. Men, for at vi sammen skal kunne bidra til å styrke barnehagene sin rolle som en helsefremmende og forebyggende arena er det viktig at flest mulig barnehager deltar.

Alle opplysninger blir behandlet strengt fortrolig og etter lovbestemte regler. Dataene fra din barnehage kobles ikke til barnehagens navn og alle opplysninger blir behandlet konfidensielt. Undersøkelsen er tilrådd av Personvernombudet for forskning, Norsk samfunnsvitenskapelig datatjeneste AS.

Har du noen spørsmål kan du ringe oss på telefonnummer 468 85 004, eller sende en e-post til bra-studien@medisin.uio.no

Vi ser frem til å høre fra dere og håper dere vil delta i BRA-studien!

Med vennlig hilsen,

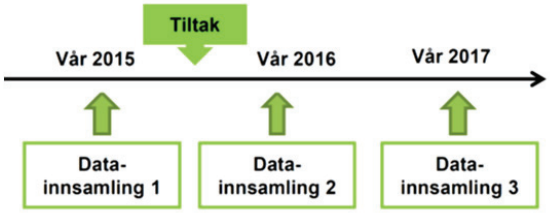
Lene Frost Andersen, professor
Prosjektansvarlig

Nanna Lien, professor
Prosjektansvarlig

Illustrasjon:Colourbox.com

MER INFORMASJON OM BRA-STUDIEN

Studien starter våren 2015 med gjennomføring av datainnsamling 1, og slutter våren 2017 med gjennomføring av datainnsamling 3, som vist i figuren.



Datainnsamlingene

Datainnsamling 1, 2 og 3 er like.

For barnehagen innebærer datainnsamlingene:

- Å fylle ut spørreskjemaer. Det vil være ett skjema til styrer og ett skjema til hver av de ansatte på den avdelingen der BRA-barna går. Tiden det tar å fylle ut skjemaene vil være:
  - Ca. 20 minutter for pedagogisk leder
  - Ca. 15 minutter for styrer
  - Ca. 10 minutter for assistenter
- Å veie hvor mye grønnsaker som forbrukes i løpet av 5 dager på den avdelingen der BRA-barna går.
- Å få besøk av prosjektmedarbeidere fra UiO, ca. 1 dag hvert år. Disse vil observere kostholdet til BRA-barna, intervjue styrer samt samle inn relevante dokumenter.

For foreldrene innebærer datainnsamlingene:

- Å fylle ut ett spørreskjema. Skjemaet tar ca. 20 minutter å fylle ut.
- Å registrere barnets kosthold hjemme i 2 dager.

For 2010-barna vil siste datainnsamling i barnehagen være datainnsamling 2. Disse barna vil følges opp for videre datainnsamling via e-post til foreldrene. Siste datainnsamling for 2011-barna i barnehagen er datainnsamling 3.

Tiltak

For å sikre at vi vet om tiltakene har effekt utover det som spontant skjer i barnehagene og i samfunnet for øvrig, vil barnehagene som deltar trekkes tilfeldig til tre ulike grupper. I to av gruppene vil det iverksettes tiltak i barnehageåret 2015/2016, mens det i den tredje gruppen ikke iverksettes tiltak. Denne siste gruppen vil være kontrollgruppen som fortsetter slik den pleier.

Tiltakene vil ha fokus på det som skjer ved måltidene i det daglige. Det være seg rutiner rundt servering av grønnsaker til måltidene og teknikker for å oppmuntre barn til å smake på og spise grønnsaker. Det kan ikke gis en mer detaljert beskrivelse av hva som skal skje i de barnehagene som får tiltak, da dette kan påvirke forskningsresultatene.

Tiltakene vil være utviklet og testet i samarbeid med barnehagepersonell og foreldre. De vil være i tråd med rammeplanen og de skal være relativt enkle å gjennomføre og inkludere i hverdagen både i barnehagen og hjemme.

HVA SKAL GJØRES FOR Å FÅ FORESATTE TIL Å DELTA?

Dersom din barnehage takker ja til å delta i studien vil vi be om hjelp til å videreformidle et brev med forespørsel om deltagelse i BRA-studien til alle foresatte med barn født i år 2010 eller i år 2011. Barnehagen vil motta brevene i januar 2015, og vi ber om at disse videreformidles til de foresatte umiddelbart. Foreldrene må beherske norsk for å kunne delta.

GODTGJØRELSE

Som godtgjørelse for den tiden de ansatte bruker på datainnsamlingene vil alle barnehager som deltar i datainnsamling 1 og 2 få utbetalt kroner 2000,-. Utbetalingen vil skje i august 2016.

MER INFORMASJON?

Har du noen spørsmål kan du ringe oss, på telefonnummer 468 85 004, eller sende en e-post til bra-studien@medisin.uio.no

Svarslipp - barnehagen

Forespørsel om deltagelse i en forskningsstudie for å øke inntaket av grønnsaker blant barnehagebarn

Vennligst returner utfylt svarslipp snarest, og senest innen mandag 8. desember 2014. Benytt ett av følgende alternativer:

1) Skanne og sende på e-post: **bra-studien@medisin.uio.no**

2) Fotografert digitalt (med for eksempel smarttelefon) og sende på e-post: **bra-studien@medisin.uio.no**

3) Gå inn på **www.uio.no/BRA** og fyll ut en elektronisk svarslipp.

SVARSLIPP

Kryss av for "JA" i ruten under dersom du samtykker i at barnehagen skal delta i studien. Dersom du ikke ønsker at barnehagen skal delta i studien og vil reservere deg mot å bli oppringt krysser du av for "NEI".

JA ☐ NEI ☐

Barnehagens navn: _____

Hvis ja, ber vi om at følgende informasjon også fylles ut slik at vi kan sende dere en pakke med nok brev til aktuelle foresatte.

Antall barn i barnehagen som er født i 2010 og i 2011: _____

Oppgi beste adresse å sende postpakke til barnehagen for å sikre at den kommer raskt frem:

_____

Grovt sett, hvordan vil du beskrive den sosiale statusen til barnegruppen i din barnehage?

Lav ☐ Høy ☐ Blandet ☐

_____

Sted Dato Underskrift styrer

Appendix II

Datainnsamling 2017

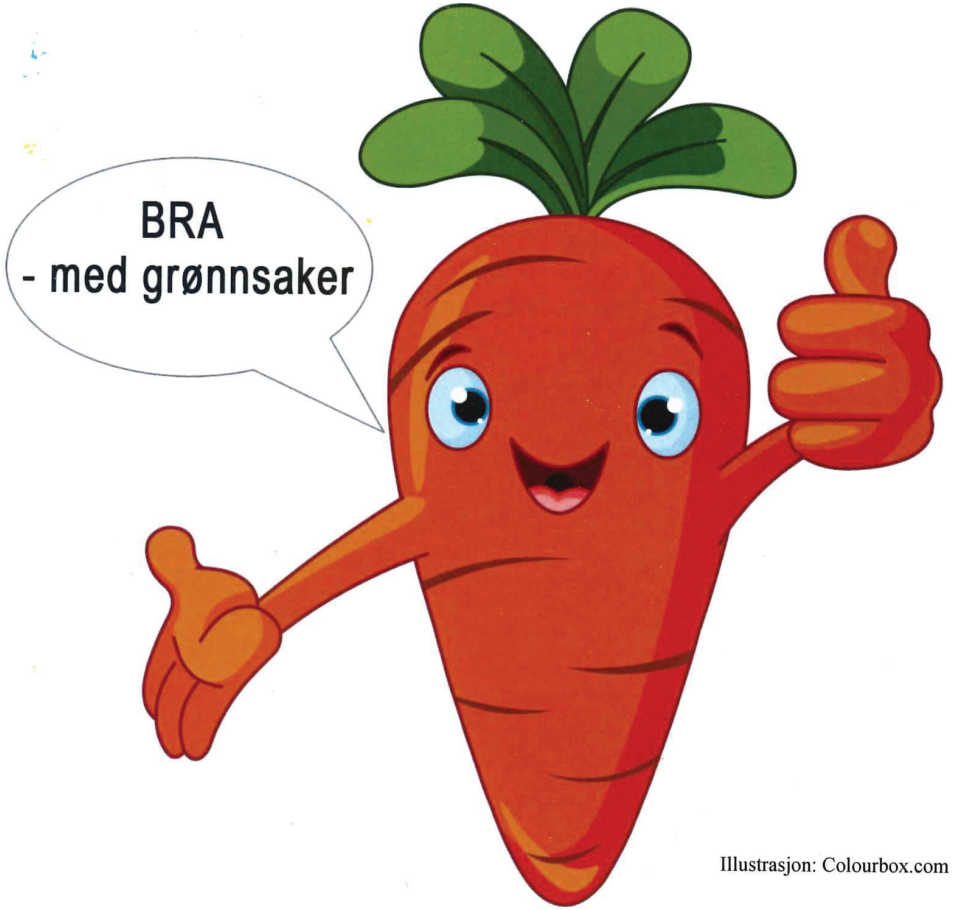
Dagbok for føring av

5-DAGERS forbruk av grønnsaker

Barnehagens ID-nummer:

Avdelingens navn:

Dato:



Illustrasjon: Colourbox.com

Veiledning for føring av 5-DAGERS forbruk av grønnsaker

Vi ønsker å vite noe om din avdeling sitt forbruk av grønnsaker i 5 dager. Grønnsaker inkluderer ikke poteter i denne sammenhengen.

Hvordan skal forbruket av grønnsaker føres i dagboken?

FØR frokost, lunsj, ettermiddagsmat og mellommåltider:

1) Sett plastbollen på vekten, og trykk på «ON/OFF» knappen, slik at den viser **0 gram** i displayet
2) Putt grønnsakene som skal serveres oppi bollen
3) **Før vekten (i gram) i kolonnen som heter «FØR måltidet» og i raden som heter «GRAM grønnsaker»**

ETTER frokost, lunsj, ettermiddagsmat og mellommåltider:

1) Sett plastbollen på vekten, og trykk på «ON/OFF» knappen, slik at den viser **0 gram** i displayet
2) Putt grønnsakene som ikke ble spist oppi bollen
3) **Før vekten (i gram) i kolonnen som heter «ETTER måltidet» og i raden som heter «GRAM grønnsaker»**

- Dersom det ikke serveres grønnsaker til et eller flere av måltidene de 5 dagene – noter dette for måltidene det gjelder i dagboken.
- Varmrett med grønnsaker - vei og noter GRAM grønnsaker før grønnsakene tas i retten. Gi en beskrivelse av retten. Når måltidet er over, vei restene av varmretten om mulig.

EKSEMPEL:

LUNSJ	FØR måltidet	ETTER måltidet	Antall barn tilstede under måltidet	Antall voksne som spiser av de serverte grønnsakene
GRAM grønnsaker	283 gram	77 gram		
Beskrivelse av grønnsakene	Agurk, Cherry tomater og paprika	Cherry tomat og paprika – mest tomat igjen	18	3
Er grønnsakene spiseklare? (dvs. uten kjerne, skall etc.)	Ja			
Ditt navn	Anne Lene Kristiansen	Anne Himberg-Sundet		

DAG 1

FROKOST	FØR måltidet	ETTER måltidet	Antall barn tilstede under måltidet	Antall voksne som spiser av de serverte grønnsakene
GRAM grønnsaker				
Beskrivelse av grønnsakene				
Er grønnsakene spiseklare? (dvs. uten kjerne, skall etc.)				
Ditt navn				

LUNSJ	FØR måltidet	ETTER måltidet	Antall barn tilstede under måltidet	Antall voksne som spiser av de serverte grønnsakene
GRAM grønnsaker				
Beskrivelse av grønnsakene				
Er grønnsakene spiseklare? (dvs. uten kjerne, skall etc.)				
Ditt navn				

ETTERMIDDAGSMAT	FØR måltidet	ETTER måltidet	Antall barn tilstede under måltidet	Antall voksne som spiser av de serverte grønnsakene
GRAM grønnsaker				
Beskrivelse av grønnsakene				
Er grønnsakene spiseklare? (dvs. uten kjerne, skall etc.)				
Ditt navn				

Dersom dere serverer grønnsaker til andre måltider i løpet av dagen – se baksiden av dette arket

Appendix III

27803

22. Hvor ofte tilbyr din avdeling/base/gruppe frisk frukt/bær og grønnsaker til <u>frokosten</u>? *Sett ett kryss for hver linje*

	5 dager i uken	4 dager i uken	3 dager i uken	2 dager i uken	1 dag i uken	1-3 ganger per måned	Aldri
Frisk frukt/bær	☐	☐	☐	☐	☐	☐	☐
Grønnsaker	☐	☐	☐	☐	☐	☐	☐

25. Hvor ofte tilbyr din avdeling/base/gruppe frisk frukt/bær og grønnsaker til <u>lunsjen</u>? *Sett ett kryss for hver linje*

	5 dager i uken	4 dager i uken	3 dager i uken	2 dager i uken	1 dag i uken	1-3 ganger per måned	Aldri
Frisk frukt/bær	☐	☐	☐	☐	☐	☐	☐
Grønnsaker	☐	☐	☐	☐	☐	☐	☐

28. Hvor ofte tilbyr din avdeling/base/gruppe frisk frukt/bær og grønnsaker til <u>ettermiddagsmaten</u>? *Sett ett kryss for hver linje*

	5 dager i uken	4 dager i uken	3 dager i uken	2 dager i uken	1 dag i uken	1-3 ganger per måned	Aldri
Frisk frukt/bær	☐	☐	☐	☐	☐	☐	☐
Grønnsaker	☐	☐	☐	☐	☐	☐	☐

27803

24. Hvor ofte tilbyr din avdeling/base/gruppe følgende grønnsaker til <u>frokosten</u>?
Sett ett kryss for hver linje

	5 dager i uken	4 dager i uken	3 dager i uken	2 dager i uken	1 dag i uken	1-3 ganger per måned	Aldri
Agurk	☐	☐	☐	☐	☐	☐	☐
Tomat	☐	☐	☐	☐	☐	☐	☐
Paprika	☐	☐	☐	☐	☐	☐	☐
Sukkererter	☐	☐	☐	☐	☐	☐	☐
Salat	☐	☐	☐	☐	☐	☐	☐
Gulrot	☐	☐	☐	☐	☐	☐	☐
Annet	☐	☐	☐	☐	☐	☐	☐

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27. Hvor ofte tilbyr din avdeling/base/gruppe følgende grønnsaker til lunsjen?
Sett ett kryss for hver linje

	5 dager i uken	4 dager i uken	3 dager i uken	2 dager i uken	1 dag i uken	1-3 ganger per måned	Aldri
Agurk	☐	☐	☐	☐	☐	☐	☐
Tomat	☐	☐	☐	☐	☐	☐	☐
Paprika	☐	☐	☐	☐	☐	☐	☐
Sukkererter	☐	☐	☐	☐	☐	☐	☐
Salat	☐	☐	☐	☐	☐	☐	☐
Gulrot	☐	☐	☐	☐	☐	☐	☐
Mais	☐	☐	☐	☐	☐	☐	☐
Brokkoli	☐	☐	☐	☐	☐	☐	☐
Blomkål	☐	☐	☐	☐	☐	☐	☐
Kålrot	☐	☐	☐	☐	☐	☐	☐
Hodekål	☐	☐	☐	☐	☐	☐	☐
Erter	☐	☐	☐	☐	☐	☐	☐
Annet	☐	☐	☐	☐	☐	☐	☐

Dersom du har krysset av for annet, vennligst spesifiser her:

30. Hvor ofte tilbyr din avdeling/base/gruppe følgende grønnsaker til <u>ettermiddagsmaten</u>? *Sett ett kryss for hver linje*

	5 dager i uken	4 dager i uken	3 dager i uken	2 dager i uken	1 dag i uken	1-3 ganger per måned	Aldri
Agurk	☐	☐	☐	☐	☐	☐	☐
Tomat	☐	☐	☐	☐	☐	☐	☐
Paprika	☐	☐	☐	☐	☐	☐	☐
Sukkererter	☐	☐	☐	☐	☐	☐	☐
Salat	☐	☐	☐	☐	☐	☐	☐
Gulrot	☐	☐	☐	☐	☐	☐	☐
Mais	☐	☐	☐	☐	☐	☐	☐
Brokkoli	☐	☐	☐	☐	☐	☐	☐
Blomkål	☐	☐	☐	☐	☐	☐	☐
Kålrot	☐	☐	☐	☐	☐	☐	☐
Hodekål	☐	☐	☐	☐	☐	☐	☐
Erter	☐	☐	☐	☐	☐	☐	☐
Annet	☐	☐	☐	☐	☐	☐	☐

Dersom du har krysset av for annet, vennligst spesifiser her:

Appendix IV

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Denne delen av spørreskjemaet omhandler regler for hvordan barn og voksne skal oppføre seg ved bordet i barnehagen.

7. Hvor enig eller uenig er du i følgende påstander?
Sett ett kryss for hver linje

	Helt uenig	Litt uenig	Verken enig eller uenig	Litt enig	Helt enig
Jeg forteller barna om hvilke grønnsaker vi skal spise	☐	☐	☐	☐	☐
Jeg beskriver konsistens og/eller smaken på nye grønnsaker for barna	☐	☐	☐	☐	☐
Jeg viser barna hvordan de kan utforske grønnsakene med sansene (lyd, lukt o.l)	☐	☐	☐	☐	☐
Jeg tillater at barna "leker" med grønnsakene (lager figurer, bruke som hoggtenner o.l)	☐	☐	☐	☐	☐
Jeg viser til figurer som barna kjenner fra TV/bøker/spill som spiser grønnsaker	☐	☐	☐	☐	☐
Jeg sier til barna at de må være like flinke som andre barn til å spise grønnsaker	☐	☐	☐	☐	☐
Jeg lover barna andre typer mat jeg vet barna vil foretrekke mot at de spiser grønnsaker	☐	☐	☐	☐	☐
Jeg oppmuntrer barna til å spise grønnsaker for å bli sterke, hold seg friske o.l	☐	☐	☐	☐	☐
Jeg skryter av barna når jeg ser at de spiser grønnsaker	☐	☐	☐	☐	☐
Jeg forteller barna at grønnsaker smaker godt	☐	☐	☐	☐	☐
Jeg oppmuntrer barna til å prøve et par biter av en grønnsak	☐	☐	☐	☐	☐
Jeg gir barna grønnsaker de liker	☐	☐	☐	☐	☐
Jeg spør barna om hjelp til å velge grønnsaker i butikken	☐	☐	☐	☐	☐
Jeg spør barna om å velge grønnsaker til måltider og snacks	☐	☐	☐	☐	☐
Jeg tilsetter noe for å få grønnsakene til å smake bedre	☐	☐	☐	☐	☐

8. Hvor enig eller uenig er du i følgende påstander?

Sett ett kryss for hver linje

	Helt uenig	**Litt uenig**	**Verken enig eller uenig**	**Litt enig**	**Helt enig**
Når jeg gir barna grønnsaker må de spise opp hele porsjonen	☐	☐	☐	☐	☐
Jeg er streng på at barna må spise grønnsaker	☐	☐	☐	☐	☐
Jeg insisterer på at barna må sitte ved bordet til de har spist grønnsakene sine	☐	☐	☐	☐	☐
Jeg lover barna noe de liker (annet enn mat) om de spiser opp grønnsakene	☐	☐	☐	☐	☐
Jeg er et forbilde for barna ved selv å spise grønnsaker	☐	☐	☐	☐	☐
Jeg prøver å spise grønnsaker når jeg er sammen med barna, selv om jeg ikke liker grønnsakene	☐	☐	☐	☐	☐
Jeg prøver å vise entusiasme når jeg spiser grønnsaker	☐	☐	☐	☐	☐
Jeg viser barna at jeg virkelig liker å spise grønnsaker	☐	☐	☐	☐	☐
Jeg viser barna hvordan de kan spise grønnsaker (ting de kan blande, bruke som pålegg o.l)	☐	☐	☐	☐	☐
Jeg lar barna delta i å tilberede grønnsaker som skal serveres (skrelle, kutte, legge på fat o.l)	☐	☐	☐	☐	☐

45449

9. Hvor enig eller uenig er du i følgende påstander?

Sett ett kryss for hver linje

På vår avdeling/base/gruppe…..	**Helt uenig**	**Litt uenig**	**Verken enig eller uenig**	**Litt enig**	**Helt enig**
...har vi vanligvis grønnsaker til varm mat hver gang	☐	☐	☐	☐	☐
...varierer vi type grønnsaker som serveres til varm mat	☐	☐	☐	☐	☐
... varierer vi tilberedningen av grønnsaker (rå, varme etc.) som serveres til varm mat	☐	☐	☐	☐	☐

10. Hvor enig eller uenig er du i følgende påstander?

Sett ett kryss for hver linje

	Helt uenig	**Litt uenig**	**Verken enig eller uenig**	**Litt enig**	**Helt enig**
Jeg minner barna på å spise grønnsaker flere ganger i løpet av et måltid	☐	☐	☐	☐	☐
Jeg sender fat/skål med grønnsaker rundt bordet	☐	☐	☐	☐	☐
Jeg plasserer fat/skål med grønnsaker rundt på bordet	☐	☐	☐	☐	☐
Vi har vanligvis mer enn én type grønnsaker på bordet slik at barna kan velge	☐	☐	☐	☐	☐
Vi serverer vanligvis grønnsaker hver for seg slik at barna kan velge hvilke de vil ha	☐	☐	☐	☐	☐
Jeg forsyner vanligvis barna med grønnsaker	☐	☐	☐	☐	☐
Barna forsyner seg vanligvis selv med grønnsaker	☐	☐	☐	☐	☐
Vi kutter opp grønnsaker som barna kan spise mellom måltider	☐	☐	☐	☐	☐
Vi serverer grønnsaker barna ikke liker flere ganger i løpet av en måned	☐	☐	☐	☐	☐
Vi inkluderer grønnsaker i de fleste måltidene	☐	☐	☐	☐	☐

Appendix V

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SPØRRESKJEMA FOR STYRER

Noen spørsmål om deg

1. Er du mann eller kvinne? *Sett ett kryss*

- ☐ Mann
- ☐ Kvinne

2. Hvor gammel er du? *Fyll inn antall år*

☐☐ år

3. I hvilket land er du født?
Sett ett kryss

- ☐ Norge
- ☐ Annet land, spesifiser:

4. Har du fullført barnehagelærer- / førskolelærerutdannelse eller annen likeverdig pedagogisk utdannelse? *Sett ett kryss*

- ☐ Ja
- ☐ Nei

5. Hvor lenge har du jobbet som styrer? *Fyll inn antall år*

☐☐ år i denne barnehagen

☐☐ år totalt

Noen spørsmål om barnehagen

6. Er barnehagen kommunal eller privat? *Sett ett kryss*

- ☐ Kommunal
- ☐ Privat

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7. Hvordan er inndelingen av barna i barnehagen organisert? *Sett ett kryss*

- ☐ I avdelinger
- ☐ Barnehagen er avdelingsfri (Bruk av baser/grupper e.l)
- ☐ Annet

Dersom du har krysset av for annet, vennligst spesifiser her:

8. Hvor mange avdelinger / grupper / baser er det i barnehagen?
Skriv ned antall i rutene

9. Hvor mange barn er det totalt i barnehagen?
Skriv ned antall barn i rutene

10. Hvor mange barn i barnehagen er minoritetsspråklige? (dvs. har et annet morsmål enn norsk, samisk, svensk, dansk og engelsk). *Skriv ned antall barn i rutene*

11. Hvor mange barn med redusert / fritak for foreldrebetalingen er det i barnehagen?
Skriv ned antall barn i rutene

12. Hvor mange årsverk (inkludert styrer) har barnehagen?
Skriv ned antall årsverk i rutene

13. Hvor mange årsverk i barnehagen har fullført barnehagelærer- / førskolelærerutdanning eller annen likeverdig pedagogisk utdanning?
Skriv ned antall årsverk i rutene

14. Har barnehagen ansatt en kjøkkenassistent, kokk eller lignende som har hovedansvaret for matlagingen i barnehagen? *Sett ett kryss*

- ☐ Ja, på heltid
- ☐ Ja, på deltid
- ☐ Nei

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Denne delen av spørreskjemaet omhandler hvordan arbeidet med mat og måltider i barnehagen er forankret.

15. Hvem har hovedansvaret i barnehagen for å:
Flere kryss tillatt per linje

	Assistent	Pedagogisk leder	Styrer	Kokk / kjøkkenass.	Andre
Bestemme mat- og drikketilbudet	☐	☐	☐	☐	☐
Planlegge mat- og drikketilbudet	☐	☐	☐	☐	☐
Tilbereding av maten	☐	☐	☐	☐	☐
Gå i butikken og handle	☐	☐	☐	☐	☐
Bringe maten til barnehagen	☐	☐	☐	☐	☐
Bestille mat og drikke	☐	☐	☐	☐	☐

Dersom du har krysset av for andre, vennligst spesifiser her:

16. Er arbeidet med mat og måltider forankret i barnehagens årsplan eller i form av skrevne retningslinjer? *Sett ett kryss for hver linje*

	I årsplan	I skrevne retningslinjer	I årsplan og i skrevne retningslinjer	Nei	Vet ikke
Medbrakt mat og drikke	☐	☐	☐	☐	☐
Mat og drikke som tilbys	☐	☐	☐	☐	☐
Rammene rundt måltidet	☐	☐	☐	☐	☐
Hva som spises/drikkes ved bursdager	☐	☐	☐	☐	☐
Annet arbeid med mat og måltider	☐	☐	☐	☐	☐

Dersom du i spørsmål 16 har krysset av på at barnehagen har skrevne retningslinjer for mat og måltider svarer du på spørsmålene nedenfor, hvis ikke hopper du til spørsmål 21

17. Når ble barnehagens skrevne retningslinjer sist revidert? Fyll inn årstall

18. Hvem har utarbeidet barnehagens skrevne retningslinjer? *Flere kryss er tillatt*

- ☐ Styrer
- ☐ Pedagogisk leder(e)
- ☐ Assistent(er)
- ☐ Hele personalgruppen
- ☐ Andre

Dersom du har krysset av for andre, vennligst spesifiser her:

19. Har dere rutiner for hvordan ansatte får kjennskap til barnehagens skrevne retningslinjer? *Flere kryss er tillatt*

- ☐ Ja, vi gjennomgår retningslinjene på et personalmøte en gang i året
- ☐ Ja, vi gjennomgår retningslinjene i en medarbeidersamtale ved ansettelse
- ☐ Nei, men det forventes at de ansatte setter seg inn i disse
- ☐ Nei
- ☐ Annet

Dersom du har krysset av for annet, vennligst spesifiser her:

20. Har dere rutiner for hvordan foresatte får kjennskap til barnehagens skrevne retningslinjer? *Flere kryss er tillatt*

- ☐ Ja, vi gjennomgår retningslinjene i foreldresamtale(r)
- ☐ Ja, vi gjennomgår retningslinjene på foreldremøte(r)
- ☐ Ja, de får skriftlig informasjon om retningslinjene når barnet starter i barnehagen
- ☐ Nei
- ☐ Annet

Dersom du har krysset av for annet, vennligst spesifiser her:

21. I hvilken grad vektlegges følgende i opplæring av nye ansatte? *Sett ett kryss for hver linje*

	I svært liten grad	I liten grad	I verken liten eller stor grad	I stor grad	I svært stor grad
Å introdusere ny mat og forberede barna på hvordan maten smaker	☐	☐	☐	☐	☐
Å spise den samme maten som barna ved bordet	☐	☐	☐	☐	☐
Å la barna utforske ny mat med alle sanser	☐	☐	☐	☐	☐
Å sitte ved bordet når barna spiser	☐	☐	☐	☐	☐
Å lære barna hvordan de kan uttrykke at de liker eller misliker mat	☐	☐	☐	☐	☐
Å ha ro og god stemning rundt matbordet	☐	☐	☐	☐	☐
Å ikke tvinge/true barn til å spise	☐	☐	☐	☐	☐
Å ikke belønne barn for å spise	☐	☐	☐	☐	☐

22. Kjenner du til "Retningslinjer for mat og måltider i barnehagen", utgitt av Helsedirektoratet? *Sett ett kryss*

- ☐ Ja
- ☐ Nei

23. I hvilken grad er "Retningslinjer for mat og måltider i barnehagen", utgitt av Helsedirektoratet, lagt til grunn for barnehagens egne retningslinjer? *Sett ett kryss*

- ☐ I svært liten grad
- ☐ I liten grad
- ☐ I verken liten eller stor grad
- ☐ I stor grad
- ☐ I svært stor grad
- ☐ Barnehagen har ikke egne retningslinjer

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Den neste delen av spørreskjemaet omhandler dine meninger rundt arbeidet med mat og måltider i barnehagen.

24. I hvilken grad..... *Sett ett kryss for hver linje*

	I svært liten grad	I liten grad	I verken liten eller stor grad	I stor grad	I svært stor grad
...mener du at barnehagen har et ansvar for å bidra til at barna i barnehagen innarbeider gode mat- og drikkevaner?	☐	☐	☐	☐	☐
...mener du det er behov for å forbedre praksis rundt måltider, mat og drikke i din barnehage?	☐	☐	☐	☐	☐
...føler du deg **trygg** i å veilede de ansatte i hva som er et sunt kosthold for barna i barnehagen?	☐	☐	☐	☐	☐
...mener du det er **viktig** for deg som styrer å kunne veilede de ansatte i hva som er et sunt kosthold for barna i barnehagen?	☐	☐	☐	☐	☐

25. Hva mener du er de tre viktigste faktorene for å sikre barn i barnehagen et sunt mat- og måltidstilbud? *Sett maks 3 kryss*

- ☐ Å følge offentlige retningslinjer for mat i barnehagen
- ☐ Kommunens prioriteringer av mat, ernæring og helse i barnehagene
- ☐ At mat- og måltidsarbeid inngår i barnehagens årsplan
- ☐ Styrers holdninger til mat, ernæring og helse
- ☐ Ansattes holdninger til mat, ernæring og helse
- ☐ Motiverte ansatte
- ☐ Dialog med foreldre om medbrakt mat
- ☐ Ansattes kunnskap/kompetanse om mat, ernæring og helse
- ☐ Ansattes ferdigheter til å tilberede mat
- ☐ Mer penger til mat
- ☐ Mer tid til å tilberede maten
- ☐ Annet

Dersom du har krysset av for annet, vennligst spesifiser her:

Den neste delen av spørreskjemaet omhandler den økonomiske organiseringen av mat- og drikketilbudet i barnehagen.

26. Hvordan dekkes utgiftene til mat og drikke i barnehagen? *Flere kryss er tillatt*

- ☐ Inngår i foreldrebetalingen
- ☐ Foreldre betaler et tillegg til foreldrebetalingen
- ☐ Tilskudd fra kommunen
- ☐ Annet

Dersom du har krysset av for annet, vennligst spesifiser her:

27. Hvor mye betaler foreldrene månedlig for mat og drikke per barn med hel plass i barnehagen? *Oppgi beløp i rutene*

☐☐☐ kr

28. Betaler de ansatte for maten de spiser i barnehagen? *Sett ett kryss*

- ☐ Ja
- ☐ Nei

Hvis ja, oppgi månedlig beløp: ☐☐☐ kr

29. I hvilken grad er du enig eller uenig i påstandene nedenfor?
Sett ett kryss for hver linje

	Helt uenig	**Litt uenig**	**Verken enig eller uenig**	**Litt enig**	**Helt enig**
Jeg kan bruke pengene til mat og drikke i barnehagen slik jeg selv ønsker	☐	☐	☐	☐	☐
Det er regler for hvordan pengene til mat og drikke i barnehagen skal fordeles	☐	☐	☐	☐	☐
Pengene til mat og drikke i barnehagen er nok til å dekke det mat- og drikketilbudet som vi ønsker å ha	☐	☐	☐	☐	☐
Hvis det er penger igjen i andre poster av barnehagens budsjett, så kan jeg bruke det på mat og drikke i barnehagen	☐	☐	☐	☐	☐

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30. Noen faktorer kan hindre dere i å handle inn eller servere grønnsaker i barnehagen. Hvor enig eller uenig er du i at følgende forhold påvirker hvorvidt det kjøpes inn / brukes grønnsaker i barnehagen? *Sett ett kryss for hver linje*

	Helt uenig	Litt uenig	Verken enig eller uenig	Litt enig	Helt enig
Grønnsaker er for dyre	☐	☐	☐	☐	☐
Grønnsaker ser ikke ferske/fine ut i butikken	☐	☐	☐	☐	☐
Grønnsaker blir fort dårlige ved lagring	☐	☐	☐	☐	☐
Det er for tidkrevende å bruke grønnsaker i den daglige matlagingen	☐	☐	☐	☐	☐
Det er vanskelig å bruke grønnsaker i barnehagens matlaging	☐	☐	☐	☐	☐

Den neste delen av spørreskjemaet omhandler arbeidsklima og kultur i barnehagen din.

31. Sosialt samspill. *Sett ett kryss for hver linje*

	Meget sjelden eller aldri	Nokså sjelden	Av og til	Nokså ofte	Meget ofte eller alltid
Om du trenger det, kan du få støtte og hjelp i ditt arbeid fra dine arbeidskolleger?	☐	☐	☐	☐	☐
Om du trenger det, kan du få støtte og hjelp i ditt arbeid fra din nærmeste sjef?	☐	☐	☐	☐	☐
Om du trenger det, er dine arbeidskolleger villige til å lytte til deg når du har problemer i arbeidet?	☐	☐	☐	☐	☐
Om du trenger det, er din nærmeste sjef villig til å lytte til deg når du har problemer i arbeidet?	☐	☐	☐	☐	☐
Om du trenger det, kan du snakke med dine venner om problemer du har i arbeidet?	☐	☐	☐	☐	☐
Om du trenger det, kan du snakke med din partner eller annen nær person om problemer du har i arbeidet?	☐	☐	☐	☐	☐
Blir dine arbeidsresultater verdsatt av din nærmeste sjef?	☐	☐	☐	☐	☐
Har du lagt merke til forstyrrende konflikter mellom arbeidskolleger?	☐	☐	☐	☐	☐

32. Rolleforventninger. *Sett ett kryss for hver linje*

	Meget sjelden eller aldri	Nokså sjelden	Av og til	Nokså ofte	Meget ofte eller alltid
Er det fastsatt klare mål for din jobb?	☐	☐	☐	☐	☐
Vet du hva som er ditt ansvarsområde?	☐	☐	☐	☐	☐
Vet du nøyaktig hva som forventes av deg i jobben?	☐	☐	☐	☐	☐

33. Organisasjonsklima. *Sett ett kryss for hver linje*

	Meget sjelden eller aldri	Nokså sjelden	Av og til	Nokså ofte	Meget ofte eller alltid
Tar de ansatte selv initiativ i din barnehage?	☐	☐	☐	☐	☐
Blir de ansatte oppmuntret til å tenke ut måter for å gjøre tingene bedre på i din barnehage?	☐	☐	☐	☐	☐
Er det god nok kommunikasjon i din barnehage?	☐	☐	☐	☐	☐

34. Organisasjonsklimaet er: *Sett ett kryss for hver linje*

	Svært lite eller ikke i det hele tatt	Nokså lite	Noe	Nokså meget	Svært meget
Konkurranseorientert	☐	☐	☐	☐	☐
Oppmuntrende og støttende	☐	☐	☐	☐	☐
Mistroisk og mistenksomt	☐	☐	☐	☐	☐
Avslappet og behagelig	☐	☐	☐	☐	☐
Stivbeint og regelstyrt	☐	☐	☐	☐	☐

35. Engasjement i organisasjonen. *Sett ett kryss for hver linje*

	Helt uenig	Litt uenig	Verken enig eller uenig	Litt enig	Helt enig
Jeg sier til mine venner at dette er en god barnehage å arbeide i	☐	☐	☐	☐	☐
Mine verdier er veldig like barnehagens verdier	☐	☐	☐	☐	☐
Denne barnehagen inspirerer meg virkelig til å yte mitt beste	☐	☐	☐	☐	☐

Har du noen kommentarer til undersøkelsen, vennligst fyll inn her:

Takk for at du tok deg tid til å svare på spørreskjemaet!

Appendix VI

Den neste delen av spørreskjemaet omhandler arbeidsklima og kultur i barnehagen din.

14. Sosialt samspill. *Sett ett kryss for hver linje*

	Meget sjelden eller aldri	Nokså sjelden	Av og til	Nokså ofte	Meget ofte eller alltid
Om du trenger det, kan du få støtte og hjelp i ditt arbeid fra dine arbeidskolleger?	☐	☐	☐	☐	☐
Om du trenger det, kan du få støtte og hjelp i ditt arbeid fra din nærmeste sjef?	☐	☐	☐	☐	☐
Om du trenger det, er dine arbeidskolleger villige til å lytte til deg når du har problemer i arbeidet?	☐	☐	☐	☐	☐
Om du trenger det, er din nærmeste sjef villig til å lytte til deg når du har problemer i arbeidet?	☐	☐	☐	☐	☐
Om du trenger det, kan du snakke med dine venner om problemer du har i arbeidet?	☐	☐	☐	☐	☐
Om du trenger det, kan du snakke med din partner eller annen nær person om problemer du har i arbeidet?	☐	☐	☐	☐	☐
Blir dine arbeidsresultater verdsatt av din nærmeste sjef?	☐	☐	☐	☐	☐
Har du lagt merke til forstyrrende konflikter mellom arbeidskolleger?	☐	☐	☐	☐	☐

15. Rolleforventninger. *Sett ett kryss for hver linje*

	Meget sjelden eller aldri	Nokså sjelden	Av og til	Nokså ofte	Meget ofte eller alltid
Er det fastsatt klare mål for din jobb?	☐	☐	☐	☐	☐
Vet du hva som er ditt ansvarsområde?	☐	☐	☐	☐	☐
Vet du nøyaktig hva som forventes av deg i jobben?	☐	☐	☐	☐	☐

16. Organisasjonsklima. *Sett ett kryss for hver linje*

	Meget sjelden eller aldri	Nokså sjelden	Av og til	Nokså ofte	Meget ofte eller alltid
Tar de ansatte selv initiativ i din barnehage?	☐	☐	☐	☐	☐
Blir de ansatte oppmuntret til å tenke ut måter for å gjøre tingene bedre på i din barnehage?	☐	☐	☐	☐	☐
Er det god nok kommunikasjon i din barnehage?	☐	☐	☐	☐	☐

17. Organisasjonsklimaet er: *Sett ett kryss for hver linje*

	Svært lite eller ikke i det hele tatt	Nokså lite	Noe	Nokså meget	Svært meget
Konkurranseorientert	☐	☐	☐	☐	☐
Oppmuntrende og støttende	☐	☐	☐	☐	☐
Mistroisk og mistenksomt	☐	☐	☐	☐	☐
Avslappet og behagelig	☐	☐	☐	☐	☐
Stivbeint og regelstyrt	☐	☐	☐	☐	☐

18. Engasjement i organisasjonen. *Sett ett kryss for hver linje*

	Helt uenig	Litt uenig	Verken enig eller uenig	Litt enig	Helt enig
Jeg sier til mine venner at dette er en god barnehage å arbeide i	☐	☐	☐	☐	☐
Mine verdier er veldig like barnehagens verdier	☐	☐	☐	☐	☐
Denne barnehagen inspirerer meg virkelig til å yte mitt beste	☐	☐	☐	☐	☐

Appendix VII

BRA-studien

Informasjon til ansatte i tiltaksbarnehager

Om prosjektet

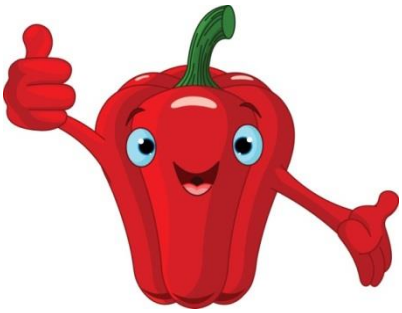
Forskning har vist at inntaket av grønnsaker blant barn i barnehagealder er lavt, samtidig vet vi at et høyt inntak av grønnsaker er forbundet med bedre helse. Grunnlaget for god helse legges tidlig i livet. I dag tilbringer 90 % av norske 1-5 åringer store deler av dagen i barnehagen. Det betyr at mange av ukens måltider spises der, noe som gjør barnehagen til en viktig arena for etableringen av gode matvaner.

Barnehagens arbeid med kosthold er forankret i barnehageloven og i rammeplanen. Ved å delta i studien kan din barnehage bidra til økt kunnskap om hvordan barnehager kan styrke sin rolle som en helsefremmende og forebyggende arena. Dessuten kan studien bidra til å redusere sosiale forskjeller i kostholdet fordi barn fra alle sosiale lag går i barnehage.

Målet med studien

Målet med studien er å finne frem til effektive og kunnskapsbaserte tiltak som øker inntaket av grønnsaker blant barnehagebarn i 3-5 års alder. Målet er at hvert barn skal spise 180 gram grønnsaker daglig (cirka 75 % av anbefalingene for voksne), og at de skal spise mange forskjellige grønnsaker i løpet av en uke. Det kan for eksempel fordeles på fire av dagens måltider med 45 gram til hvert måltid – se plakater for forslag til hva dette kan være.

Tips for å øke tilbudet av grønnsaker i barnehagen



Illustrasjonsfoto: colourbox.com

- **Planlegg innkjøp av grønnsaker hver uke**
  - Inkluder gjerne barna i planleggingen

- **Varier type grønnsaker og tilberedningsmetode**
  - For eksempel rå, kokt, stekt, bakt og most
  - Grønnsaker kan også «gjemmes» i pastasaus, supper, mos og smoothie

- **Server «ventegrønnsaker»**
  - Server gjerne grønnsaker før eller mellom måltider
  - Ofte spiser barn mer grønnsaker når de er sultne
  - Det kan være lurt å servere frukt og grønnsaker til ulike måltider, barn foretrekker ofte frukt

- **Om dere synes det tar mye <u>tid</u> å kutte opp grønnsaker**
  - Kutt opp grønnsakene samtidig som barna sitter ned til et måltid

- **Om dere synes grønnsaker er <u>dyrt</u>**
  - En tubeost og en pakke med salami koster omtrent like mye som 2 kilo gulrøtter, 3 agurker og 2 paprikaer

Tips for å øke tilgjengeligheten av grønnsaker ved bordet

- **Server to eller flere typer grønnsaker barna kan velge mellom**

- **Server grønnsaker hver for seg**

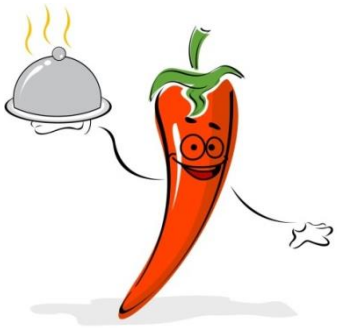
- **Sørg for at barna kan se grønnsakene**
  - Ved å bruke lave eller gjennomsiktige skåler/fat

- **Sørg for at barna kan nå grønnsakene**
  - Ved å ha flere skåler/fat eller sende rundt

- **Tilby grønnsakene flere ganger i løpet av måltidet**

Tips for å oppmuntre barna til å smake/spise grønnsaker

- **Fortell hvilke grønnsaker som skal serveres**
  - Da forbereder du barna på både smak, lyd og konsistens



Illustrasjonsfoto: colourbox.com

- **Vis hvordan grønnsakene kan spises**
  - For eksempel hvordan dyppe grønnsaker i dipp, hvordan blande egen salat

- **Vær smaksdetektiver sammen med barna**
  - Smak på for eksempel kokt vs. rått, en type vs. en annen type og med og uten dipp/krydder.

- **La barna få være kreative med grønnsaker**
  - Lag figurer/ansikter på egen tallerken eller brødskiver, se etter eller lag bokstaver/tall/former og lignende

- **Oppmuntre barna til å smake på grønnsaker flere ganger**
  - Barn må ofte smake flere ganger for å bli vant til/like smaken
  - La barnet få lov til å spytte ut/slippe å spise opp – og husk å rose for å smake!

- **Involver barna i matlagingen**
  - Da blir de mer nysgjerrige på maten

Tips for å være en god rollemodell

- **Smak og spis grønnsaker sammen med barna**
  - Barn imiterer både voksne og andre barn – vær bevisst på egen rolle

- **Vær en entusiastisk voksen**
  - Snakk om grønnsakenes farge, form, lyd og smak
  - Din positivitet smitter over på barna og skaper nysgjerrighet
  - Del dine erfaringer med andre ansatte og foreldre

- **Dersom barn ikke liker grønnsakene som serveres**
  - Lær dem å beskrive hva det er ved grønnsaken de ikke liker (konsistens, smak, lukt etc.)
  - Unngå å bruke ord og setninger som «æsj» eller «den smakte vondt».

Hva ønsker vi av deg?

Illustrasjonsfoto: colourbox.com

At du bidrar til at barna har grønnsaker til alle måltidene, og at barna blir oppmuntret til å smake/spise på en måte som gjør at de etter hvert spiser mer og flere ulike typer grønnsaker. Vi bidrar med nettside og Facebook-gruppe for videre diskusjon med ansatte og foreldre.

Nettside www.uio.no/BRA

BRA-studiens nettside bidrar med gode råd om hvordan dere kan inspirere barn til å spise mer og prøve nye grønnsaker. På nettsiden finner du blant annet forslag til oppskrifter, hvordan barna kan involveres i både matlaging og dyrking av grønnsaker og tips til hvordan du kan øke inntaket av grønnsaker i barnehagen.

Du får tilgang til nettsiden ved å sende en e-post til bra-studien@medisin.uio.no, hvor du oppgir hvilken barnehage du er ansatt i. Da vil du få svar med invitasjon og veiledning for å opprette en bruker. Årsaken til individuell innlogging er at kun ansatte og foreldre i tiltaksbarnehagene skal ha tilgang til nettsidene, mens kontrollbarnehagene ikke skal ha det.

Facebook

Vi har opprettet en egen facebookgruppe for alle barnehageansatte og foreldre som er med i tiltaksgruppen i BRA-studien. Gruppen heter BRA-studien, og kan søkes opp på Facebook. Formålet med gruppen er å dele informasjon og gode råd om hvordan man kan øke barnas grønnsaksinntak. Der kan dere dele erfaringer og diskutere utfordringer.

Slik gjør du: Klikk «bli medlem» for å bli lagt til i gruppen. Du vil motta en melding fra oss før du blir godkjent som medlem, det er for at vi skal sikre oss at du er ansatt i en av tiltaksbarnehagene. Så det er lurt å sjekke både innboks og annet-boksen på facebooksiden din, for å se om du har fått et svar fra oss.

Vi mottar gjerne både ris og ros, samt ønsker fra dere på bra-studien@medisin.uio.no eller til prosjektleder Nanna Lien på telefon 22 85 13 78.

UiO : Universitetet i Oslo

5 om dagen
Smarte vaner

HBV
Høgskolen i Buskerud og Vestfold
Profesjonshøgskolen

Geitmyra
Matkultursenter for barn

Appendix VIII

The BRA-study intervention description according to the TIDieR checklist

Item	Description
Name (1)	The BRA-study «Barnehage»=kindergarten, «gRønnsker» = vegetables, «fAmilie»=family Kindergarten-based, family involved multi-component intervention to promote vegetable consumption among 3-5 year olds.
Why (2)	Vegetables are recommended as part of a health promoting diet. Yet, vegetable consumption in Norway is lower than the recommended amount, for adults as well as children, and vegetables are primarily included in the dinner meal. More than 90 % of Norwegian 1-5 year olds attend kindergartens, and normative dietary guidelines recommend that kindergartens facilitates two nutritional full meals per day (lunch and afternoon meal), in addition they arrange for children to eat their breakfast when they arrive in the morning. The food for the meals can be provided by the kindergarten, brought from home or a combination. Based on the literature, children's taste for specific foods can be modified by repeated exposure, encouragement and positive role modelling by adults and peers. The intervention thus aimed at increasing the frequency, variation and amount of vegetables eaten by 3-5 year olds by changing the practices related to the four determinants; vegetable availability, accessibility, encouragement and role modelling by kindergarten staff and parents through a multi-component intervention.
What – Materials(3)	*1. Training of kindergarten staff* A one-day inspirational course was conducted. This course consisted of a brief introduction of the rational for the study, a practical training in the kitchen making vegetable soup and vegetables with dip in small groups under the instruction of a cook based on the practice of Geitmyra culinary centre for children. Participants eat the food for lunch together before a theoretical session going through research and practical ideas related to the four determinants. The day ended with starting to make action plans where the content of the day was applied to the needs and possibilities of each kindergarten. Finally the supporting material was handed out (2 & 3). *2. Welcome package for kindergarten staff at training* A booklet with vegetable recipes describing practical ideas for how to cook food and involve children in the cooking based on the practice of Geitmyra culinary centre for children. • There were one large (70x100 cm) poster with photos of vegetables from the Norwegian information bureau for fruit and vegetables and 6 small posters (A4) made for the project; two on amounts of vegetables and four with ideas of "what to do" for each of the four determinants. • Aprons (4 per unit) and a fruit and vegetable memory game from the Norwegian information bureau for fruit and vegetables. • Brochures (folded A3) about the project, the ideas for how to change the four determinants, login instruction for the website and the Facebook group for all staff at the participating unit. • Information about the Norwegian national guidelines for food and meals in the kindergartens and the Norwegian dietary guidelines to all staff. • One hand blender (MQ 5007 Puree+ from Braun) per kindergarten. *3. Welcome package for the parents*

	A cover letter explaining the rational and purpose of the intervention. A brochure with vegetable recipes and ideas for how to change the four determinants made for the project in collaboration with the Norwegian information bureau for fruit and vegetables. A stack of post-it's with the slogan on to be used to prompt buying and eating vegetables. A booklet to read for the child about "Mons and Mona shopping" made by the Norwegian information bureau for fruit and vegetables. *4. Website with materials for kindergarten staff and parents* Two login-protected websites (https://www.med.uio.no/imb/forskning/prosjekter/bra-studien/ressurser/) were made - one for staff and one for parents. The websites contained mostly the same information, but were adapted when relevant to better fit the targeted setting. The web-site contained facts about vegetables, recipes of various level of difficulty, small articles (some with links to films) related to the four determinants, as well as a word-version and a pdf-version of all material given out during the intervention. *5. Facebook group* A closed Facebook group for both staff and parents were made for them to share ideas and discuss challenges. *6. Booster activity 1 for kindergarten staff (November 2015)* A booklet with recipes on cabbage, a vegetable card/poster to register when and which vegetables were served for three days with potential for winning a gift card by sending it to the project group, a sheet with suggestion of how to play tasting games with the kids. *7. Booster activity 1 for parents (November 2015)* An e-mail for the parents to be forwarded by staff with a letter with ideas and suggestion of how to play tasting games with the kids and a vegetable card for the individual child at home and promoting the potential for winning a gift card by sending it in same as for the kindergarten. *8. Booster activity 2 for kindergarten staff (February 2016)* A booklet with spring recipes and suggestions of activities to grow vegetables at three levels of difficulty. *9. Booster activity 2 for parents (February 2016)* A cover letter. A folded A3 sheet with all the ideas for how to change the four determinants. Five activity sheets to be completed with the child related to the same four factors. Two booklets of "Mons and Mona" (tasting and cooking vegetable soup) made by the Norwegian information bureau for fruit and vegetables and a stack of post-it's with the slogan.
What - Procedures (4)	The kindergarten staff was trained and provided with the material and the welcome package for the parents at a one-day inspirational course. They were instructed to train/inform the relevant staff of their kindergartens, submit an action plan within 4 weeks after they attended the course and deliver the Welcome package to the parents as bested fitted their activities, but within a reasonable amount of time. Booster activities were sent to the kindergartens at two and five months after the training course. The family components were distributed through the kindergartens.
Who provided (5)	At least one person from each kindergarten was trained by the research team (theory) and a cock (kitchen practice) in a one-day inspirational course. The four kindergartens

	who did not attend the course were visited by the research team and given a 1.5-2 hour theoretical introduction to the intervention and provided with the Welcome package for kindergarten and the Welcome package for parents. The kindergarten person trained could belong to any of these categories: Kindergarten assistant; no formal education required, Pedagogical leader; three years of formal education as a kindergarten teacher (bachelor degree), Kindergarten leader; three years of formal education as a kindergarten teacher (bachelor degree) or other similar education, Cook/the one responsible for the food served in the kindergarten; no formal education.
How (6)	The staff training was conducted face-to-face and the kindergarten staff was provided with the power-point presentation including the manuscript through the project's website. The intervention was delivered by the kindergarten staff to the children as part of the daily meals and any additional pedagogical activities conducted in the participating department in the intervention kindergartens. Each department had between 12-25 children aged 3-5 years, and usually employed 3-4 staff. The intervention to the families was delivered by print or e-mail to the parents by the kindergarten staff. The kindergarten staff could also address the intervention topic face-to face during daily delivery and pick-up routines or at parent meetings/events.
Where (7)	The staff training was conducted at three different locations to allow easy access for the participants. One was a fully equipped teaching kitchen at a university college, while the two others were kitchens used for home economics at two primary schools. The intervention itself was delivered in the 37 intervention kindergartens within the physical, economic and staffing resources available to each of them and the usual communication routines with parents.
When and how much (8)	The intervention was aimed at changing availability and vegetable-related practices in the kindergartens and homes and was implemented from September to February the following year. The kindergartens and parents choose themselves how to work with the intervention material.
Tailoring (9)	The kindergarten staff was instructed at the training to apply what they had learned to their local situation when making their action plan. The parents were encouraged to use the strategies that best fitted their child and their families in eating situations, and make small, gradual changes rather than large ones.
Modifications (10)	The intervention was not modified during the course of the study.
How well – Planned (11)	Process evaluation on perceptions and use of the intervention components were collected from the staff participating on the inspirational day training and midway through the first year of the intervention (January 2016) through online questionnaires to staff and parents. Selected kindergartens who reported many (mean n=31) or few (mean n=20) practices were interviewed to understand the differences.
How well - Actual (12)	The process evaluation showed that the staff was initially positive to the training and the intervention components, but the usefulness of the components were scored lower half way through the first intervention year than immediately after the training. Components involving the children were more highly rated and kindergartens with previous experience in diet related projects made more changes to their practices. The response rate of the parents was low and a higher proportion reported that they did not see a need to change their practices.