**ORGINAL ARTICLE**

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

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**Abstract**

*Aim:* The aim of the present study was to explore the associations between the economic, political, sociocultural and physical environments in the kindergartens, along with frequency and variety of vegetables served and amount of vegetables eaten. *Method:* The BRA Study collected data through two paper-based questionnaires answered by the kindergarten leader and pedagogical leader and a 5-day vegetable diary from kindergartens (N 73) in Vestfold and Buskerud Counties, Norway. The questionnaires assessed environmental factors and frequency and variety of vegetables served. The non-parametric tests Mann-Whitney U and Kruskal-Wallis were used to explore 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. ***Conclusion:*** **This study indicates that the economic environment in the kindergarten seems to be positively associated with vegetables served and eaten in the kindergarten. 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 OECD (2012), 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 grams of vegetables per day [6]. Among Norwegian 2 and 4 year olds the intake is roughly 50-70 grams daily [7, 8].

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 am until 5:00 pm 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 ANGELO framework, factors within the kindergarten environment can be characterized as economic factors (i.e., resources related to buying vegetables), political factors (guidelines and rules related to vegetables), sociocultural factors (i.e. values and behavior related to vegetables), and physical factors (i.e. what can hinder or enable 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 political factors, policy recommendations and written guidelines are not necessarily enough 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. (2017) 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 [20]. 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].

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

Data was collected by 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) amount of vegetables eaten was assessed by a 5-day vegetable diary completed by employees in 122 of the 135 departments (90%) (Figure I). 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 2 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 5-day vegetable diary*

Questionnaire A was piloted among eleven 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". 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?". Twelve vegetable alternatives were given with the same response categories as mentioned above.

For the 5-day vegetable diary, all kindergartens were given a digital kitchen scale (EKS – Electronic Kitchen Scale, capacity: 5kg, graduation: 1g). One employee from each department received face-to-face instruction on how to measure and report the amount of vegetables eaten in the 5-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

123 to assess a typical week. Data from the lunch and the afternoon meals are presented as
124 amount of vegetables consumed per person per day. A protocol was developed on how to
125 interpret missing data. The two main types of missing data were the number of children and
126 employee eating, and whether the vegetables were “ready-to-eat” or not. If the diaries had
127 data from 50% of the meals regarding number of children and employee eating, then a mean
128 number was calculated to replace missing data. Diaries with data of less than 50% were
129 registered as missing. Diaries with missing data for “Are the vegetables ready-to-eat?” were
130 assumed to be “ready-to-eat”.
131 *(2) Factors in the kindergarten environment – Questionnaire B*
132 Questionnaire B was piloted with two kindergarten leaders. Only minor revisions were made
133 after the pilot test. Most of the questions were from the last national dietary survey in
134 Norwegian kindergartens [14]. In this paper, questions describing four aspects of the
135 kindergarten environment were used: the economic, political, sociocultural and physical
136 environments. In all questions where a 5-point Likert scale was used, the scale is collapsed into
137 three categories: “Agree, Neither, Disagree” or “Small, Neither, Large”, and two of
138 “Small/Neither, Large”. The economic environment was assessed through five questions as
139 shown in Table II, the political environment through four questions as shown in Table III, while
140 the sociocultural environment was evaluated through two questions shown in Table IV. In this
141 Table the factor that covers “to what degree different mealtime pedagogics are emphasized in
142 the training of new employees” is based on eight items summed from one to eight and
143 thereafter grouped into “low” (0-3) “average” (4-5) and “high” (6-8). The physical

144 environment was assessed through three questions as shown in Table V. The item pool used to
145 assess barriers was composed of modified versions of statements used in an American study
146 among parents of preschool children [22]. For the question regarding "How many have the
147 primary responsibility to…." in Table V, the number of persons for each task was collapsed into
148 "1 person" or "more than 1 person". In this study the physical environment has not measured
149 availability of vegetables but rather the barriers for serving vegetables and how many
150 employees are responsible for planning and organizing the food.

151

152 *Statistical analysis*

153 Statistical analyses were performed using the statistical software package IBM®
154 SPSS® Statistics Version 24.0. Data on frequency and variety (Questionnaire A) in addition to
155 data on amount of vegetables served (5-day vegetable diary) were aggregated to the
156 kindergarten level as the data on the kindergarten environment were collected at an
157 institutional level and not at the department level (Questionnaire B). Shapiro-Wilk was used to
158 test for normality. Due to data not being normally distributed, the non-parametric tests
159 Mann-Whitney U and Kruskal-Wallis were used to test for differences between groups.

160

161 **Results**

162 According to Statistics Norway, there were a total of 568[15] kindergartens in Vestfold and
163 Buskerud Counties in 2014 (Table Ia), 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 fulltime 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 fulltime equivalents and 5.9 with formal education. Furthermore, 47% of kindergartens in these counties were registered as 5-a-day fruit and vegetable kindergartens compared with 41 % of the BRA kindergartens. Only fulltime 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 5-day vegetable diary. The number of kindergartens with data from all three sources (Questionnaire A, Questionnaire B and 5-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 grams (Table Ib). A higher frequency of vegetables served was found in kindergartens where children consumed 30.1g vegetables or more per day, compared to those kindergartens where children consumed 30g or less per day (Table Ib).

*Associations between the kindergarten environment and vegetables served and eaten*

In the economic environment three out of nine factors were associated with variety of vegetables served, one out of nine factors was associated with frequency of vegetables served, and three out of nine factors were associated with amount of vegetables eaten (Table II). Kindergartens with food and beverages covered through 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 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 II).

For the political environment one out of six factors was associated with frequency of vegetables served, and one out of six factors was associated with amount of vegetables eaten (Table III). 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 ten factors was associated with 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 IV). No significant associations were found with the sociocultural environment (Table V).

## Discussion

This study indicates that more factors in the economic environment were important for the served and eaten vegetables 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. Kindergartens with more than NOK 251 in additional payment 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 also in these kindergartens a larger amount of vegetables was eaten. The higher amount of vegetables eaten may be explained by adults eating with the children and 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 eats 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 socio-economic groups opting for kindergartens with a lower additional payment for food. Taking into consideration experience from other 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 be affected by other factors than economy as well[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 situation[14]. However, a review conducted in 2011 found that four out of eleven studies explored guidelines and recommendations related to the environment affecting nutrition and food served in child care settings[18]. Moreover, two of these found insufficient intake of vegetables and only one of the four found adequate serving of fruit and vegetables, despite having food specific recommendations, policies or written guidelines to follow [18]. We also found associations indicating 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).

*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 using vegetables in the 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 healthy compared to 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 sociocultural environment*

Contrary to previous research[19, 20, 27], we did not find 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 methodology 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 direct observations [19]. In addition, previous environmental studies have measured other factors in this environment in contrast to this study, such as staff behavior, supervision practice and food serving style[19], nutrition education and support for healthy eating[29], and parenting styles and practices[27].

*Strengths and weaknesses of the study*

This study is 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 5-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 5-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 of the vegetables served, they potentially eat larger portions compared to the children, which in total contributes to a higher amount of vegetables eaten. 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 the kindergartens seems to be positively associated with vegetables served and eaten in the kindergarten. Also, the political environment seems to be important for the servings and intake of vegetables in the kindergarten. This is of high relevance for public health policy as vegetable consumption is an important factor in reducing the risk of non-communicable diseases. 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 variety, frequency and intake of vegetables.

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**Conflict of interest**

The Authors declare that there is no conflict of interest.

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