

# Forced Choice Restriction in Promoting Sustainable Food Consumption: Intended and Unintended Effects of the Mandatory Vegetarian Day in Helsinki Schools

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**Abstract** This paper discusses the use of forced restriction of food choice as an instrument of food policy by using the mandatory Helsinki School District weekly vegetarian day as a natural experiment. Overall, the results show that the initiative produced a mixture of intended and unintended effects. On vegetarian days, there were clear signs of non-compliance in the short term, manifested as a decrease in the participation in school lunches and in the amount of food taken to the plate and as an increase in plate waste. In the medium term, the only sign of non-compliance was a decrease in the amount of food taken to the plate. The difference between the short- and medium-term effects can be interpreted as a weakening of non-compliance, as a change in the way it manifested itself, or a combination of both. The effects of the vegetarian day differed between school levels. In the short term, the clearest indications of non-compliance were found in lower-secondary schools. However, these schools also registered positive spillover effects in the medium term. The best way to reduce the unintended effects of a policy involving forced choice restriction depends on the causes of such effects. In the case of psychological reactance, default options may be preferable to forced choice restriction. For hedonic dislike, menu development should be prioritized, and moral suasion and information campaigns may help where non-compliance stems from a disagreement with the objectives and effectiveness of the intervention. Thus, forced choice restriction should be accompanied by detailed data collection to understand the possible causes of intended and unintended effects and to tailor the intervention to the target group.

**Keywords** Consumer behaviour · Finland · Food policy · School lunches · Sustainability

## Introduction

It is widely recognized that food consumption has major sustainability impacts. For example, agricultural and food systems account for one third of global greenhouse gas emissions;

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agriculture is a leading cause of loss of global biodiversity; the emergent pattern of dietary shifts risks leading to significant negative health consequences, and food production is closely linked to questions of poverty, development, and livelihoods (see Pretty et al. 2010). Thus, it is not surprising that there is a strong interest in promoting sustainable food consumption.

The need for some degree of policy intervention to promote sustainable food consumption is generally accepted, but there is a lot of discussion as to the appropriate means of such intervention. Suggested policies include information provision through mandatory or voluntary labelling (e.g., Fahlman et al. 2008; Nissinen et al. 2007; Saarinen et al. 2012; Stutts et al. 2011); taxes to make prices reflect the social cost of food (e.g., Cash et al. 2005; Vinnari and Tapio 2012; Wirsenius et al. 2011); libertarian paternalistic choice architecture, that is, modifying food environments such as school cafeterias to nudge consumers towards healthier diets (Just and Wansink 2009; Just et al. 2008; Thaler and Sunstein 2008) and bans on specific foods (Gould et al. 2006).

Of these, the last policy measure differs fundamentally from the others in the degree to which it restricts food choice. Broadly speaking, choice restriction can be defined as “any internally or externally imposed boundary that limits and/or confines choices” (Botti et al. 2008, 185). Although restrictions can also be internal, meaning that it is the individual who voluntarily self-imposes boundaries to choice (Ibid. 186–187), and although certain policy interventions can help individuals keep their commitment to self-imposed restrictions, of particular interest for this paper are external restrictions in which the policy maker limits choice. External restrictions can be direct as in the case of bans, or indirect, such as those imposed through tax increases, which by increasing prices restrict the choice set. The focus of the present paper is on external and direct choice restriction, which can be termed forced choice restriction for brevity. The institution of the Helsinki School District mandatory vegetarian day (hereafter Helsinki vegetarian day), whereby meat and fish have been eliminated from the school menu once a week, is a clear example of such forced choice restriction.

While information provision and choice architecture do not restrict choice (Thaler and Sunstein 2008, 5) and while taxes can indirectly restrict the choice set, bans and other forms of forced choice restriction limit food choice for all consumers regardless of their budget. However, little is known about the ability of forced restriction of food choice to produce the intended effects, since empirical evidence is limited to the effects of bans on sugar-sweetened drinks and on low-nutrient, energy-dense food, and its findings are contradictory (see, e.g., Cullen et al. 2008; Huang and Kiesel 2012; Taber et al. 2011).

The present paper examines the effects of forced restriction of food choice through a natural field experiment, the Helsinki vegetarian day. This initiative restricted students’ food choices to vegetarian alternatives once a week. The immediate intended effect, which is the object of this study, was to increase the relative consumption of vegetarian hot dishes. The indirect intended effect was to reduce the environmental impact of school lunches via a decrease in the consumption of meat- and fish-based hot dishes. The focus of the analysis in this paper is on whether forced restriction of food choice can effectively change food consumption patterns, while it is outside the scope of this paper to assess if the Helsinki vegetarian school day initiative yielded net environmental benefits. This is an important question for further research which would require a data set different from the one in this paper.

Studying 33 schools where the vegetarian day was implemented and 10 control schools, it was found that the initiative produced a mixture of intended and unintended effects. In the short term, there were clear signs of non-compliance: Participation in school lunches and the amount of food taken to the plate decreased while plate waste increased compared with pre-intervention levels. In the medium term, the only sign of non-compliance was a decrease in the amount of food taken to the plate. The difference between the short- and medium-term effects can be interpreted as a weakening of non-compliance, as a change in the way it

manifested itself, or a combination of both. In lower-secondary schools, a combination of unintended and intended effects emerged in the medium term: Participation in school lunches decreased (unintended effect), but the share of vegetarian hot dish consumption on days when meat and fish were also available increased (intended effect).

This paper is structured as follows. In “[The Helsinki Vegetarian Day](#),” the Finnish school lunch system and the Helsinki vegetarian day initiative are described. “[The Effects of Forced Choice Restriction](#)” illustrates the theoretical framework, and the next section introduces the “[Data and Methods](#).” The “[Results](#)” of the analysis are presented next, while a discussion of the results and their policy implications is offered in “[Discussion and Conclusions](#).”

## The Helsinki Vegetarian Day

### The Finnish School Lunch System

The beginning of the free school lunch system in Finland can be traced back to 1943, when schools were obliged to offer free lunches to students in comprehensive schools on full school days (Jeronen and Helander 2012, 21). The free lunch system was extended to upper-secondary schools in 1988 (Ibid. 23). At present, the responsibility for providing school lunches is with the municipalities, which are expected to offer one free meal every school day in elementary, lower and upper-secondary, and vocational schools (Finnish National Board of Education 2008). According to current rules, the school meal should fulfil about one third of students’ daily nutritional requirements, students should be given a lunch break of at least 30 min, and teachers should supervise students during the lunch break (Lintukangas et al. 2007). Usually, elementary school students are not allowed to leave the school grounds during the lunch break, upper-secondary and vocational school students are, and for lower-secondary schools, this depends on the school.

In Helsinki, schools have been divided into two groups. The first group is directly assigned to the catering firm Palmia owned by the City of Helsinki. The procurement of school lunches for schools belonging to the second group is done through a competitive bidding process. As a result of this process, Palmia catered for 10 schools in the second group at the time of the data collection. All Helsinki school cafeterias are organized on a self-service basis: students assemble their own meals, which are served daily from 10AM to 12 noon. Meals consist of a selection of two (in some instances three) main dishes accompanied by salad, grated vegetables, or fruit. Water, milk, buttermilk, bread, and table spread are also served (City of Helsinki Education Department 2012.)

Since 2007, a daily vegetarian hot dish alternative has been offered in all Helsinki schools with the objective of increasing the consumption of vegetables and introducing students to new foods and tastes (Helsinki City Council 2010). More recently, environmental considerations have also been steering school lunches toward vegetarian food as shown by the Council of State Decision of Principle which states that “The sustainability of food services and food procurement in state food services shall be increased: Organic, vegetarian or seasonal food shall be on offer in state kitchens and food services at least once a week as of 2010 and twice a week as of 2015.” (Finnish Government 2009, 2, translation by Wahlen et al. 2012, 12). In summary, in the background of the Helsinki vegetarian day is a well-established school lunch system that aims at encouraging healthy and sustainable food choices.

### The Helsinki Vegetarian Day: Origins and Immediate Reactions

Several studies have found that the adverse sustainability impacts of food are particularly pronounced in the case of animal products. Firstly, the production of food of animal origin

has a great impact on the environment. Steinfeld et al. (2006) estimate that 70% of all agricultural land is dedicated to livestock production and that the expansion of the livestock sector is the major driving force of deforestation and loss of biodiversity as well as the major cause of land degradation. To the livestock sector are attributed a third of the loads of phosphorous and nitrogen into freshwater, 55% of erosion and sediment, 50% of antibiotic use, and 37% of pesticide use. Of all anthropogenic ammonia emissions, which contribute to acid rain formation and to the acidification of the ecosystem, 64% originate from the livestock sector. This sector also contributes significantly to climate change with 18% of all greenhouse gas emissions measured in CO<sub>2</sub> equivalent, including 37% of anthropogenic methane emissions (Ibid. xxi-xxiii). Baroni et al. (2007) calculate that, within the same method of production (organic or conventional), the greater the consumption of animal products in a diet, the higher the impact on the environment. For both methods of production, beef emerges as the food item with the greatest impact on the environment. Other food items with high environmental impacts are cheese, fish, and milk. This is true also with respect to school lunches: Saarinen et al. (2012, 182) estimate that the climate impact of a single Finnish school lunch portion can range between 0.57 and 2.06 kg of CO<sub>2</sub> equivalent and the eutrophication potential between 0.52 and 2.13 g PO<sub>4</sub> equivalent, and that the environmental impacts of the vegetarian lunches are clearly lower than those of the meat- and fish-based lunches.

Numerous studies have also found that increasing the share of vegetables in the diet significantly reduces the environmental impact of food production (Baroni et al. 2007; Carlsson-Kanyama 1998; Carlsson-Kanyama et al. 2003; Carlsson-Kanyama and Gonzales 2009; Duchin 2005; Gonzalez et al. 2011; Pimentel and Pimentel 2003; Reijnders and Soret 2003; Stehfest et al. 2009; Virtanen et al. 2011). For instance, Stehfest et al. (2009) calculate that the adoption of a low-meat diet as recommended by the Harvard Medical School for Public Health would be a cost-efficient way to achieve a 450 ppm CO<sub>2</sub> equivalent stabilization target in 2050.

Reducing the intake of meat and dairy products and replacing them with plant-based foods is beneficial not only for the environment but also for health, since approximately 50% of the total saturated fatty intake comes from meat and dairy, and the consumption of red and processed meat has been associated with cancer (e.g., Macdiarmid et al. 2012). Finally, a lower consumption of animal products could be beneficial for animal welfare, given that many farm animals live in dire conditions and that the direct and indirect land use requirements of the livestock sector has adverse effects on wild animals (e.g., Matheny and Chan 2005).

Consequently, in the fall of 2009, several Finnish non-governmental organizations (Fauna, the Vegan Society of Finland, Friends of the Earth, The Finnish Nature League, and The Finnish Association for Nature Conservation) launched a campaign called "Choose Vegetarian." The campaign objective was to institute a weekly mandatory vegetarian day in all Finnish schools during which neither meat nor fish would be served (Choose Vegetarian 2012). The campaign was motivated as follows: "One important choice through which we can promote the well-being of the environment, of ourselves and of all living beings is to favour vegetarian food" (Choose vegetarian: Welcome to Choose Vegetarian 2012). As part of the campaign, City Council commissioners in Espoo, Helsinki, Tampere, and Jyväskylä presented motions to their City Councils for the institution of a weekly vegetarian day in their city district schools. The Helsinki City Council approved on February 17, 2010, the proposal to introduce a vegetarian day in schools (Helsinki City Council 2010). A weekly vegetarian day was also approved in Tampere and Jyväskylä but rejected in Espoo (Junnilainen 2011, 32).

The discussions during the meetings of the City Councils about the institution of the weekly vegetarian day were exceptionally heated (for a detailed analysis, see Junnilainen 2011). The debate was partly about whether the immediate intended effect of the initiative, to increase the relative consumption of vegetarian hot dishes, would increase the sustainability of school food consumption. Several city commissioners underlined the environmental merits of the initiative in terms of decreasing greenhouse gases and protecting biodiversity. However, some argued that instead of switching to vegetarian food, the environmental goals for school food could have been achieved more effectively by targeting food items identified as most harmful to the environment, such as rice or prey fish (Ibid. 53–55). There was also disagreement about the health benefits of the initiative: Proponents saw that a shift towards more vegetarian food constituted a diversification of the diet that would improve students' health, while opponents saw it as an impoverishment that would risk student health (Ibid. 62). Interestingly, in only one address among all the City Councils' discussions, animal welfare was brought up as a reason for the institution of the vegetarian day (Ibid. 53).

Considering that the key question in this paper is not whether the vegetarian day is beneficial from an environmental, health, or animal welfare perspective but rather whether forced choice restriction is an appropriate policy instrument for achieving the intended effects on students' food consumption, it is worth noting that several addresses in the City Council debates focused on this question. Fear was expressed that on vegetarian days children may leave the hot vegetarian dishes uneaten and end up eating just bread and water: "Why are we beating children who are unaccustomed to vegetarian food to a diet of rye crisp and water once a week?" (Junnilainen 2011, 57). In fact, the main argument presented against the institution of a vegetarian day was that forced restriction of food choice was simply not acceptable in principle (Ibid. 56): "In my opinion nobody here is in the position to dictate what food other people eat" (Ibid. 51); "I am in favour of vegetarian food but I am against the reduction of the choices now available ... This goes against my belief in pluralism." (Ibid. 56); "I also do not believe that coercion belongs to our days nor, hopefully, to the future. In this respect I wish that the City Council, as a political signal, would specifically further freedom of choice and not coercion" (Ibid. 57).

The general public followed the debate with attention. In the 24 h that followed the vegetarian day debate at the Helsinki City Council, 368 comments were posted on an online discussion board in which opponents to the vegetarian day initiative emphasized the importance of meat as a key component of a balanced, healthy diet and described a meatless diet as unnatural and abnormal. They saw the initiative as a way to impose a green ideological identity on others. Provocatively, some commentators proposed a mandatory meat day. Although opponents did not dispute that public food services should attempt to shape and steer consumption towards greater sustainability, they highly resented the fact that the vegetarian day was mandatory. On the other hand, those in favour of the vegetarian day interpreted the growing trend in the consumption of vegetarian food as a sign of its normality and viewed the vegetarian day as offering students the possibility to taste new types of food and to learn to eat vegetarian food (Wahlen et al. 2012). At the time of writing this paper, extracts of the vegetarian day debate at the Helsinki City Council posted on YouTube had reached over 100000 views, compared to 360 views for the most viewed Helsinki City Council video not related to the vegetarian day.

Such emotional clamour around the vegetarian day initiative suggests that people can react very strongly even to the threat of forced choice restriction in the domain of food and further underlines that the likely effects of forced restriction of food choice are unclear. Next, we turn to examining these effects more closely both in theory and as they emerge from the case of the Helsinki vegetarian day.

## The Effects of Forced Choice Restriction

### Intended Effects

Food policy interventions are implemented having in mind specific intended effects, that is, desired changes in behaviour and/or in its proximal and distal determinants such as intention or attitudes (Ajzen 1991). In what follows, the paper focuses on intended end-effects, that is, changes in actual behaviour. Forced choice restriction very rarely extends to all (food) environments in which choice is made, wherefore it is important to make a distinction between attaining the intended behavioural effects in the environments where choice is restricted and the spilling over of the intended effects to environments where such restrictions do not apply. In fact, a choice restriction intervention could be considered most successful when the intended behavioural effects are maintained even in the absence of the restriction. In the case of the vegetarian day, this means distinguishing the intended effects obtained in school during the vegetarian day from those obtained on other school days.

As pointed out by Botti et al. (2008), individuals' reactions to choice restrictions can vary on a continuum from compliance to rebellion. In this paper, the term compliance describes the adoption, in the restricted environment, of the behaviours intended by the policy. In the case of the Helsinki vegetarian day, the intended effect was to increase the relative consumption of vegetarian hot dishes. Bearing in mind that the school lunch should fulfil about one third of students' daily nutritional requirements (Lintukangas et al. 2007), the intended effect is achieved on vegetarian days if replacing meat- and fish-based hot dishes by vegetarian ones does not produce any adverse effects on students' school lunch behaviour. Any effect that would endanger the fulfilment of the nutritional requirements would be considered an adverse effect.

Adapting Thøgersen and Crompton (2009), if the intended behaviours are maintained even when and where choice is not restricted, choice restriction produces positive spillovers, which can emerge through several paths. Choice restriction may help individuals learn about their preferences by forcing them to try alternative options when the preferred choice is restricted. Moreover, performing the behaviour may make individuals develop more positive attitudes towards it as well as activate pro-environmental goals and values related to the performed behaviour. The restriction can also make pro-environmental goals more salient even in the absence of any communication campaign. For instance, the mere absence of meat and fish may activate thoughts about the reasons for this absence, that is, the goal to reduce environmental impacts. Finally, positive spillovers may be due to the avoidance of the adverse feelings linked to cognitive dissonance, which could emerge if individuals complied with the restriction but then elsewhere reverted to the behaviour the restriction discouraged. In the case of the Helsinki vegetarian day initiative, positive spillovers are present if the relative consumption of vegetarian hot dishes increases on days other than the weekly vegetarian day.

### Unintended Effects

Choice restriction may produce unintended effects (for a typology of unintended effects, see Cho and Salmon 2007) among which of particular importance here are non-compliance in the restricted choice environment as well as boomerang effects both in the restricted and unrestricted environments.

Non-compliance emerges when, in the restricted environment, individuals do not adopt the behaviour that the restriction was meant to encourage. In the case of bans on soft drink



vending machines in schools, students may bring sodas from home, or in the case of the vegetarian school day, they may, for instance, skip lunch. When individuals do not comply, not only are the intended effects not achieved, but it is also possible that undesirable adverse effects emerge. For example, non-complying lunch-skipping students may end up not getting their nutritional requirements fulfilled from the school lunch, in which case they might compensate by eating more elsewhere during the day. Unless that food is also vegetarian, the consumption of meat and fish will not have been reduced, only shifted outside school.

Based on the existing literature, it appears that hedonic dislike, that is, distaste for vegetarian food due to its sensory attributes (taste/flavour, texture and mouth feel, appearance and smell) is a potential major cause of non-compliance in the case of the vegetarian day. Koivisto and Sjöden (1996) find that, in Swedish families with 2- to 17-year-old children, the main reason for not liking specific foods was “distaste.” Krølner et al. (2011), in a meta-analysis of studies on the determinants of fruit and vegetable consumption among children and adolescents, found that taste was a main reason for not liking vegetables. Caporale et al. (2009) report that hedonic ratings of lunch food predicted well the amount uneaten during school lunch and that vegetable dishes were the least preferred. When the taste of meat and fish is preferred to that of vegetables, the immediate goal of hedonic pleasure may outweigh the more distant goals of environmental protection, even when students support such goals, especially if the threat to the environment, as in the case of climate change, is felt to be distant.

In addition to non-compliance, choice restriction may produce boomerang effects, that is, effects opposite to the ones the policy intended to produce (Byrne and Hart 2009; Cho and Salmon 2007). Boomerang effects can manifest themselves both in the restricted and in the unrestricted environment. In the latter case, analogously to positive spillovers, they can be called negative spillovers. Following Byrne and Hart (2009), boomerang effects can arise for several reasons. For example, it is possible that the intervention, in this case forced choice restriction, makes people start to value more the restricted behaviour or, alternatively, the liberty to eat whatever they please (psychological reactance). According to psychological reactance theory, the sole perception that individual freedom is being threatened, even when the threat is not actual, can cause an aversive affective reaction that ignites behaviours meant to try to restore such freedom (Brehm 1966; Brehm and Brehm 1981) such as, in the case of the vegetarian day, eating more fish or meat.

Additional reasons for boomerang effects or non-compliance can be that the targeted individuals disagree with the motivation for the forced choice restriction (e.g., protecting the environment) or do not believe in the ability of the intervention to achieve the indirect intended effect (e.g., significantly reduce the environmental impact of school lunches). Thus, there are many theoretical reasons why forced choice restriction could lead to unintended effects. While the empirical data in this paper do not allow distinguishing between the underlying causes of the possible unintended effects of the vegetarian day, these do allow the identification of the behavioural reactions to the intervention.

#### Previous Empirical Evidence of the Effects of Forced Choice Restriction in the Domain of School Food

Empirical research on forced choice restriction focuses mostly on the behavioural effects of restricted choice such as in the case of school bans on sugar-sweetened beverages (SSBs) and other foods of minimal nutritional standards. The results of these studies are somewhat contradictory both with respect to compliance in the restricted environment and to effects in

the unrestricted environment. For instance, Cullen et al. (2008) report that restricted access to less healthy food and beverages in schools decreased students' lunchtime consumption of these food items even when food brought from home was taken into account, while Blum et al. (2008) find no impacts of restricted choice on in-school consumption. Schwartz et al. (2009) address the issue of potential compensatory increases of consumption outside school due to bans and find that replacing low-nutritional value snacks and beverages in middle school decreased students' consumption at school without any compensatory increase at home. However, the results by Taber et al. (2011) show that compensation took place so that the bans did indeed reduce the purchase of SSBs in schools without, however, decreasing their overall consumption. No evidence of increase in out-of-school household purchases to compensate for the restricted access due to the Connecticut ban on regular and diet soft drinks is found by Huang and Kiesel (2012). Studies suggest that the effects of restricted access to unhealthy foods is likely to depend partially on school level. For instance, as pointed out by Fernandes (2008), the fact that elementary school children have less pocket money and more teacher oversight than older students makes them less likely to be affected by competitive foods at school.

One interesting point that emerges from the literature is that a focus on how bans change aggregate consumption may hide important differences in the effects of restricted choice on specific groups. For instance, Fernandes (2008) estimates that, even though the removal of sugar-sweetened beverages from elementary schools would not have a significant impact on aggregate SSB consumption, it would decrease the share of children who consume them by 4%. Blum et al. (2008) find significant effects of reduced availability of SSBs on girls' consumption in intervention schools compared with control schools but no effects on boys' consumption. Taber et al. (2011) find an association between bans and reduced consumption by those who consume SSBs infrequently, and increased consumption by those who consume them frequently. Based on these results, it appears that restricted choice can produce simultaneously intended, unintended, or no effects and that the effects may be very different among individuals depending on factors such as age, gender, or frequency of consumption. This idea is supported also by previous findings about the effects of gender and socio-economic status on the likelihood of boomerang effects, psychological reactance, and hedonic dislike. For instance, Byrne et al. (2009) report that males are more likely to exhibit a boomerang effect, and males also exhibit stronger psychological reactance than females (Seemann et al. 2004; Woller et al. 2007). Finnish adolescent girls eat more vegetables than boys: Among seventh-graders, 28% of boys and 40% of girls report eating fresh vegetables daily (Hoppu et al. 2010; see also Tikkanen and Urho 2009). Moreover, in Finland, children of families of high socio-economic status eat more vegetables (Haapalahti et al. 2003).

## Data and Methods

The empirical research question in this paper is what effects of forced restriction of food choice are visible in students' eating behaviour in the case of the Helsinki vegetarian day. We now turn to explaining the data and methods used to examine this question.

### Sampling

As this was a natural experiment, the assignment of schools to intervention and control groups was the result of administrative decisions taken prior to and independently of the vegetarian day initiative and this study. However, from among the population of intervention



and control schools, the schools to be studied were randomly sampled or, where the subpopulation was very small, the whole population was studied. Since in all the sampled schools the school lunch was prepared and served by the same catering firm, Palmia, the participation of the schools was automatically secured as soon as the collaboration of Palmia and the City of Helsinki Education Department was obtained for this study.

The vegetarian day was implemented as of January 2011 in all those Helsinki schools where the provision of food had been directly assigned to the city's catering firm Palmia without a competitive bidding process. For this study, the vegetarian day schools were sampled from a population of 90 schools that followed the same menu and were catered by Palmia. In the case of elementary and lower-secondary and upper-secondary schools, the schools were randomly selected so that each school of the same grade had the same likelihood of being sampled (stratified random sampling); in other words, 10 schools were randomly drawn out of the elementary schools, 10 out of the lower-secondary schools, and 10 out of the upper-secondary schools. In the case of vocational schools, the entire population of three schools was studied. This resulted in a final sample containing 33 intervention schools.

In addition, there was a total of 10 schools catered by Palmia which otherwise followed the same menu as the intervention schools but did not yet implement the vegetarian day during the study period. These are schools for which the catering firm was assigned by a competitive bidding process and for which the implementation of the vegetarian day has been postponed to after the existing contracts, which do not include any provision for a vegetarian day, will have expired. This entire population was selected as control schools.

Having pre-intervention and post-intervention data for both intervention and control schools in this study is important for several reasons. School food menus reflect the seasonal availability of ingredients and thus change according to the period of the year. Changes in the amount of food taken to the plate or in food waste could therefore simply reflect reactions to seasonally different menus rather than to forced choice restriction. Moreover, in schools where students are allowed to leave the school grounds during lunchtime, changes in participation in school lunches may reflect changes in weather since students may be more willing to be outdoors in the spring than in the winter. Also, menu development can account for changes in eating behaviour over time. The control schools make it possible to check that changes in behaviour are not due to factors like these.

### Variables and Data Collection

On vegetarian days, students' reactions can be measured through three operational variables that capture the hierarchy of their behavioural choices with regard to school lunches. Students first decide whether to go to the cafeteria, and this decision is captured by the number of participants in the school lunch as a share of the students present at school on that day (the variable Participation). In the cafeteria, they decide how much of the hot dish to take to the plate, which is measured by the amount of food taken to the plate per student participating in the school lunch (Food Taken). Finally, having tasted the food, they decide how much to eat and how much to throw away as plate waste. This last behaviour is measured by the amount of plate waste produced per participant in the school lunch (Plate Waste).

Any behaviour which reduces the consumption of the hot dish during the vegetarian day, such as decreased participation in school lunches, reduction in the amount of food taken, or increased plate waste, is an expression of non-compliance. On the other hand, if there is no decrease in participation and in food taken to the plate and if plate waste does not increase, there is compliance. Positive spillovers emerge if the share of the vegetarian hot dishes

consumed on days other than the vegetarian day (a fourth variable, Veg-Share) increases, and negative spillovers if it decreases. Table 1 summarizes the possible intended and unintended effects of the vegetarian day both in the restricted and unrestricted school environments as well as the operational variables through which they can be measured.

The data were collected at the school level rather than at student level. For example, the aggregate amount of plate waste created in the school cafeteria during a measurement day was recorded and then divided by the number of students who had eaten in the cafeteria (school-level collection) instead of measuring the plate waste created by each individual student (student-level collection). Pre-intervention data were collected for 5 days in November 2010, before the introduction of the vegetarian day, in both intervention and control schools. The first set of intervention data were collected for 5 days in April–May 2011, after the weekly vegetarian day had been implemented 11 times. It included only vegetarian days in intervention schools and only mixed-food days (days on which also meat and fish were on the menu) in control schools. This data set is considered to represent the short term in the students' adaptation to the initiative for two reasons. Although studies show that repeated taste exposures can be effective in changing food preferences, firstly, there is great variability in the number of necessary exposures depending on age group and food type. Up to 15 exposures may be required for school-age children, and vegetables require more exposures than, e.g., fruit (see, e.g., Lakkakula et al. 2010). Secondly, while the students had been exposed to the vegetarian day 11 times by the collection of the first set of intervention data, the vegetarian dishes that were served on these occasions varied. The second set of intervention data, considered to represent the medium term, was collected in September 2011, after 23 implementation times of the vegetarian day, and contained one vegetarian day and four mixed days for intervention schools and five mixed-food days for

**Table 1** Intended and unintended effects of the vegetarian day and related operational variables

	Restricted choice environment (vegetarian days)	Unrestricted choice environment (other days)
Intended effects	Compliance: the adoption of the intended behaviours	Positive spillover: increased adoption of the intended behaviours in the absence of restrictions
	Measured through no changes in participation in school lunches	
	Measured through no changes in the amount of the hot dish taken to the plate	Measured through increased share of the vegetarian hot dish taken to the plate
Unintended effects	Measured through no changes in plate waste	
	Non-compliance: the non-adoption of the intended behaviours	Boomerang effect (negative spillover): decreased adoption of the intended behaviours in the absence of restrictions
	Measured through decreased participation in school lunches	
	Measured through decreased amount of the hot dish taken to the plate	Measured through decreased share of the vegetarian hot dish taken to the plate
	Measured through increased plate waste	
	Boomerang effect: the adoption of the opposite of the intended behaviours	

control schools.<sup>1</sup> Table 2 presents the descriptive statistics for the intervention and control schools used in the study.

## Methods

PASW Statistics 18 was used for all statistical analyses. The data were averaged separately for each school to avoid that the variation between individual hot dishes on the different measurement days in each data collection wave overly affected the results.

Given the sample size and the fact that only two of the variables were normally distributed, non-parametric methods were used. Because they make fewer assumptions than parametric methods, non-parametric methods tend to be more robust; for instance, they are less sensitive to outliers. Robustness, however, comes at a cost in terms of power in that non-parametric tests have a lower probability of rejecting a  $H_0$  when it is false. (Siegel and Castellan 1988, 35–36.) This implies that it will be more difficult to find statistically significant changes in the operational variables before and after the introduction of the vegetarian day.

As a first step, it was confirmed with the Median test that the pre-intervention levels of the variables in the control schools did not differ significantly from those in the intervention schools. To examine changes in the variables, the Wilcoxon signed-rank test for two repeated samples was used (Siegel and Castellan. 1988, 87–95) with the 0.10 significance level as the cut-off point.

## Results

All the results presented in this section are based on a comparison between two measurement periods: between November 2010 and April–May 2011 for the short-term results and between November 2010 and September 2011 for the medium-term results. To check the robustness of the results, all the analyses were also carried out so that only those schools for which data were available in all three measurement periods were included. This did not affect the qualitative results, and the results are not reported here. Vocational schools are included in the overall results, but the results relative to these schools are not presented separately since there were only three very heterogeneous intervention schools in this group.

### Short-Term Effects of the Vegetarian Day

First, the overall effects of the vegetarian day were examined in the short term. Compared with the pre-intervention situation, there were statistically significant effects in all variables (Table 3) which suggests that there was non-compliance with the vegetarian day. Participation in school lunches decreased from 83% to 77%, which represents a 7% reduction ( $p=0.074$ ). Participating students took 9% less food to the plate ( $p=0.007$ ), and their plate waste increased by 60% ( $p=0.002$ ). In the control group, no statistically significant changes were found with the exception of participation in school lunches which, however, increased ( $p=0.075$ ) as opposed to the decrease in the intervention group.

Second, the effects of the vegetarian day in different school levels were examined. As can be seen from Table 4, the effects were strongest in lower-secondary schools, where on

<sup>1</sup> Ideally, the first set of intervention data would have contained measurements also for mixed-food days in intervention schools, and the second set of intervention data would have contained measurements for more than one vegetarian day, but for practical reasons this was not possible.

**Table 2** Descriptive statistics

	Intervention	Control
Participation		
<i>N</i>	26	6
Mean	83%	78%
Median	89%	74%
SD	18.44	20.15
Food taken (grams per participant)		
<i>N</i>	28	10
Mean	288 g	341 g
Median	277 g	379 g
SD	71.32	90.87
Plate waste (grams per participant)		
<i>N</i>	27	10
Mean	35 g	33 g
Median	28 g	30 g
SD	23.32	22.77
Veg-share		
<i>N</i>	28	10
Mean	16%	22%
Median	13%	24%
SD	8.72	7.48

vegetarian days participation in school lunches decreased by 19%, the amount of food taken to the plate per participating student decreased by 11%, and plate waste increased by 40%. In elementary schools, there was no change in participation in school lunches. This is understandable since, contrary to other students in the sample, elementary school students (aged 7–13 years) are generally not allowed to leave school grounds or otherwise skip lunch during the school day. Elementary school students could, however, still take less food to the plate. This is exactly what happened: The amount of food taken per student decreased by 21%. The amount of plate waste did not change. Also this is understandable considering that elementary school children are more closely supervised in the school cafeteria, and plate waste is often discouraged. In upper-secondary schools, the only statistically significant change was a very high increase (89%) in plate waste.

**Table 3** The overall short-term effects of the vegetarian day

	Intervention schools			Control schools		
	Pre-intervention	Short term	<i>p</i> value	Pre-intervention	Short term	<i>p</i> value
Participation	83%	77%	0.074, <i>N</i> =25	78%	89%	0.075, <i>N</i> =6
Food taken (grams per participant)	288 g	263 g	0.007, <i>N</i> =28	333 g	316 g	0.953, <i>N</i> =9
Plate waste (grams per participant)	35 g	56 g	0.002, <i>N</i> =27	30 g	32 g	0.767, <i>N</i> =9

**Table 4** The short-term effects of the vegetarian day by school level

Operative variable	Intended effects	Unintended effects
Participation in school lunches on vegetarian days	No change in elementary and in upper-secondary schools	Decreased in lower-secondary schools by 19% ( $p=0.012$ , $N=8$ )
Amount of hot dish taken to the plate on vegetarian days per participant	No change in upper-secondary schools	Decreased in elementary schools by 21% ( $p=0.007$ , $N=10$ ); decreased in lower-secondary schools by 11% ( $p=0.038$ , $N=8$ )
Plate waste per participant	No change in elementary schools	Increased in lower-secondary schools by 40% ( $p=0.021$ , $N=9$ ); increased in upper-secondary school by 89% ( $p=0.075$ , $N=6$ )

### Medium-Term Effects of the Vegetarian Day

Next, the effects of the vegetarian day on students' eating behaviour in the medium term were examined. The medium-term data also allowed the examination of possible spillover effects. Table 5 shows that, overall, students participating in the school lunch still took 18% less food to the plate ( $p=0.010$ ) than in the pre-intervention situation on the single vegetarian day for which the data were collected. By contrast, there were no statistically significant differences in participation or in plate waste. These results suggest that the earlier non-compliance caused by the introduction of the vegetarian day has weakened, or changed its form and become channelled primarily through the amount of warm dish taken to the plate, or a combination of both. There was no change in the share of the vegetarian alternative on non-vegetarian days, which means that overall there were signs of neither positive nor negative spillovers. In control schools, there were no changes compared with pre-intervention levels in any variable.

Looking at the different school levels separately (Table 6), we find that, in elementary schools, there was a 35% decrease and in upper-secondary schools a 26% decrease in the amount of food taken to the plate, but there were no other effects in these school levels. In lower-secondary schools, participation in the school lunch on the vegetarian day was still 16% lower compared with pre-intervention levels. At the same time, however, there was also evidence of positive spillovers in lower-secondary schools, as the share of vegetarian hot dishes consumed voluntarily on non-vegetarian days increased from 11% to 15%.

**Table 5** The overall medium-term effects of the vegetarian day

	Intervention schools			Control schools		
	Pre-intervention	Medium term	<i>p</i> value	Pre-intervention	Medium term	<i>p</i> value
Participation	82%	87%	0.918, $N=17$	81%	87%	0.225, $N=5$
Food taken (grams per participant)	281 g	229 g	0.010, $N=23$	333 g	371 g	0.767, $N=9$
Plate waste (grams per participant)	36 g	48 g	0.484, $N=23$	30 g	31 g	0.953, $N=9$
Veg-share	16%	18%	0.166, $N=26$	23%	20%	0.678, $N=9$

**Table 6** The medium-term effects of the vegetarian day by school level

Operative variable	Intended effects		Unintended effects
	Compliance	Positive spillovers	
Participation in school lunches on vegetarian days	No change in elementary schools and upper-secondary schools		Decreased in lower-secondary schools by 16% ( $p=0.068$ , $N=5$ )
Amount of hot dish taken to the plate on vegetarian days per participant	No change in lower-secondary schools		Decreased in elementary schools by 35% ( $p=0.012$ , $N=8$ ); decreased in upper-secondary schools by 26% ( $p=0.043$ , $N=5$ )
Plate waste per participant	No change in any school		
Consumption of the vegetarian hot dish on mixed-food days	No change in elementary schools and in upper-secondary schools	Increased in lower-secondary schools from 11% to 15% ( $p=0.036$ , $N=8$ )	

Since evidence of a positive spillover effect in lower-secondary schools is particularly interesting, the data were analysed further. It is possible that the scope for an increase in the consumption of the vegetarian alternative on mixed-food days depends on the level of vegetarian food consumption prior to the intervention so that the lower the initial consumption of vegetarian food, the more scope there is for its increase. In fact, the pre-intervention share of the vegetarian hot dish was the smallest in lower-secondary schools (median 10.63, mean 10.73, SD 3.75,  $N=8$ ), where the spillover effect was indeed discovered. In elementary schools, the pre-intervention share of the vegetarian hot dish was somewhat higher (median 13.19, mean 14.85, SD 8.09,  $N=9$ ), and it was the highest in upper-secondary schools (median 20.84, mean 22.45, SD 10.25,  $N=6$ ). Thus, it was first assessed if these differences were statistically different. The Kruskal–Wallis test for independent samples confirmed that the distribution of the pre-intervention share of the vegetarian hot dish differed across school levels (sig. 0.056). Pairwise comparison between school levels using the Mann–Whitney  $U$  test for independent samples found no difference in the pre-intervention share of the vegetarian hot dish between elementary and lower-secondary schools (sig. 0.386), while significant differences existed both between upper- and lower-secondary schools (sig. 0.020) as well as between elementary and upper-secondary schools (sig. 0.099). This suggested that positive spillovers may be present in elementary and lower-secondary schools taken together, given that they did not significantly differ in their pre-intervention levels of the share of the vegetarian hot dish and that both had lower pre-intervention levels than upper-secondary schools. The Wilcoxon signed rank test for related samples (sig. 0.084) confirmed a positive spillover for elementary and lower-secondary schools combined.

Thus, the following hypothesis was formulated:

Hypothesis 1 (scope for positive spillover): There is a negative correlation between the pre-intervention share of vegetarian hot dish and its absolute change in the medium term.

The hypothesis was tested using non-parametric correlation tests (Kendall's tau-b = -0.455, Sig(two-tailed) = 0.002, Spearman's rho = -0.656, Sig(two-tailed) = 0.001,  $N=23$ ). Both tests indicate that there is a negative correlation between these two variables that is significant at



the 0.01 level (two-tailed). Interestingly, in the medium term, the difference in the distribution of the share of the vegetarian hot dish across the three school levels disappeared as shown by the Kruskal–Wallis test for independent samples (sig. 0.201).

In summary, before the implementation of the vegetarian day, there were significant differences in the relative consumption of vegetarian hot dishes by school levels, with the lowest consumption in lower-secondary schools and the highest in upper-secondary schools. The vegetarian day reduced these differences in the medium term by increasing the share of the vegetarian hot dish in elementary and lower-secondary schools taken together.

## Discussion and Conclusions

### Discussion of Key Findings

Forced restriction of food choice is highly controversial, and its effects are still unclear. This paper examined its intended and unintended effects using the mandatory Helsinki vegetarian day as a natural experiment. The analysis suggests that the initiative produced unintended effects in the short term and a mixture of intended and unintended effects in the medium term. In the short term, there were clear signs of non-compliance manifested as a decrease in the participation in school lunches and in the amount of food taken to the plate and as an increase in plate waste. In the medium term, the only sign of non-compliance was a decrease in the amount of food taken to the plate, and there were some indications of positive spillovers in lower-secondary schools and lower-secondary and elementary schools combined.

There are two possible interpretations for such a change in the effects between the short and the medium term. Firstly, non-compliance may have weakened: Hedonic dislike may have waned as students got used to the taste of vegetarian food, and psychological reactance may have lessened as the public discussion on the vegetarian day petered out and the threat to freedom of choice thus became less salient. Secondly, it may be the case that, instead of weakening, non-compliance simply changed form. For instance, in upper-secondary schools, there was increased food waste in the short term and a reduced amount of food taken to the plate in the medium term. This may indicate that as students learned more about the taste of vegetarian food, those disliking it started to take less to the plate, which in turn reduced plate waste. Both these interpretations may be simultaneously valid.

A closer examination of the results reveals that the effects of the vegetarian day differed between school levels. In the short term, the clearest indications of non-compliance were found in lower-secondary schools, that is, among 13–16-year-old students whose participation in school lunches and amount of food taken to the plate decreased while plate waste increased. For this school level, while the decrease in participation persisted also in the medium term, the other signs of non-compliance disappeared. Moreover, a positive spillover emerged with an increase in the share of the vegetarian hot dish on days on which non-vegetarian food was also served.

Further analysis of the positive spillover showed that there were significant differences in the relative consumption of vegetarian hot dishes by school levels prior to the intervention, with the lowest levels in lower-secondary schools. This led to the formulation of a hypothesis that there may be a negative correlation between the pre-intervention share of the vegetarian hot dish and its absolute change in the medium term. This hypothesis was confirmed by statistical analysis. It was also found that, in the medium term, the vegetarian day reduced the differences between school levels in the relative consumption of the vegetarian hot dish on mixed-food days by increasing the share of the vegetarian hot dish in elementary and lower-secondary schools, which combined showed a positive spillover.

In addition to the pre-intervention consumption of vegetarian food, the differences between school levels in their reactions towards the vegetarian day may be explained both by different student populations and by different school lunch practices. The fact that lower-secondary schools were the only ones in which non-compliance emerged in all three key variables in the short term is in line with previous studies showing that the intense desire of adolescents for independence and their tendency to resent external impositions by authorities makes them more prone to psychological reactance (Elder and Shanahan 2006) while children are less susceptible to it (Rummel et al. 2000). In addition, in the case of elementary schools where non-compliance emerged only as a decrease in the amount of food taken to the plate, the stricter supervision by teachers during lunchtime and the prohibition to leave the school grounds may explain differences in compliance between these two school levels.

Finally, it is important to underline that a vegetarian alternative has been offered in all Helsinki schools on all days since the year 2007. The introduction of a mandatory vegetarian day in schools where vegetarian food represents a true novelty might show different results from the ones found in this study.

### Limitations and Suggestions for Further Research

There are certain limitations in the data that should be taken into account in the interpretation of the findings. First, since the data in this study cover only school lunch behaviour, it is not possible to assess how the consumption of meat, fish, and vegetables changed over the 24-h period. The effectiveness of choice restriction can be greatly reduced when it is implemented only in one food environment (for instance, the school cafeteria) while the restricted food is still available elsewhere. Studies registering food consumption also outside school hours (and outside school lunch by those students who skipped it) would be required to obtain a complete picture of the effects of the vegetarian day. Second, the medium-term results on compliance and non-compliance in this study are based only on a 1-day observation (on which, however, more than one different vegetarian dish was served) and are thus less reliable than the short-term results which are based on five observation days. The analysis of medium-term spillovers, however, relies on four days' observations and is therefore relatively robust. Third, the data cover only the short and the medium term. In order to obtain a fuller picture of the effects of the initiative, an assessment of its long-term effects would be important.

While the present study did not collect individual-level data, the fact that in lower-secondary schools there are, in the medium term, signs of both non-compliance and positive spillovers suggests that the vegetarian day may have affected different students in opposite directions within the same school level. It is possible that those students disliking forced restriction of food choice or the taste of vegetarian food the most have cut down their participation in school lunches, while students with weaker negative reactions have adapted to the restriction and even shifted their diet in favour of vegetarian food. These results are in line with the literature on bans which suggests that frequency of consumption prior to the intervention and the gender and age of participants are important factors that may explain individual-level differences in the effects of forced choice restriction. Future studies with individual-level data would be needed to better understand the effects of the Helsinki vegetarian day or similar initiatives.

Another interesting topic for further research would be to study the impacts of forced choice restriction as an element of a multicomponent programme as opposed to a single-component intervention as in this study. For example, in Gent (Belgium), the vegetarian day was not restricted to schools but was extended to the whole city and was launched with an

educational campaign as well as with a kick-off event meant to increase the visibility of the initiative (Leenaert unpublished). In Helsinki, on the other hand, the initiative was restricted to schools, and the introduction of the vegetarian day was not supported by educational campaigns, kick-off initiatives, or other events that would intentionally make it more visible. This might have reduced psychological reactance but also missed the opportunity to make pro-environmental values more salient.

This paper examined a subset of intended and unintended effects of the vegetarian day, namely its behavioural effects on individuals. However, the vegetarian day may have had other possible effects that would be important to study. For instance, it may have reinforced pre-existing positive and negative attitudes towards vegetarian food, thus polarizing students (social reproduction), or it may have activated sectors of society which oppose the vegetarian day (system activation) with a negative impact on the initiative and the consumption and acceptability of vegetarian food (see Cho and Salmon 2007). Furthermore, the focus of the analysis was on whether the vegetarian day achieved its immediate intended effect, that is, an increase the relative consumption of vegetarian hot dishes. An important topic for future studies would be to assess whether it also produced net environmental benefits, since this was the motivation for its institution.

### Policy Implications for Promoting Sustainable Food Consumption

In light of these results, can policies relying on forced restriction of food choice be expected to achieve their intended effects? The picture that emerges from the analysis is that forced choice restriction can produce the intended effects as in the case of the positive spillovers. However, at the same time, the risk of adverse unintended effects is clearly present: For instance, due to non-compliance, students may not get their nutritional requirements fulfilled through the school food they eat. Whether the intended or unintended effects prevail is likely to depend on how the forced choice restriction is designed as well as on the characteristics of the target group such as age, gender, socioeconomic status, or frequency and amount of consumption. The optimal design in turn depends on the causes of the unintended effects. Thus, forced choice restriction should be accompanied by detailed individual-level data collection to understand the possible causes of intended and unintended effects so as to better tailor the intervention to the intended audience.

For instance, if the main cause of unintended effects is psychological reactance, offering vegetarian food as the non-mandatory, default option once a week and leaving to the parents and students the possibility to opt out would most likely decrease such reactance and its adverse effects. In fact, abundant evidence from behavioural economics shows that people tend to stay with the default option anyway (Bernheim et al. 2011). This is also what happened in the case of the vegetarian day initiative in Gent, where the vegetarian day was introduced in schools as the default option and where 93% of all students stayed with it. Moreover, there was no evidence that those consuming the vegetarian option ate less of the main course compared with those who had opted out, nor that they compensated by eating more dessert or soups. (De Keyzer et al. 2012). If, on the other hand, hedonic dislike is the main cause of non-compliance, greater effort should be put into developing vegetarian hot dishes that meet the taste of students. If non-compliance stems from students disagreeing with the objectives of the vegetarian day or not believing that vegetarian food is less harmful to the environment, adequate moral suasion and information campaigns would be needed in support of the initiative.

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