

Exploring Intervention Components in Association with Changes in Preschool Children's Vegetable Intake: The BRA-study

Anne Lene Kristiansen (✉ anne.l.kristiansen@usn.no)

University of South-Eastern Norway <https://orcid.org/0000-0002-7175-135X>

Mona Bjelland

University of Oslo

Anne Himberg-Sundet

University of Oslo

Nanna Lien

University of Oslo

René Holst

University of Oslo

Lene Frost Andersen

University of Oslo

Research note

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Abstract

Objective: The present study aimed to explore kindergarten staffs' perceived usefulness of intervention components in association with changes in children's vegetable intake and vegetables served in the kindergarten. Assessment of the perceived usefulness of intervention components consisted of a paper-based questionnaire for the kindergarten staff assessing usefulness of "posters", "supplementary material" and "one-day inspirational course". Children's vegetable intake in the kindergarten was assessed by direct observation, while vegetables served was assessed by a 5-day weighted vegetable diary.

Results: Seventy three kindergartens in two counties in Norway participated (response rate 15 %) and parental consent was obtained for 633 children 3-5 years of age at baseline (response rate 39 %). Mixed effect models indicated a tendency that "posters" were associated with increased child vegetable intake ($P = 0.062$). Surprisingly, a low degree of perceived usefulness of "supplementary material" was associated with the largest increase in child vegetable intake ($P = 0.020$). No significant associations between perceived usefulness of intervention components and vegetables served in the kindergarten were found. This study indicated a tendency that "posters" were associated with increased child vegetable intake, however this may also be due to synergies between multiple intervention components.

Trial registration: International Standard Randomized Controlled Trials ISRCTN51962956 (<http://www.isrctn.com/ISRCTN51962956>). Registered 21 June 2016 (retrospectively registered).

Introduction

Benefits of sufficient intake of fruits and vegetables are well recognized in the prevention of several non-communicable diseases and all-cause mortality^[1-5]. Despite this, consumption in many countries^[5], including Norway^[6-10] is low. Therefore, increasing consumption is a public health priority^[5].

Dietary habits are established in childhood, and may track into adulthood^[11-16]. Moreover, early childhood seems important for dietary habits, because food preferences appear to be modifiable during this period of life^[17]. Early childhood and care institutions for preschool children are generally referred to as kindergartens in Norway. As more than 90% of all Norwegian children aged 1–5 years attend kindergartens^[18], kindergartens are a highly relevant setting for interventions at this age. Norwegian kindergartens frequently consist of multiple units, often referred to as departments. Each department is usually staffed with one pedagogical leader in addition to two or more assistants. One kindergarten department typically includes 18 children, either of the same age or of mixed age.

Several interventions among preschool children have been conducted to better understand how to increase vegetable intake in early childhood^[19-21]. Results indicate that multicomponent interventions are more successful in increasing vegetable consumption compared to single exposure strategies^[19]. However, limited knowledge on how to successfully increase vegetable intake among young children exists. As such, process evaluations are essential in intervention research to assist in understanding why

or why not an intervention was successful [22-24]. The present study aimed to explore the association between kindergarten staffs' perceived usefulness of the intervention components and changes in children's vegetable intake and vegetables served in the kindergarten, from baseline to follow-up 1 in a kindergarten-based trial.

Materials And Methods

Study design and subjects have been presented [25, 26]. Briefly, overall aim of the BRA-study was to improve vegetable intake (primary outcome) among preschool children through changing the food environment and food-related practices in kindergarten and home (secondary outcomes). Child consumption of vegetables and vegetables served in the kindergarten were assessed with regards to frequency, variety and amount of vegetables served and consumed.

Children born in 2010-2011, attending public or private kindergartens in the counties of Vestfold and Buskerud, Norway were included. All regular kindergartens (n = 479) in the counties were invited by letter followed-up by a phone call to inform about the study and to motivate for participation. Seventy three kindergartens participated (response rate 15.2%) and parental consent was obtained for 633 children (response rate 38.8%). This study was conducted according to the guidelines laid down in the Declaration of Helsinki, and the Norwegian Center for Research Data approved all procedures involving human subjects.

The intervention and its components have been reported [27, 28]. Briefly, the intervention components to the kindergartens consisted of a one-day inspirational course (kitchen practice and theory) in addition to resources like aprons, a vegetable memory game, a hand blender, booklets, posters and brochures. The intervention components were related to the four determinants: availability, accessibility, encouragement and role modelling. The study focused on the potential for improving child vegetable consumption and vegetable serving in the kindergartens, by changing these determinants, as implemented in the intervention components.

Data collection

There were 313 (49%) children in the intervention group, representing 37 kindergartens and 70 departments, while corresponding numbers for the control group were 320 children (51%), representing 36 kindergartens and 65 departments.

The research team conducted direct observations to assess children's vegetable intake at two meals (lunch and an afternoon snack meal) in one day in the kindergarten. A 5-day weighted vegetable diary was completed by the kindergarten staff to assess amount of vegetables served in the kindergarten. Data were collected at baseline (spring 2015) and at follow-up 1 (spring 2016) and a description of methods are provided elsewhere [25, 26]. By completing all data collections, kindergartens received a gift card of 2000 NOK.

In January 2016, process evaluation was conducted in the intervention group, both in kindergartens and at home. Due to a lack of significant effects upon children's vegetable consumption in the home setting [28, 29], this paper reports on process evaluation from the kindergartens.

Process evaluation consisted of a paper-based questionnaire including several aspects assessing to what degree the intervention components were perceived useful or not for changing usual vegetable practices in the kindergarten department. The present study includes responses to the question "to what degree have the following components been important in getting started with the changes you have been working on?" (i.e. during the intervention period). Perceived usefulness of the components were assessed by four response alternatives: "not at all", "to a small degree", "to some degree" and "to a large degree". Nine intervention components, described in Table 1, were combined into three groups of components: "posters", "supplementary material" and "one-day inspirational course".

Table 1

Kindergarten staff's perceived usefulness of the given intervention materials in the BRA-study (n = 48)^a

	Not at all	To a small degree	To some degree	To a large degree
"Posters"				
A large poster (70 x 100 cm) with photos of vegetables	1 (2.1%)	7 (14.6%)	17 (35.4%)	23 (47.9%)
2 small posters (A4) on amounts of vegetables	2 (4.2%)	10 (20.8%)	20 (41.7%)	16 (33.3%)
4 small posters (A4) with ideas of "what to do" for each of the four determinants ^b	4 (8.3%)	13 (27.1%)	19 (39.6%)	12 (25.0%)
"Supplementary material"				
Four child-aprons	5 (10.4%)	11 (22.9%)	13 (27.1%)	19 (39.6%)
One fruit and vegetable memory game	2 (4.2%)	12 (25.0%)	18 (37.5%)	16 (33.3%)
One hand blender	5 (10.4%)	11 (22.9%)	16 (33.3%)	16 (33.3%)
"One-day inspirational course"				
Practical training in the kitchen	2 (4.2%)	7 (14.6%)	24 (50.0%)	15 (31.3%)
A theoretical session	4 (8.3%)	8 (16.7%)	25 (52.1%)	11 (22.9%)
Make action plans	4 (8.3%)	8 (16.7%)	27 (56.3%)	9 (18.8%)
^a kindergarten departments				
^b availability, accessibility, role model and encouragement				

Data analysis

Children's observed vegetable intake (grams/day) and served vegetables in the kindergarten (grams/day) were dependent variables in separate mixed effects models. For children's observed vegetable intake, kindergarten, department and participant were used as random effects, while for vegetables served in the kindergarten, kindergarten and department were used as random effects. Time (baseline and follow-up 1) and perceived usefulness ("not at all/to a small degree", "to some degree" and "to a large degree") were used as fixed effects. The reference category for perceived usefulness was "not at all/to a small degree". To avoid small subgroups, response alternatives "not at all" and "to a small degree" were merged into one category in analysis. We defined the effect of a component, as the difference in change of vegetable intake from baseline to follow-up 1 between the response alternative "to some degree"/"to a large degree" and the reference category "not at all/to a small degree". The perceived usefulness factor thus measured the effect of being in one of the two other categories relative to being in "not at all/to a small degree". A potential difference in effects of the perceived usefulness categories between the two time points may be attributed to the intervention. In particular it was of interest to assess if the intervention provided the same change in effect of "to some degree" and "to a large degree" levels. This was accommodated by an interaction effect between time and perceived usefulness. Test for significance was done by likelihood ratio tests. Corresponding models were considered for each of the two outcomes and each of the three groups of intervention components. Models including children's vegetable intake were adjusted for covariates: maternal education, child gender and child year of birth. Participants were included in analyses if they had data on baseline and/or follow-up 1 and if they had data on all covariates. All analyses were conducted using Stata Statistical Software: Release 15. College Station, TX: StataCorp LLC. P values less than 0.05 were considered statistically significant.

Results

Of the 48 departments (69%) that completed the process evaluation, 34 departments (49%) were included in analysis as they had complete data on process evaluation and data on the 5-day weighted vegetable diary at baseline and/or at follow-up 1. Of the 217 children that had been observed at baseline and/or at follow-up 1, 161 children (74%) were included in analysis as they had data on all covariates and the process evaluation data.

Analyses indicated a tendency that in kindergartens where "posters" were considered useful by the staff, an increase in children's vegetable intake ($P = 0.062$) was observed (Table 2). Kindergartens who perceived "posters" useful "to a large degree" showed an additional increase in children's vegetable intake of 38 grams/day (95% CI: 4.6, 70.7) compared to those who perceived "posters" as "not at all/to a small degree" useful.

Interestingly, in kindergartens where staff reported that "supplementary material" were perceived as "not at all/to a small degree" useful, a significantly larger increase in children's vegetable intake was observed compared to those who reported perceived usefulness to be "to some degree". A mean difference in children's vegetable intake of 39 grams/day between groups was estimated (95% CI: -65.5, -12.1) ($P = 0.020$) (Table 2).

Table 2

Estimated mean vegetable intake (gram) by component and time in the BRA-study. The "Effect Size" measures the difference in change from baseline to follow-up, between the given group and the reference group "not at all/to a small degree"

	Baseline Mean (SD)	Follow-up 1 Mean (SD)	Effect Size (CI 95%) ^a	Likelihood ratio test P
Children's vegetable intake (n = 161)^b				
"Posters"^c				
<i>Not at all/to a small degree</i>	43.6 (16.5)	69.5 (16.9)	12.2 (-17.8, 42.2)	0.062
<i>To some degree</i>	47.2 (12.7)	85.3 (12.9)	37.7 (4.6, 70.7)	
<i>To a large degree</i>	35.8 (15.5)	99.4 (15.4)		
"Supplementary material"^c				
<i>Not at all/to a small degree</i>	33.0 (14.8)	97.3 (15.0)	-38.8 (-65.5, -12.1)	0.020
<i>To some degree</i>	48.6 (13.3)	74.1 (13.4)	-21.2 (-51.1, 8.7)	
<i>To a large degree</i>	43.7 (15.1)	86.8 (15.2)		
"One-day inspirational course"				
<i>Not at all/to a small degree</i>	41.4 (16.3)	87.7 (16.2)	6.9 (-26.0, 39.7)	0.746
<i>To some degree</i>	49.8 (12.8)	99.9 (17.3)	-7.0 (-43.8, 29.9)	
<i>To a large degree</i>	33.9 (15.5)	84.1 (19.4)		
Vegetable served in the kindergarten (n = 34)^d				
"Posters"				
<i>Not at all/to a small degree</i>	48.7 (33.9)	62.9 (7.8)	0.9 (-15.8, 17.7)	0.243
<i>To some degree</i>	49.7 (5.2)	63.9 (5.6)	-1.1 (-20.0, 17.9)	
<i>To a large degree</i>	47.6 (6.8)	61.8 (7.1)		
"Supplementary material"				
<i>Not at all/to a small degree</i>	44.1 (6.0)	58.9 (6.0)	10.5 (-4.6, 25.6)	0.856
<i>To some degree</i>	54.6 (5.9)	69.4 (6.4)	3.1 (-12.8, 18.9)	
<i>To a large degree</i>	47.2 (6.4)	61.9 (6.8)		
"One-day inspirational				

course^a	43.0 (6.9)	57.4 (7.2)		
<i>Not at all/to a small degree</i>	48.3 (5.5)	62.7 (5.9)	5.3 (-10.8, 21.4)	
<i>To some degree</i>	54.0 (6.2)	68.4 (6.6)	11.0 (-6.0, 28.1)	0.257
<i>To a large degree</i>				

^aFixed effect parameter estimates.

^bAdjusted for kindergarten clustering, time, maternal education, child gender and child year of birth. Participants were included in the analyses if they had data on baseline and/or follow-up 1 and all covariates.

^cIncluding the interaction term: intervention component and time.

^dAdjusted for kindergarten clustering and time. Participants were included in the analyses if they had data on baseline and/or follow-up 1.

No significant effects were found for the perceived usefulness of the “one-day inspirational course” upon children’s vegetable intake (Table 2). Furthermore, no significant effects on amount of vegetables served in the kindergarten setting were found for “posters”, “supplementary material” or for the “one-day inspirational course” (Table 2).

To assess mean response in “posters”, “supplementary material” and “one-day inspirational course” across time, marginal means were estimated. There seemed to be a trend towards larger increase in children’s vegetable intake with increasing degree of perceived usefulness of “posters” (“to some degree” (P = 0.03) and “to a large degree” (P < 0.001)) (Figure 1A).

For “supplementary material”, children’s vegetable intake increased by 64 grams/day among those who reported perceived usefulness to be “not at all/to a small degree” (P < 0.001) while the increase was 43 grams/day for those who reported perceived usefulness to be “to a large degree” (P = 0.002) (Figure 1B).

For “one-day inspirational course” upon children’s vegetable intake, a significant increase of 46-50 grams/day were seen in all groups (“not at all/to a small degree” (P = 0.001), “to some degree” (P = 0.018) and “to a large degree” (P < 0.001)) (Figure 1C).

A significant increase in vegetables served were seen for those who reported perceived usefulness of “posters” to be “to a large degree” (P = 0.024) (Additional figure A). No significant increases were observed for “supplementary material” and “one-day inspirational course” (Additional figure B and C).

Discussion

The present study aimed to explore how kindergarten staffs’ perceived usefulness of intervention components related to changes in children’s vegetable intake and vegetables served in the kindergarten. Findings suggest that there was a trend towards a larger increase in children’s vegetable intake with

increasing degree of perceived usefulness of “posters”. However, this may also be due to synergies between multiple intervention components.

When kindergartens were visited at follow-up 1, the impression was that many of the intervention kindergartens had displayed the posters. Hence, posters might have had a prompting effect ^[30] and been a reinforcement of the key messages on amount to be served and how to encourage children to taste and eat vegetables. As an illustration, the two posters on amount of vegetables might have been especially important in creating shifts in children’s vegetable intake as they displayed suggestions for children’s vegetable portion sizes. Previous studies among adults have reported confusion over portion sizes for fruits and vegetables ^[31, 32]. This might also be the case in Norway, as the adult recommended intake of fruits and vegetables is 500 grams/day ^[33], while no precise recommendations for amount exists for young children.

It is difficult to explain why those who reported the lowest degree of perceived usefulness of “supplementary material” showed a significantly larger increase in children’s vegetable intake compared to those who perceived such components useful “to some degree”. In many kindergartens aprons and blenders might not be in everyday use as national data indicate that kindergartens in general serve a hot meal for lunch once a week ^[34]. At the same time, national data also indicate that about 20% of the kindergartens reported to serve a hot meal for lunch several times a week ^[34]. One might speculate that such differences in the frequency of a hot meal for lunch exist in the participating kindergartens, resulting in different views on the perceived usefulness of the components included in “supplementary material” in relation to getting started with creating daily vegetable changes.

Limitations

Strengths and limitations

One limitation was that process evaluations were completed in January 2016, while the follow-up assessments of vegetables were assessed between April and June 2016. Hence, a variation in length of implementation period was introduced. For vegetables served in the kindergarten, this study involved about half of the eligible sample and it is not known to what extent this sample was representative of the participating kindergartens. Moreover, different persons may have filled in the 5-day weighted vegetable diary at baseline and at follow-up 1, leading to impaired consistency between measures of vegetables served in the kindergarten ^[26].

Abbreviations

The BRA-study: An acronym for the Norwegian words “Barnehage” (kindergarten), “gRønnsaker” (vegetables) and “fAmilie” (family). The Norwegian word “BRA” means “good”.

Declarations

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Author's contributions

ALK wrote the draft of the manuscript and AHS conducted the statistical analyses. ALK, MB, NL, and LFA participated in designing the BRA-study. ALK, MB, AHS, NL, and LFA participated in project planning and ALK and AHS participated in data collections. RH assisted and provided advice of statistical analysis. All authors have critically revised the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

Data used and analyzed during the current study will be available from the corresponding author upon request, provided compliance with current legislation for application for data access in Norway.

Ethics approval and consent to participate

This study was conducted according to the guidelines laid down in the Declaration of Helsinki, and the Norwegian Center for Research Data approved all procedures involving human subjects. Parental written consent was obtained for 633 children.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests

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Figures

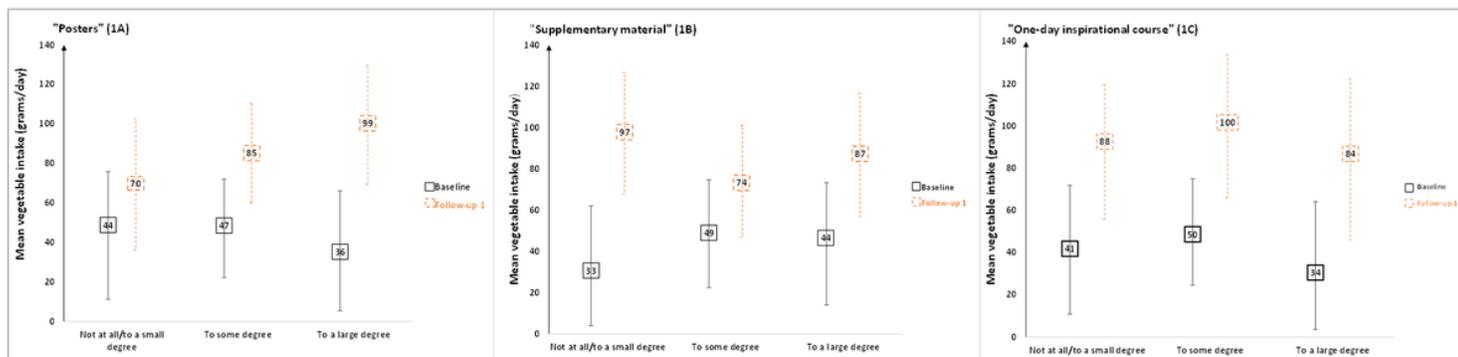


Figure 1

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Supplementary Files

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