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A workplace feasibility study of the effect of a minimal fruit intervention on fruit intake

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Abstract

Objective: The main purpose of the study was to investigate the feasibility of using workplaces to increase the fruit consumption of participants by increasing fruit availability and accessibility by a minimal fruit programme. Furthermore, it was investigated whether a potential increase in fruit intake would affect vegetable, total energy and nutrient intake.

Design: A 5-month, controlled, workplace study where workplaces were divided into an intervention group (IG) and a control group (CG). At least one piece of free fruit was available per person per day in the IG. Total fruit and dietary intake was assessed, using two 24 h dietary recalls at baseline and at endpoint.

Setting: Eight Danish workplaces were enrolled in the study. Five workplaces were in the IG and three were in the CG.

Subjects: One hundred and twenty-four (IG, *n* 68; CG, *n* 56) healthy, mainly normal-weight participants were recruited.

Results: Mean daily fruit intake increased significantly from baseline to endpoint only in the IG by 112 (SE 35) g. In the IG, mean daily intake of added sugar decreased significantly by 10·7 (SE 4·4) g, whereas mean daily intake of dietary fibre increased significantly by 3·0 (SE 1·1) g. Vegetable, total energy and macronutrient intake remained unchanged through the intervention period for both groups.

Conclusions: The present study showed that it is feasible to increase the average fruit intake at workplaces by simply increasing fruit availability and accessibility. Increased fruit intake possibly substituted intake of foods containing added sugar. In this study population the increased fruit intake did not affect total energy intake.

Keywords
Fruit intake
Dietary intervention
Dietary change

According to WHO, poor nutrition accounts for 4·6 % of the total disability-adjusted life-years (DALY) lost in the EU[1], where one DALY represents the loss of one year of healthy life. An additional 3·7 % of DALY are lost due to overweight and obesity. International experts conclude that the global obesity epidemic poses one of the largest threats to public health and that low fruit and vegetable consumption is among the top ten risk factors for mortality worldwide[2]. Moreover, WHO states that there is convincing evidence that consumption of a diet high in fruit and vegetables reduces the risk of obesity[2]. This is supported by a recent review suggesting that high fruit intake may be associated with low body weight[3].

Several national food-based dietary guidelines recommend an increased consumption of fruit and vegetables[4,5]. In addition, a Nordic Plan of Action on better health and quality of life through diet and physical activity, adopted by the Nordic Council of Ministers, emphasizes the importance of reversing the alarming tendency of an increasing number of overweight and obese individuals in the Nordic region by different schemes such as enhancing the consumption of fruit and vegetables and reducing the consumption of added sugar[6].

In Denmark, only 16 % of the adult population consumes the amount of fruit and vegetables that meets the official Danish recommendations of 600 g/d[7,8]. At the same time, it is estimated that 55 % of the adult Danish population is overweight (BMI $\geq$ 25 kg/m^2) and 15 % is obese (BMI $\geq$ 30 kg/m^2)[8]. Thus, effective community-based strategies that aim to promote healthy eating habits and increase the average fruit and vegetable consumption of the general population are much needed. Adopting workplaces for this purpose seems a suitable approach and is in accordance with recommendations from different international and regional bodies such as WHO, the Nordic Plan of Action, and Guidelines for the Prevention

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of Obesity at the Workplace (GPOW) Project[6,9,10]. The rationale behind this is that workplaces constitute appropriate settings for health promotion programmes as a substantial amount of the adult population attends a workplace each day and a relatively large number of individuals can be addressed simultaneously. Furthermore, one must assume that employers are interested in investing in their human resources and offering them healthy alternatives.

Several workplace-based programmes attempting to implement healthy dietary behaviour among employees have been conducted[11–17]. The majority of these studies aimed to change the overall dietary intake patterns of the participants through relatively extensive interventions including education and counselling. In the present workplace study, we attempted, through minimal intervention, to increase fruit consumption of the participants by addressing only two important determinants for increased fruit intake: availability and accessibility of fruit[18]. This decision was based upon the assumption that fruit can be introduced at a workplace relatively easily and without any radical demands such as extensive involvement of the canteen or other staff. Further, fruit can be consumed as a snack without any form of preparation and it does not require much modification of the physical environment of the workplace.

In addition to elevating the employees' fruit intake, implementation of free available fruit at the workplace may contribute to an alteration in their snacking habits. Fruit can be consumed as a between-meal snack and as such may substitute snacks that are relatively high in fat and added sugar, thereby decreasing total energy intake. Furthermore, consumption of fruit may affect satiety due to its low energy density and high water and dietary fibre content[19,20]. Hence, intake of the subsequent meal and therefore the total energy intake may potentially be reduced.

The main purpose of the present study was to investigate the feasibility of using workplaces as settings to increase fruit consumption of the participants through minimal intervention by increasing fruit availability and accessibility, using a minimal fruit programme. A 'minimal fruit programme' is without any additional instructions, counselling or other health promotion activities and holds the advantages that it is relatively low in cost and easy to implement. Furthermore, it was investigated whether a possible increase in fruit intake would affect vegetable and nutrient intake and whether such an effect would influence the total energy intake.

Materials and methods

Workplaces and participants

Recruitment of the workplaces was carried out in cooperation with the Danish Cancer Society, who contacted the companies that supply fruit and asked them to place a briefing letter on their website, encouraging workplaces to enrol in the present study. Workplaces that were planning to offer free fruit to their employees and therefore contacted the company-fruit dealers could then, if interested, sign up for the study. The briefing letters were also distributed to 1000 workplaces, randomly selected from a company database provided by an information service company, and printed in a magazine published by a company sports union, which covered more than 150 000 members. Furthermore, staff at the Danish Cancer Society were consulted about workplaces that were considering to introduce free fruit.

Eight workplaces in the Copenhagen area signed up for the study. The workplaces were allocated as intervention workplaces if they were planning to offer free fruit to their employees. Hence, five workplaces were enrolled as intervention workplaces. The remaining three workplaces, which had never had free fruit or were not considering having free fruit at the workplace at least for the following 6 months, were enrolled as control workplaces. The workplaces consisted mainly of white-collar workers with the exception of two, one in the intervention group and one in the control group, consisting mainly of blue-collar workers. Recruitment at the workplaces of individuals who were interested in participating in the study occurred through a contact person who was nominated at each workplace. A total of 146 participants, eighty-two in the intervention and sixty-four in the control group, were included at baseline. Pregnant and lactating women, and individuals who did not expect to be at the particular workplace at the study endpoint, were excluded from the study. The study protocol was accepted by the Ethics Committee of Copenhagen and Frederiksberg municipality (J. No. KA-20060047).

Intervention

Workplaces entered the study at distinct points in time, starting from June to September. Assessments were made both at baseline and at endpoint approximately 5 months later. The intervention was a fruit programme, consisting of a fruit basket that was set out in a room to which participants had free and easy access, such as the reception or the staff kitchen. At least one piece of fruit was available per participant per day. Fruits available were mainly apples, pears, oranges and bananas. The fruit programme stood alone in that the participants did not receive any further counselling, etc.

Dietary assessment

Dietary intake was assessed using a 24 h recall questionnaire, which was a modified form of the dietary record questionnaire from the Danish National Dietary Survey 2000–2002[21]. The 24 h recall has been validated with an objective biomarker of fruit intake[22]. The questionnaire was completed on two non-consecutive weekdays, covering the dietary intake of the previous weekday, carried out by trained interviewers in closed rooms, at baseline and endpoint. The software program General Intake Estimated Systems (GIES) version 0.995a

(Danish Food Institute, Technical University of Denmark, Søborg, Denmark; released 26 June 2005) was used to calculate nutrient intake. Items included in the analysis were fruit, vegetables, total energy, fat, protein and total carbohydrates, as well as added sugar and dietary fibre separately. Added sugar was calculated as the sum of industrially manufactured refined sugars including sucrose, glucose, fructose and starch hydrolysates. The dietary fibre calculations were based on analytical values obtained by the AOAC method[21].

Background information

Background variables such as sex, age, education and occupation were assessed using a background questionnaire based on the validated questionnaire from the Danish National Dietary Survey 2000–2002[21]. Body weight and height were measured without shoes in light indoor clothing using a Soehnle Verona Quattrotronic digital scale (model 63686; Soehnle, Backnang, Germany) to the nearest 0·1 kg and a Soehnle 5001 Ultrasonic Height Measure to the nearest cm, respectively.

Employee satisfaction

At endpoint, participants from the intervention group were asked about their satisfaction level with the fruit programme. There were four levels of response option: (i) very satisfied; (ii) reasonably satisfied; (iii) less satisfied; or (iv) not satisfied.

Statistical analysis

Power analyses showed that with a mean expected difference of 100 (SD 220) g/d in fruit intake between intervention and control group, with a power of 80 % and a significance level of 5 %, at least seventy-five participants were necessary in each group. Paired *t* tests were performed in the intervention and control group separately to evaluate changes in intake from baseline to endpoint. Two-sample *t* tests were performed to evaluate differences in changes from baseline to endpoint between the intervention and control group. The analyses were made using the Statistical Analysis Systems statistical software package version 9·1 (SAS Institute, Cary, NC, USA). Homogeneity of variance and normal distribution were confirmed by plots, histograms and Shapiro–Wilk's tests.

Results

At endpoint, the total number of participants was reduced from 146 to 124, sixty-eight in the intervention and fifty-six in the control group, due to unexpected end of employment or pregnancy.

Baseline characteristics

Baseline characteristics, including sex, age, educational level, occupation, smoking status and BMI, did not differ significantly between the intervention and control groups (Table 1). However, although non-significant, there was a larger proportion of women in the intervention group than in the control group. Additionally, participants in the intervention group tended to have a higher education than those in the control group. Both groups consisted predominantly of white-collar workers.

Dietary intake

Table 2 shows mean daily intake values with their standard errors for the intervention and control groups at baseline and endpoint for fruit (exclusive of juice), vegetables (exclusive of potatoes), energy and macronutrients (including added sugar and dietary fibre), which were assessed by using the two 24 h recall questionnaires. At baseline, no statistically significant differences in consumption variables were found between the intervention

Table 1 Baseline characteristics of intervention and control groups: employees from eight Danish workplaces enrolled in a workplace feasibility study of the effect of a minimal fruit intervention on fruit intake

	Intervention group (*n* 68)		Control group (*n* 56)	
	Mean	SD	Mean	SD
Age (years)	46·5	9·9	44·9	8·3
BMI (kg/m^2)	26·2	5·2	25·2	4·0
	%		%	
Sex female	74		57	
Education				
Basic school	6		9	
Vocational education	22		36	
Short (<3 years)	13		16	
Medium length (3–4 years)	32		27	
Long (>4 years)	27		13	
Occupation				
Skilled	2		4	
Unskilled	9		16	
Office worker	90		80	
Smoker	18		14	

Table 2 Daily intake values in the intervention and control groups before and after the intervention, a Danish workplace feasibility study of the effect of a minimal fruit intervention on fruit intake

	Intervention group (*n* 68)						Control group (*n* 56)					
	t = 0		*t* = 5		*t* = 5 − *t* = 0		*t* = 0		*t* = 5		*t* = 5 − *t* = 0	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Fruit (g)	260	25	372[a]	31	112	35	234	22	244	26	10[b]	24
Vegetables (g)	192	15	209	20	17	15	210	15	206	17	−4	15
Energy (MJ)	8·9	0·4	9·0	0·4	0·1	0·4	9·0	0·3	9·2	0·5	0·2	0·4
Protein (g)	79·3	3·6	84·2	3·8	4·9	3·8	78·3	3·1	79·0	3·4	0·7	3·6
Carbohydrate (g)	249·2	10·7	251·7	10·7	2·4	11·3	267·9	9·7	273·0	13·2	5·1	11·4
Added sugar (g)	43·9	4·7	33·2[a]	3·6	−10·7	4·4	50·4	4·1	45·3	5·3	−5·1	4·4
Dietary fibre (g)	20·1	1·0	23·2[a]	1·2	3·0	1·1	22·6	1·1	23·3	1·3	0·7	1·0
Fat (g)	76·0	3·5	77·1	4·2	1·1	3·8	76·5	3·6	80·2	5·6	3·7	5·3

t = 0, intake at baseline; *t* = 5, intake at endpoint; *t* = 5 − *t* = 0, change from baseline to endpoint.
[a]Significant change from *t* = 0 in the intervention group (fruit, $P = 0{\cdot}002$; added sugar, $P = 0{\cdot}019$; dietary fibre, $P = 0{\cdot}007$).
[b]*t* = 5 − *t* = 0 in the control group significantly different from *t* = 5 − *t* = 0 in the intervention group ($P = 0{\cdot}021$).

and control groups. After the intervention, mean daily fruit and dietary fibre consumption increased significantly by 112 (SE 35) g ($P = 0{\cdot}002$) and 3·0 (SE 1·1) g ($P = 0{\cdot}007$), respectively, whereas there was a significant decrease of 10·7 (SE 4·4) g ($P = 0{\cdot}019$) in the mean daily consumption of added sugar in the intervention group. Mean daily intakes of vegetables, total energy and macronutrients remained unchanged in the intervention group. In the control group, no changes in any of the intake variables were observed from baseline to endpoint. Only the change in fruit intake was significantly different between the intervention group and the control group ($P = 0{\cdot}021$).

Employee satisfaction

The satisfaction level in the intervention group was as follows: 50 %, 41 % and 9 % of the participants chose the first (very satisfied), second (reasonably satisfied) and third (less satisfied) option, respectively. The fourth option (not satisfied) was not selected by any of the participants. The number of individuals who selected options (i) and (ii) was significantly higher than those who selected option (iii) ($P < 0{\cdot}001$).

Discussion

The present feasibility study has shown that the 'minimal intervention' method used at workplace settings is a relatively easy and low-cost way to increase the daily intake of fruit significantly. Simple and easy methods that can increase the consumption of fruit in the general population are greatly warranted since this could contribute to a better nutritional status and reduction in overweight and obesity, and thus an overall reduction in DALY lost.

A number of other workplace intervention studies, aiming to implement healthy dietary behaviour among the participants, have been performed[11–17], including the relatively extensive American 'Treatwell 5-a-Day worksite study'[16], the 'Seattle 5-a-Day Worksite Project'[11] and a less extensive Danish workplace study[15]. These studies achieved successful results in increasing the average fruit intake of the participants through a range of determinants, such as education and counselling of the participants and in some cases also families of the participants or other staff at the workplace. However, the present study differs from these studies at various levels, including the adoption of a relatively simple approach. The novel idea behind the present study was to investigate if application of a relatively minimal intervention in the form of increased availability and accessibility of fruit at workplaces can be an effective strategy to enhance the average fruit intake of the participants. Our results indicate that this was possible. It cannot be excluded that the dietary pattern of the participants may also have been affected in that the participants' intake of added sugar was decreased, suggesting a potential substitution of a part of the sugar-sweetened food items in their diet with fruit.

In the study, no effect of increased fruit intake on the total energy intake was observed, which supports the suggestion that fruit was not added to the usual diet but may have substituted other food items in the diet. Other intervention studies have found an effect of increased fruit intake on total energy intake[23–27]. These intervention studies are either behavioural intervention studies, addressing several dietary and lifestyle factors among free-living individuals[24–26], or clinical trials, implementing strict dietary regulations[23,27]. Common to all these studies is that participants were either overweight or obese and may thus have had a high motivation for weight reduction. It can be argued whether such intensive interventions are sustainable and possible to implement in everyday life. The present study explored if a minimal intervention was sufficient to generate a potential reduction in total energy intake among the participants. However, our participants were mainly of normal weight and may therefore not have had a strong incentive to reduce their total energy intake. Further, the participants had a relatively high baseline fruit intake and possibly

therefore increased their daily fruit intake by only one piece of fruit during the intervention. While a decrease in the consumption of added sugar was observed, the reduction was not adequate to affect the total energy intake of the participants. Individuals with a lower fruit and higher total energy intake than the participants in the present study might have increased their fruit intake more extensively and substituted a larger proportion of their usual diet with fruit, which potentially could have been reflected in their total energy intake.

Although the present minimal intervention has shown to be an effective initiative to increase participants' fruit intake at the enrolled workplaces, some limitations should be considered. Workplaces were all from the Copenhagen area and the majority of the participants consisted of white-collar workers. Hence, extrapolation of the results to other areas and to individuals with a different occupational profile should be done with caution. Because the workplaces purchased the fruit themselves, the allocation of the workplaces and the participants to the intervention or the control group was self-selected and not randomized. This reduces the generalizability of the findings because participants in the intervention group may have been more motivated to increase their fruit intake than participants at an average workplace. Moreover, due to the self-purchased fruit, only a small number of the workplaces, initially approached, chose to enrol in the study, increasing the risk of selection bias.

In conclusion, the current study suggests that it is feasible to increase the fruit intake of employees by increasing the availability and accessibility of fruit at workplaces, using a minimal intervention method. Additionally, dietary fibre intake of the participants was increased, whereas intake of added sugar was reduced and possibly substituted with fruit. One additional piece of fruit per day was not sufficient to affect total energy intake in this study population, suggesting a substitution effect. In future minimal interventions of this kind, it would be interesting to examine if inclusion of overweight or obese participants with a relatively low fruit intake prior to the study and a potentially greater incentive to reduce body weight would result in a change in total energy intake. Further, future intervention studies need to be randomized in order to provide more robust and generalizable results.

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