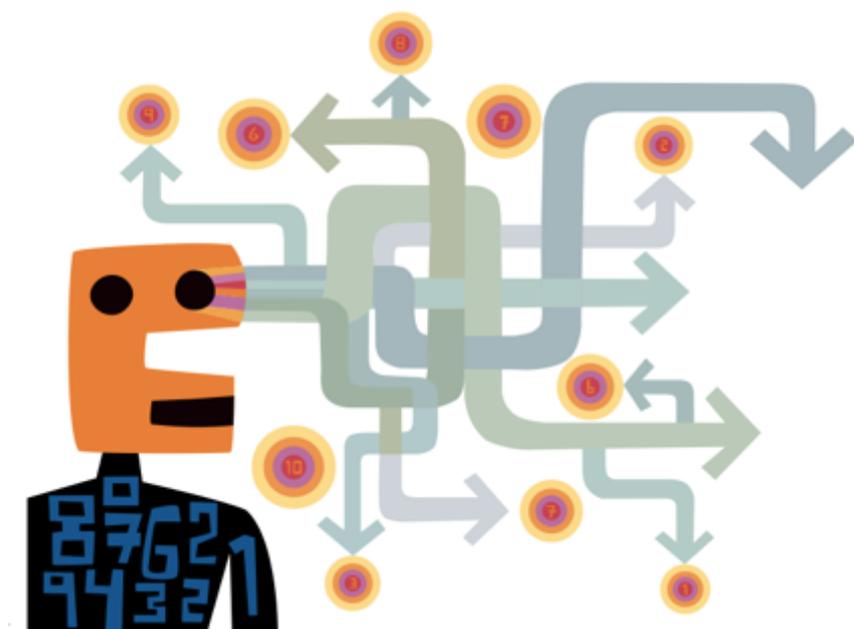


From Knowledge to Action

The behavioral insights of food choices: Influencing consumers to eat healthier

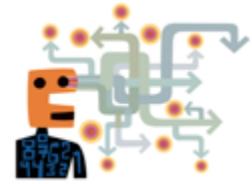


Knut Ivar Karevold, Samira Lekhal & Helena Berz Slapø

October 1, 2017



Management summary



Background: food choices and health

Food choices influence health and wellbeing, and unhealthy diets are among the main risks for loss of good living years.

The global burden of disease project shows that unhealthy diets increase the risk of developing non-communicable diseases (NCDs). Unhealthy food choices, high blood pressure and smoking account for the greatest disease burden in Norway. The objective of the Norwegian National Action Plan for Healthy Diets (2017-2021) is to increase the intake of fruits, vegetables, whole-grain products and fish, and to reduce the intake of saturated fat, sugar and salt.

This report is issued as part of the Norwegian competence project "From Knowledge to Action", focused on preventing overweight and obesity. Samira Lekhal (PhD)(Center for Morbid Obesity) leads this project which includes three initiatives on educating health personnel, educating teachers, and influencing consumers. The present report is published by GreeNudge in cooperation with the research institutes SIFO and Nofima. Knut Ivar Karevold (PhD)(University of Oslo & BI Norwegian Business School) leads this project, and the report is funded by Norwegian food providers, food producers and consumer authorities.

Focus: How contextual factors can promote healthier food choices

The recent years there has been growing interest in how behavioral and contextual interventions can promote healthy choices. Several publications from United Nations, World Health Organization, World Bank, OECD and the European Commission focus on how altering the environment can encourage healthier choices and behaviors.

Objectives: design health-promoting food contexts

The report summarizes scientific research on how contextual factors can influence consumers to make healthier food choices, and suggests how food providers in cooperation with researchers and health authorities can design and measure the impact of contextual interventions.

The report provides research-based evidence for behavioral food policies. It also links general health policy recommendations with research on which specific alterations of the food context that most

effectively seem to sway consumers' choices. Behavioral interventions focused on designing healthier food contexts seem like a promising strategy for promoting population health, as they can influence large population groups and are believed to be particularly effective in targeting vulnerable, lower-income population segments. Contextual interventions can help reduce social differences and social inequalities in health.

Although many studies suggest that altering the food environment can influence consumers' choices, the report concludes that the empirical evidence for supporting broader population focused interventions is limited. We need more scientific knowledge about how behavioral and contextual interventions can be designed, implemented and monitored.

The behavioral economics of food choices: How context can change selection

Many everyday choices are made quickly, intuitively, and impulsively. Contextual interventions build on the principles of behavioral economics and the dual-system cognitive framework. Based on behavioral insights, we can redesign the food decision context to increase the likelihood of healthier choices.

Contextual interventions involve changing how the healthy and unhealthy food options are presented, where they are placed, the order in which they are positioned, their price, and what information is provided about the alternatives.

The report discusses the opportunities and limitations of behavioral and contextual interventions, and suggests how behavioral food policies can be integrated with other policy measures to promote population health.

Randomized control studies on how context influences healthy food choices

The report identifies and analyzes more than 700 empirical studies on how contextual interventions influence food choices in grocery stores, restaurants and schools.

The studies examine how changes in the decision context or choice architecture affect food consumption. All the included studies are randomized experimental interventions that measure actual behavioral changes. The analysis includes 30 review articles and over 700 original articles, all published in peer-reviewed scientific journals. All the included studies are on a western population, but only a limited number of studies from Norway and the Nordic countries.

Based on our review of the research literature, the report first identifies the most studied and most effective contextual interventions in general. Next, the report reviews studies focused on interventions in three specific food contexts: grocery stores and supermarkets, restaurants and schools.

The four most studied interventions: Placing, Prompting, Pricing and Portioning

The four most studied contextual interventions are placing, prompting, price and portioning. The interventions seem to work independently, but also combination.

Placing refers to making the healthiest options more available and salient by placing them first, placing them nearer, or by adding more healthy options. Placing seems to have the most consistent effect, and stimulated consumers to choose significantly healthier in 60-100% of the studies.

Prompts such as signs and labels can focus consumers' attention on the healthiest options. This is the most studied contextual intervention, and we found significant variation in how effectively prompts can influence food choices. Labeling stimulated significantly healthier choices in 30-60% of the studies, and symbol labeling had a significantly greater impact than information-rich signs such as nutrition and calorie labels.

Price level and price changes can influence consumers, but the effects can vary depending on product categories, outlets and consumer groups. Price levels and price changes significantly affect what consumers choose in 50-70% of the studies, and the effects are different for healthy versus unhealthy options.

Portioning is a cost-effective way to help people eat less. Portioning stimulated consumers to eat significantly less or healthier food in 70% of the studies.

Consumers can be influenced in grocery stores and retail outlets

The review articles on grocery stores showed that placing, prompting and price can impact food purchases. However, relatively few studies examined the impact of contextual interventions in supermarkets and food retail outlets. The in-depth analysis of the original studies found a strong or medium effect in 80% of the included papers. Placement of healthy options seem to influence consumers, while changing the selection or range of options has a weaker effect.

Most of the studies on prompting showed medium effects sizes. Symbols and signs had a stronger effect than more detailed labels. Most of the studies concluded that health labels alone have limited effect, but may work in combination with other interventions. Labels that signal that a healthy option tastes good may be more efficient. Some studies found that health labels reduced the number of unhealthy choices, but did not increase the proportion of healthy choices. Customer magazines that promote and give discounts on unhealthy food options can increase sales of these products. Marketing of fruit and vegetables along with labeling can increase sales of healthier alternatives.

Studies on price and price changes show that price reduction on healthier alternatives may be more effective than increasing the price of unhealthy products. Some studies show that price reductions are particularly strong effect on fruit and vegetables. However, healthier products at a reduced price may not necessarily substitute unhealthy products. Price reductions may have unwanted side effects and cause the energy content of the shopping cart to increase.

Guests can be influenced in restaurants

The review articles examining different types of restaurants, buffets, cafés and canteens show significant variation in effect sizes of the interventions depending on the types of restaurants and how the interventions were designed. The in-depth analysis shows that contextual interventions had a medium or strong effect on food choices in 70% of the original articles.

In restaurants, guests can be influenced to choose healthier by the order, location and selection of options. Placement seems to have a strong effect in many cases. Some studies show that increased selection of healthy alternatives does not reduce sales of unhealthy options.

The effect of prompting and labeling varies. Studies show that health labeling of menus can influence guests in a healthier direction. Labels that make the food sound tasty can be more effective than health labeling. The studies on calorie labeling show weak effects, and in some cases even increased calorie intake.

Most studies on pricing showed a strong effect. Some studies found that price changes work best alone and that health labeling may weaken its effect.

Portioning can affect how much guests eat, and smaller portions can be an effective tool to help guests take the right amount of food. One study found that larger healthy portions and smaller

unhealthy portions reduced the guest's total energy intake. Some guests perceive large portions as more attractive. Other studies show that small changes in portion sizes can go unnoticed.

Children and adolescents can be influenced in schools

The review articles on schools show variations in how strongly contextual factors impact children and adolescents. Some conclude that contextual interventions such as placement, prompting and price have a significant influence, while others concluded that the research-based knowledge is too limited to draw clear conclusions. The in-depth analysis of school meals shows that 70% of the studies report a medium or strong effect of contextual measures on children's food choices.

Several studies show that better placement of the healthiest options can make these more attractive, and that increasing the numbers of healthy options can stimulate healthier choices.

Prompting and labeling the healthiest options with funny and catchy names can make them more appealing to children and adolescents. Price and payment systems can impact consumption of healthier choices in school settings.

Several studies show that contextual measures in combination with education can increase children's and adolescents' intake of healthier food alternatives.

Everyone can be influenced by food product composition and design

Product design impacts food choices independently of the setting and can influence choices. The in-depth analysis of product design and composition shows that 70% of the studies report a medium or strong effect.

Consumers more frequently choose products that easily accessible, and take less of alternatives that are placed further away. Peoples' food choice can also shift towards healthier options by creating new and healthier product variations, by changing the number of unhealthy and healthy options, or by changing how these options are presented.

Prompting and branding can affect consumers' perception of how healthy a product is. Health labeling may also cause consumers to overestimate products healthiness based on a single healthy claim or property.

Portioning can help consumers choose the right amount and composition of food. Many studies show that people have difficulty assessing the right amount of food or energy. Signals on packages, sizes of dinnerware, serving size and the food environment influence on people's eating behavior. Consumers may also be affected by the shape and color of the packages.

Conclusion: Contextual interventions should be tested and evaluated

Based on an overall assessment of the research included in this report, we recommend health authorities, food policy makers and the food industry to implement and evaluate contextual interventions. There is sufficient scientific evidence to support that contextual interventions can influence consumers towards healthier food choices.

We have identified a considerable volume and range of research evidence showing that contextual interventions may sway food choices. However, the research based knowledge on how these interventions work for Norwegian and Nordic consumers is limited. We also lack research-based knowledge on how different population groups are stimulated to choose healthier.

We need more systematic research-based knowledge on how contextual interventions can be used to impact different sub-groups and the long-term effects of these types of interventions on public health.

From knowledge to action: Dialogue and cooperation

The report can be used for dialogue and collaboration between health authorities, health policy makers, and the food industry on how to achieve the national goals for healthier food choices and diets.

Also, the report can be used for designing researched-based criteria to document how the food industry impact consumers' food choices. The report can also be used to evaluate the effects of existing interventions, to set committing targets for change, and to plan future measures promoting healthier food choices. The report provides examples of contextual interventions that can be translated to health policy practices.

Professionals in the education sector can also use the report to design schools that promote healthy dietary habits.

Note on the English translation

The original in-depth analysis of supermarkets and restaurants was done by SIFO, and Nofima covered the original in-depth analysis of schools and products. The structure and language of these sections have been slightly modified after the English translation.

All the original references are included, and the conclusions and recommendations are the same.

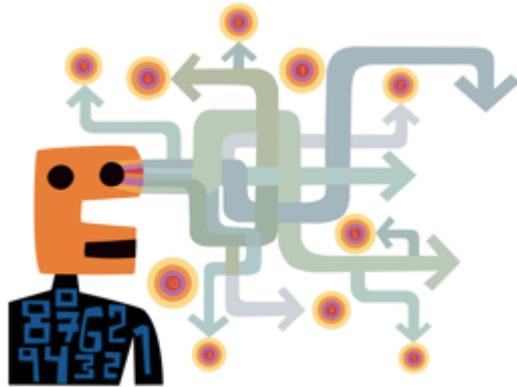
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Appendix can be distributed at request

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| <p>Title: From Knowledge to Action. The behavioral insights of food choices: Influencing consumers to eat healthier</p> | <p>Report no: 004</p> |
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| <p>Summary</p> <p>Background: A healthy diet is important for quality of life and wellbeing Healthy food choices and good diets have a positive impact on health and wellbeing, while unhealthy diets are among the main risk factors for disease and loss of good living years in Norway and the rest of the world. The global burden of disease project shows that unhealthy diets increase the risk of developing non-communicable diseases. Unhealthy eating, high blood pressure and smoking account for the greatest disease burden in Norway. To achieve the health policy goals, it is essential to reduce the intake of saturated fat, sugar and salt, and to increase the intake of fruits, vegetables, whole-grain products and fish. In this report, we analyze over 700 studies on how contextual factors influence consumers' food choices in grocery stores, restaurants and schools. The studies examine how changes in the food context impact purchasing and eating behaviors.</p> <p>Conclusion: Contextual interventions should be tested and evaluated Based on an overall assessment of the research, the report recommends that health policy makers and the food industry should test and evaluate contextual interventions. The four main changes that can change choices are placing, labeling, pricing and portioning.</p> <p>Grocery stores: In total, 80% of the studies showed that contextual factors influenced food choices. The studies on placing showed promising results. Point of purchase health labeling had a limited effect, and simplified labels had a greater impact than detailed labels. Price strategies alone, or in combination with other interventions, were particularly effective in influencing customers' food choices. Reducing the price for healthy foods seems more effective than increasing the price on unhealthy foods.</p> <p>Restaurants: About 70% of the studies showed that situational factors influenced food choices. Changing the placement and location of foods on a buffet and menu on food purchase. Labeling was the most studied intervention, and labels focused on taste seem more effective than health labels. Almost all studies found a strong effect of price. Portioning can effectively influence food choices and calorie intake.</p> <p>Schools: About 70% of the studies showed that situational factors influenced food choices for children and adolescents in schools. Favorable placing of the healthiest alternatives can make them more popular. Labeling healthy foods with funny and attractive names can encourage children to consume more. The effects of placing, labeling, price and portioning were mixed and showed no clear long-term effects.</p> <p>Product design: The design of a product impacts food choices independently of the context and is among the most powerful tool to sway food choices. Studies showed a strong effect of placing and labeling. Portioning is how the design of a food product helps consumers choose the right amount of food, and has a significant impact on food choices.</p> <p>The report shows that we have scientific knowledge suggesting that contextual factors seem to influence food choices, but there is need for more knowledge on how we can apply these interventions in Nordic countries. We need more knowledge about how contextual interventions can be designed to influence larger segments of the population.</p> <p>The report can be used as a basis for dialogue between health policy makers and the food industry. The ideas and examples in this report could be considered when designing new health policies. Additionally, the report can be used as a basis for researched-based criteria of how changes in outlets and stores affect consumers' choices. The report can also enable evaluation studie, for establishing targets for change, and to plan future interventions for healthier diets. The report can also be used by the education sector for designing healthy diet solutions for children and adolescents.</p> | |

0 Project information: From Knowledge to Action



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From Knowledge to Action by Samira Lekhal

“From Knowledge to Action” is a nationwide project to develop and implement actionable knowledge about life style diseases (NCDs) among children and adolescents in Norway. The project has three elements: 1) Competence development for health care professionals, 2) Competence development for professionals in the education sector, and 3) Influencing consumer behavior.

Element 1: Competence development for health care professionals. Norway has as the first country in Europe implemented a nationwide public educational program for preventing overweight and NCDs. The training for health care professionals is about guiding families suffering from overweight and obesity towards healthier healthier diets and more physical activity. The training focuses on how to talk about and address sensitive issues related to lifestyle and overweight, and how health professionals can use a web based tool (www.kostholdsverktøyet.no) in their work. A cross-functional reference group with a broad set of representatives from the public health sector coordinates this part of the project.

Element 2: Competence development for professionals in the education sector. This element consists of educational interventions for personnel in the education sector, mainly teachers and staff in elementary schools and kindergartens. The training builds awareness about the importance of good a good diet for life long health, knowledge about how to use Norwegian dietary guidelines in practice, and how to influence children and adolescents to make healthier food choices. This part of the project will also develop educational tools to support further implementation, and engage children in fun food-related activities. A cross-functional reference group with a broad set of representatives from the public educational sector coordinates this part of the project.

Element 3: Influencing consumer behavior. This present report (The Behavioral Insights of Food Choices) provides the scientific evidence for understanding how consumers make food choices. The report describes the behavioral insights of food choices, and how we can influence consumers to eat healthier. Such interventions can provide new potentials for enabling consumers eat healthier, might be particularly effective in influencing vulnerable groups. Behavioral interventions focus on designing health-promoting food contexts which increase the likelihood of healthier choices, without relying on regulations, tax incentives, information or education. Implementing such interventions require cooperation between commercial food providers and public health policy makers.

I hope that this report can inspire and stimulate further testing and implementation of contextual interventions for healthier food choices.

The behavioral insights of food choices: Influencing consumers to eat healthier – by Knut Ivar Karevold and Samira Lekhal

The idea for this report was conceived by merging our two complementary professional perspectives: medicine and health (Samira) and behavioral economics and business psychology (Knut Ivar).

From a medical and health perspective, many institutions and experts have suggested that contextual interventions are needed to solve the global obesity epidemic and the associated growth in NCDs and health care costs. It is argued that limited availability of affordable healthier options creates obesogenic environments that produce overweight and obesity among large population groups. Although several reports from UN and WHO suggest that healthier food environments are part of the solution for solving the global overweight challenge, we need more specific suggestions for what changes in the food context that could enable healthier food choices. This report is an attempt to bridge the gap between general policy suggestions and how food producers and food providers can sway consumers in a healthier direction.

From a psychological perspective, food choices can be understood from a behavioral economics perspective. Food choices are fast decisions, governed by the principles of intuitive decision-making. By understanding the logic of the intuitive and impulsive mind, we can change choices by altering the context where the choices are made. A nudge towards a better decision involves changing the decision architecture to promote the healthier options. In terms of food, this means that food providers need to be engaged to stimulate healthier consumer choices. Such changes need to be aligned with commercial and operational considerations among in the food industry. From the perspective of a business psychologist, this requires organizational changes related to business strategies and goals, performance management, leadership and operations. To nudge consumers, food providers need to see that they play a role in promoting healthy choices among their customers.

Thus, this report suggests how behavioral economics and business psychology can help solve a major societal challenge related to diet and population health. The implementation requires collaboration and dialogue between healthy policy makers and food providers. In Norway, the Directorate for Health and the food industry has entered an intention agreement for promoting healthier consumer choices. The parties have committed to stimulating consumers to make healthier choices.

The way this report has been conceived and produced is an example of how the food industry can be cooperate with researchers and public health officials. Norwegian and Nordic food providers financed this report, and their involvement made the results relevant. Following the publication of this report, the largest food provider NorgesGruppen has initiated a 3-year health promoting initiative focused on

contextual interventions for their supermarkets and restaurant businesses. Fazer Food Services has initiated a program for applying the behavioral insights of food choices for healthier and more sustainable food choices in their 1200 Nordic restaurants. The report is made in collaboration by three research institutions, and presented to an audience of public health officials, food industry managers and researchers.

We hope that the Norwegian approach to implementing the behavioral economics of food choices can inspire other countries to learn from this example.

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Norwegian contributors

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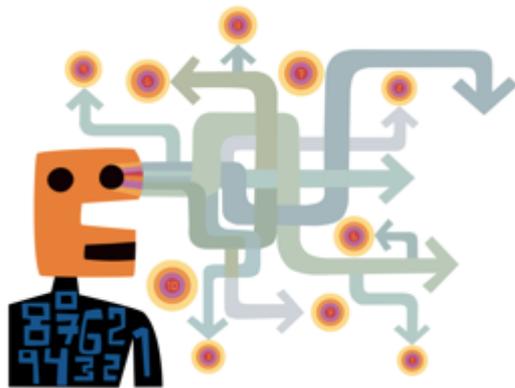
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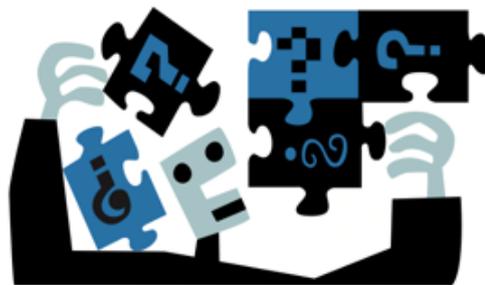
1 Introduction



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Main points



Background for the report

- Enjoying tasty and healthy food is important for health and the quality of life
- Poor diets are among the main risk factors for NCDs and poor health in Norway and the rest of the world
- Increasing interest for how behavioral and contextual interventions can promote healthier life styles

Objectives

- Argue why we need evidence based knowledge about behavioral and contextual interventions
- Communicate evidence based knowledge of how contextual interventions can influence consumers in supermarkets, restaurants and schools
- Suggest what specific contextual interventions can change consumers' choices

Target groups

- Health policy authorities, food industry, voluntary organizations, advisors and researchers

1.1 Background

Food choices influence health and wellbeing, and unhealthy diets are among the main risks for loss of good living years.

The global burden of disease project shows that unhealthy diets increase the risk of developing non-communicable diseases (NCDs) [1, 2]. Unhealthy diets together with high blood pressure and tobacco are the major health related causes of deaths in Norway [3]. Overweight and obesity are among the main health challenges, particularly among children and adolescent. Overweight increases the risk of cardiovascular diseases, premature death and risk of social disadvantages [4, 5].

The objective of the Norwegian National Action Plan for Healthy Diets (2017-2021) is to increase the intake of fruits, vegetables, whole-grain products and fish, and to reduce the intake of saturated fat, sugar and salt.

Health authorities have invested significantly in preventing NCDs through information, regulations and incentives. The recent years we have seen an increasing interest in how behavioral and contextual interventions could promote healthier food choices.

1.2 Purpose

The purpose of this report is to summarize scientific research on how contextual interventions can influence consumers' food choices and identify which are most effective.

The purpose of the report is to:

- Explain why we need more knowledge about how contextual factors influence consumer choices
- Communicate an overview of which contextual factors influence food choices in supermarkets, restaurants and schools
- Suggest how food policy authorities, food providers, and advisors and experts can use behavioral science solutions to design interventions and evaluate changes in choices

1.3 Target audiences

The target audiences for the report are healthy policy authorities, the food industry, and advisors and researchers. The report may also be relevant for educational authorities and voluntary organizations. The report communicates the existing research in a popularized style and language hopefully is comprehensible for all target groups.

1. Health and educational authorities

The report communicates research-based insights about contextual interventions that can influence how consumers choose food, and may open for policy interventions in addition to information, regulations and incentives. Such interventions may also be relevant for schools and educational contexts, and influence children and adolescents to make healthier choices.

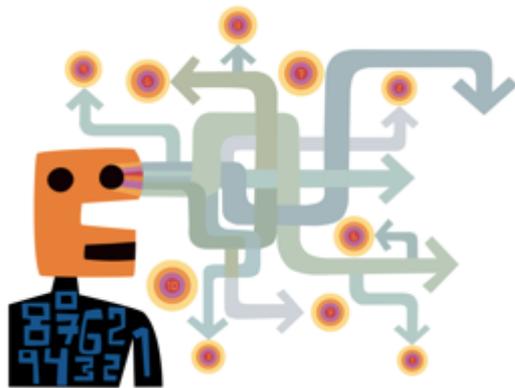
2. Food producers and food providers

The report suggests how the food industry in profitable ways can promote healthier choices and provide ways to promote CSR. The report also suggests measures and indicators that can monitor how health-promoting food outlets are designed.

3. Advisors and researchers

The interventions in the report can be applied to promote public health. As we will show later in the report, we still need more research to document the consistency and effectiveness of contextual interventions. We recommend that researchers and advisors become in designing interventions and measuring their effectiveness.

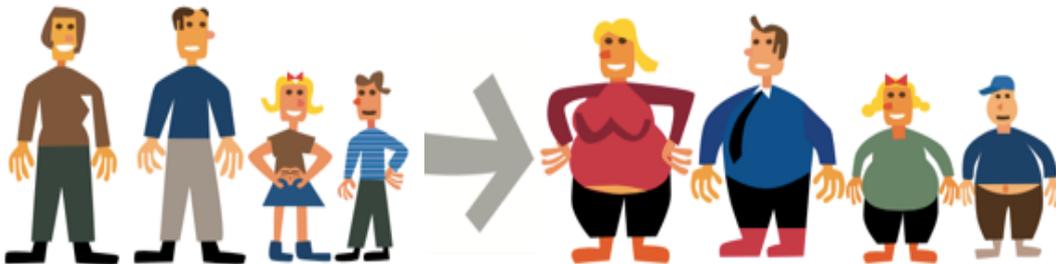
2 Solutions and strategies for healthier diets



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Main points



Unhealthy diets increase the risk of health problems and life style diseases

- Unhealthy diets are among the main risks of health problems and premature death
- It has been challenging to find effective strategies for preventing overweight and obesity
- The World Health Organization has set a target for reducing the prevalence of NCDs by 25% by 2025, and Norway has committed to this objective

Increasing optimism about the potential of behavioral and contextual interventions

- Recent international reports and recommendations suggest solutions inspired by behavioral economics to solve a range of societal challenges and policy issues
- Behavioral solutions involved changing the decision context in food outlets
- We need more research based knowledge about the effects and limitations of contextual interventions, and how these can influence health related behaviors of the larger population over time

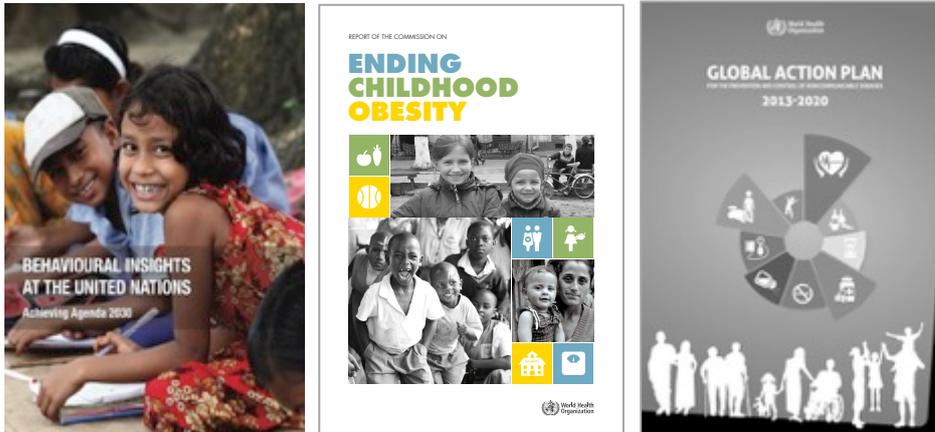
2.1 Solutions for population level changes towards healthier diets

Unhealthy food choices and poor diets are considered among top health challenges in many countries. Overweight and obesity is associated with increased health risks and Noncommunicable Chronic Diseases (NCDs).

The World Health Organization (WHO) has published the Global Action Plan for the Prevention and Control of NCDs 2013-2020 [6] aimed at reducing the prevalence of premature deaths from NCDs by 25% by 2025. This action plan [6, 7] focuses how the environment and context can make it convenient, practical and cost-effective for people to live healthier lives. WHO recommends that governmental agencies and food providers cooperate to make healthier food options available and cost-effective for consumers. In addition to health-promoting contexts, there are also recommendations for educational interventions, laws and regulations, and incentives to promote healthier choices. WHO also recommends more scientific research on causes and change mechanisms, and to engage behavioral scientist to better understand how consumers can be influenced to make healthier choices.

The WHO strategy for Ending Childhood Obesity [8] also emphasizes the influence of health promoting environments, and recommends changing contexts to promote healthier choices, making healthier options more easily available, labeling to make healthier options more salient, and using taxes to increase the price of unhealthy options. Further, WHO recommends regulations, information, education, and marketing restrictions to promote healthier choices and prevent unhealthy choices. WHO emphasizes schools as important for influencing children's consumption and formation of healthy habits, for example by making fresh drinking water freely available and restricting the access to unhealthy drinks and food. The strategy also emphasizes training of adults and caretakers to present and promote healthier choices for children.

How does the environment impact people's health?



Several recent reports have recently suggested that contextual changes and behavioral interventions can enable people to make better and healthier choices.

A recent economic analysis of health costs associated with overweight and obesity, and evaluation of the cost-effectiveness of different solutions for change, suggests that contextual interventions is the most cost-effective approach [9]. Changes in the food environment and food context are considered to have the greatest impact at the lowest cost. Such interventions are most effective because they rely on sub-conscious cognitive processes [10, 11], rather than the people's will-power and motivation. Example of contextual interventions include availability, placing, labeling, portioning and price. These can be combined with information and motivational programs.

A recent evaluation of European regulatory interventions for healthier diets concluded that these seem to have increased knowledge and awareness among consumers [12, 13], but not necessarily change what they actually choose to eat [14]. Changing the food environment and food context is considered an important future intervention strategy for promoting healthier choices [15-20].

2.2 The behavioral economics of food choices and contextual interventions

This report builds on the contextual strategies for healthier food choices, and extends our understanding of these by analyzing which specific contextual interventions seem most effective in swaying consumers' choices in a healthier direction. The report specifically investigates which of the contextual changes that empirical studies have found to be most effective.

Even though the research literature on food choices is cross-disciplinary and conceptually diverse, behavioral economics has recently been suggested as a common theoretical framework for how consumers are influenced by changes in the context. This perspective on health promotion assumes that people can be stimulated to make many, somewhat healthier food choices by small, unnoticeable changes in the food environment [20-22], and that the benefits will accumulate over time to ensure health benefits.

The basics of behavioral economics is presented and discussed in many other contemporary reports, books and publications. Behavioral interventions rely on the science of psychological and economic decision-making [10]. Although the scientific foundations for behavioral interventions seems strong – five Nobel prizes in the Economic Sciences have been awarded to behaviorally oriented scientists the recent years and there are numerous field examples that behavioral methods seem to sway choices, we still need empirical studies of how larger population groups may be influenced over longer periods of time [23].

Behavioral solutions seem particularly promising for health behaviors, and it is assumed that they can be particularly effective in targeting vulnerable population groups. In several recent reports (referanser) it is recommended to use behavioral interventions to influence those who live and suffer under poor life conditions [24-26]. Studies have found the prevalenc of overweight and obesity to be higher among vulnerable segments of the population [27].

What are behavioral interventions?



Behavioral interventions include a range of methods for influencing decisions that people make quickly, intuitively and by investing limited mental capacity [10, 11]. The recent years there has been growing interest in how such interventions can stimulate public choices from several sources [28, 29], such as the European Union [30], OECD [31], World Bank [25] and United Nations [26].

Behavioral interventions influence the consumers “at the moment of choice” in the context where they decide what to consume.

This distinguishes behavioral interventions from the interventions aimed at influencing consumers’ beliefs, preferences or motivations outside the consumption context, such as information, marketing and educational interventions [32].

Public information and commercial marketing attempt to influence the people prior to entering supermarkets, restaurants and schools where the actual choice of what to buy and eat is made [33]. Public health information and commercial marketing compete to catch the consumers’ attention and influence beliefs and choices. The same is the case in terms of contextual interventions; the same kinds of interventions can sway consumers towards healthy as well as unhealthy options.

This implies that public policy agencies need to cooperate with food providers to implement and evaluate how such interventions influence consumers in a healthier direction. Such interventions also need to be aligned food providers’ commercial and operational considerations. It seems difficult for health policy agencies to impose or regulate how food providers should implement health promoting contextual interventions in their commercial outlets. This is further discussed in the last section of the report.

2.3 Behavioral and contextual interventions: opportunities and limitations

The idea of using behavioral interventions to influence health behaviors is quite recent. Some are clearly very optimistic about the opportunities inherent in this approach, while others are skeptical. The question is to what extent behavioral solutions can be implemented in addition to or along with other governmental interventions such as regulations, information, education and incentives.

This report discusses the current empirical evidence indicating if and how consistently contextual interventions can influence peoples' food choices. If such interventions can change food choices, the next question is how they can be implemented within public governance and policy structures, and how commercial food providers could be engaged to focus on consumers' healthy choices, and what could stimulate such business organizations to implement contextual changes to achieve improved population health outcomes. Behavioral interventions can require changes organizational changes for food providers, and perhaps also new relations between governmental agencies and food providers. Thus is further discussed in the last section of the report.

Here we briefly discuss opportunities and limitations associated with behavioral interventions for healthier food choices. Several of the main points are not specifically associated with food choices, but with behavioral interventions in a policy context in general. The purpose is to highlight these considerations in terms of applying the insights from the present report.

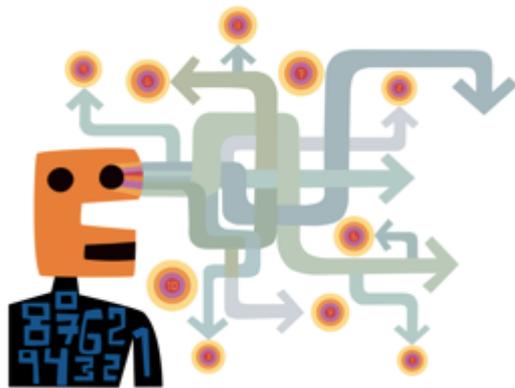
An important strength of behavioral interventions is that they are based on scientific research on how people actually make decisions and science-based evidence on how peoples' judgments are influenced by contextual cues and the choice architecture of the available options [10]. It is also promising that governments and public institutions have tested and evaluated behavioral interventions in larger scale field studies, and are providing an empirical knowledge base indicating their relative effectiveness [34, 35].

It is believed that behavioral interventions can add to policy interventions as they address how people make their choices [23, 36, 37]. It also argued that behavioral interventions are needed to counter other negative contextual influences that undermine good decisions [38, 39]. A recent European survey indicates that people feel favorably about nudges that help them make positive choices [40]. It is argued that behavioral interventions can be particularly effective in targeting vulnerable groups and those who feel indifferent towards behavior that is targeted [41].

The arguments against behavioral interventions are diverse [42-44]. In some areas, we do not yet have empirical evidence demonstrating their actual effectiveness. Even if case examples can suggest that they may be effective, there is need for more research on how larger population groups can be influenced over time. There is also need for more knowledge about how the methods might influence different population groups differently, and how consistently they work over longer periods of time [23]. There is need for more knowledge about how individuals or groups might be differently affected by the similar interventions, or whether some categories of interventions may be relatively more effective than others depending on target groups and contexts.

Also, the cost-effectiveness and relative effectiveness compared with other interventions is insufficiently understood, so they cannot yet solve larger and more complex societal problems [45], and other interventions might be more effective [46]. Prabhakar [47] fears that behavioral interventions can undermine the importance of learning, some have addressed the risk of unforeseen side effects [48], and the potential for unconscious manipulation of vulnerable consumers and groups [45, 49].

3 Consumer understanding: how context influences choice



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- 8 Implementation strategies: roadmap for healthier food choices

Main points



Factors that influence peoples' food choices

- Peoples' food choices are influenced by several factors – individual, social, contextual
- Consumers' choices are influenced by preferences and habits, mental models and needs – but also by how the food context is designed
- Behavioral economics explains how people make decisions involving limited cognitive and mental effort
- Such decisions can be swayed in a healthier direction by changing the decision context and making the healthier options more prominent and probable

3.1 The science of food choices

A range of factors – biological, psychological, social and societal, influence peoples' food choices [50]. The science of food choices is a cross-disciplinary field with a range of conceptual frameworks [51-56], some based on established models [57-60], some designed by individual researchers [61-63], and some based on quantitative research [52, 64]. In general, the explanations focus on the food products, consumers or context [53, 65, 66].

One of the most recent conceptualizations – the DONE framework [50], aims at providing an integrated overview of the cross disciplinary research on food choices. According to this framework, the science of food choices is dominated by three main disciplines: medicine/health science, nutrition science, and psychology/behavioral science.

Figure 1 below illustrates the relative number of scientific studies of food choices.

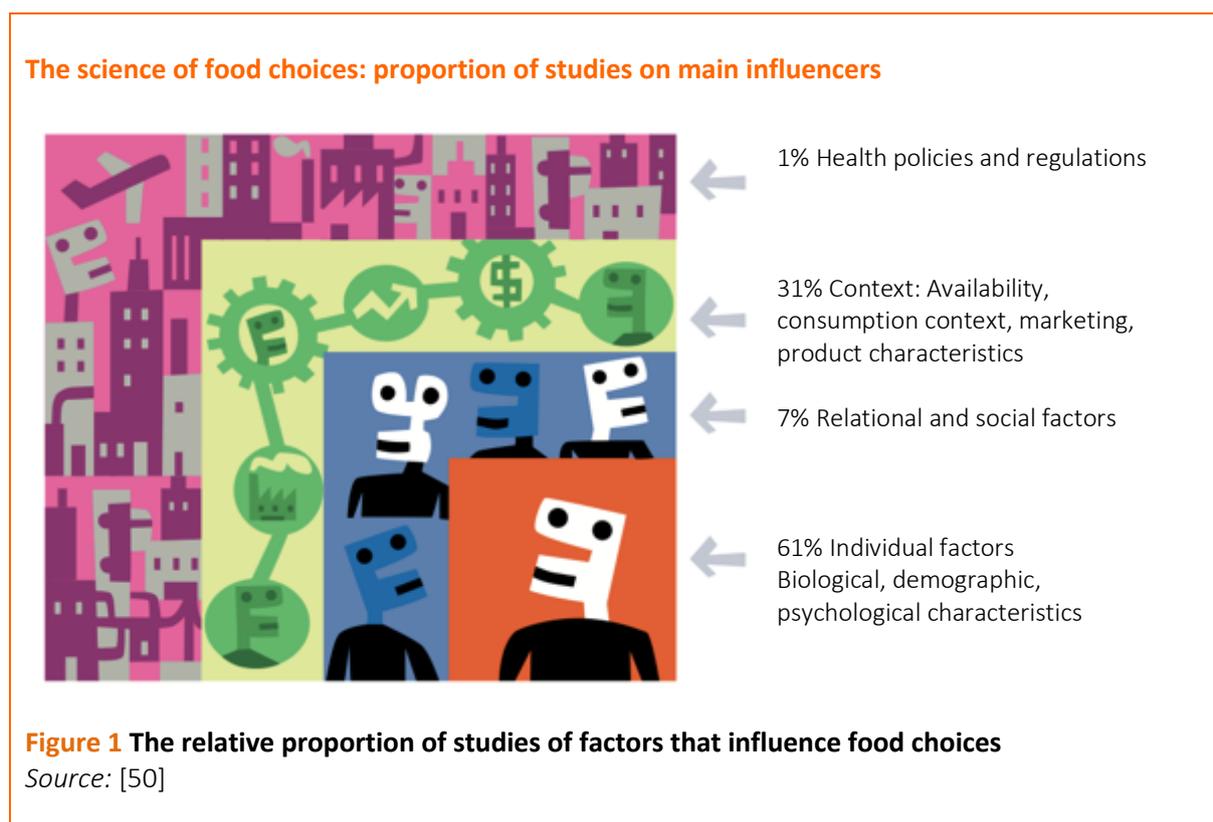


Figure 1 shows that there are most studies of how individual factors influence food choices, and second most studies and how contextual factors impact what people consume.

The DONE overview [50] shows that 61% of the influences are related to how individuals' biology, psychology and demography influence food consumption [67], while 31% of the known influences are contextual factors such as product characteristics and availability, consumption context and marketing [67]. 7% of the influences are relational, while only 1% of the scientific research has investigated the effects of policies and regulations.

This report thus addresses the second most studied set of influences, namely the context. As will be further discussed below, the science of psychology and behavioral economics addresses how situational influences in conjunction with individuals' beliefs, needs and expectations influence what foods are chosen and consumed.

3.2 The behavioral science of food choices: how contextual factors influence selection

The simplified model in figure 2 below illustrates how contextual factors are assumed to influence food choices. The illustration is inspired by other recent popularized presentations of the psychology of judgment [25, 68, 69] and dual-system models of decision-making [10, 11, 70, 71].

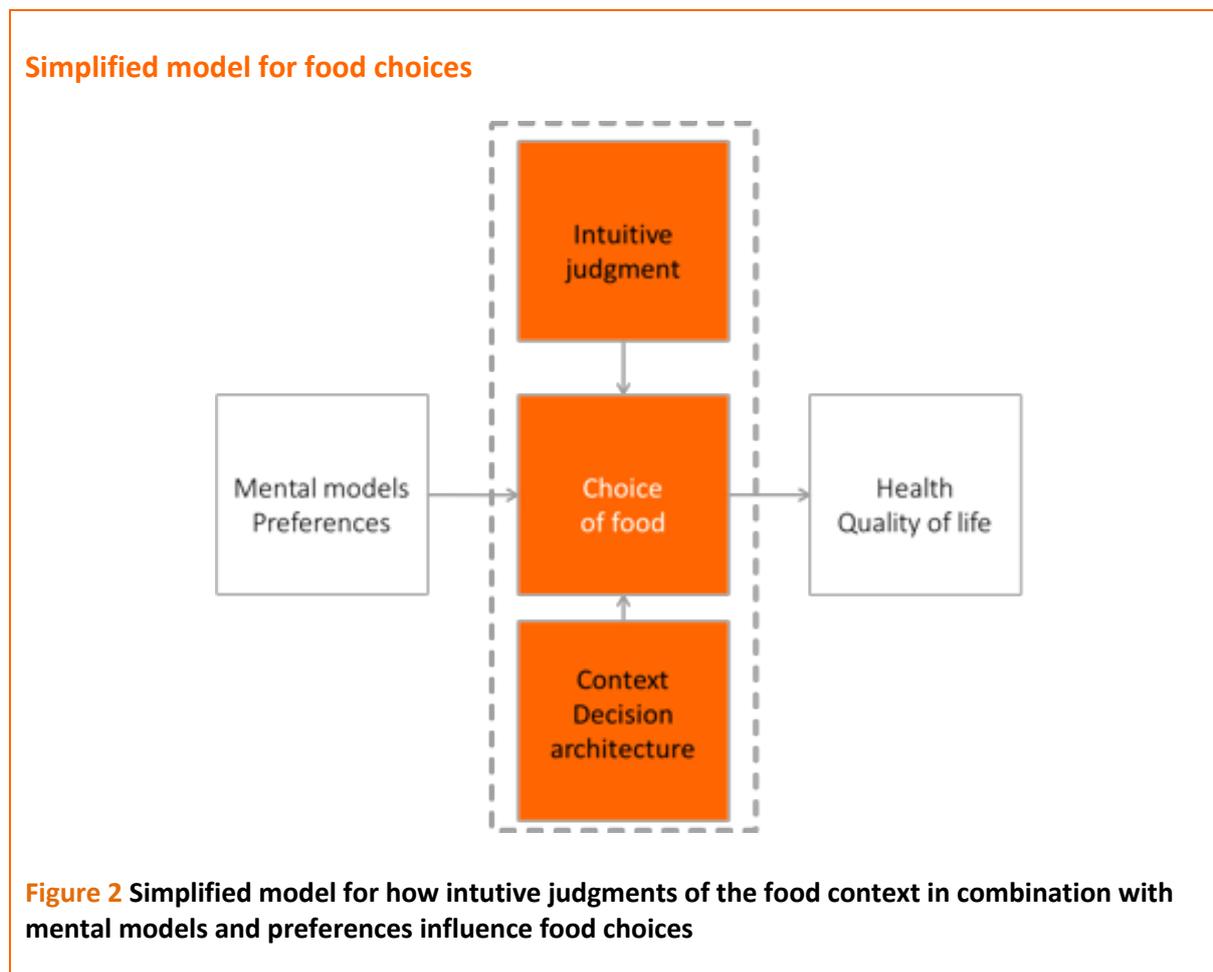


Figure 2 shows that situational food choices are influenced by the design of the context [72] and intuitive psychological judgments [70, 73-78], and that the consumers' preferences and mental models [79] also stimulate what is chosen.

The dual system model of decision-making [10, 11, 70, 71] suggests that the human mind has two modes of operation. System 1 is the fast, intuitive and associate mental processes, and System 2 that works slower, deliberately and analytically (ref).

It is assumed that System 1 guides many everyday decisions that people invest limited mental effort in [80], such as food choices [21, 81]. Recent research on food choices indicate that consumers invest limited resources in planning what to eat, have difficulties judging exactly how much they eat, and do not know what they have consumed [22, 75].

By understanding the principles of System 1 cognitive processes, choices can be swayed by redesigning how the options are presented [82]. As system 1 works automatically and associatively with limited conscious control, people are unaware how they are influenced by contextual stimuli. Important principles that guide System 1 decisions are selective attention, simplification of options, categorization, framing relative to reference points, and sensitivity to negative changes [69, 71, 83]. The concept of a nudge [38, 68] is based on behavioral science research on System 1 decision principles, and it assumed that choices can be influenced by changing how the options are presented, the order of options and the available information about the options.

3.3 The influence of preferences and mental models on situational choices

Cognitive and social sciences assume that people' knowledge, beliefs, expectations, needs and other individual factors, and social factors interact when contextual factors shape choices. Consumers' preferences, mental models and social networks can thus modify the effects of contextual interventions.

Preferences refer to knowledge, beliefs and habits that influence consumers' food choices independent of context [84-86]. A preference can narrowly be defined as what consumers like or prefer, or more broadly refer to what people typically eat, when they eat and how much they eat [87]. Some preferences can be biologically or genetically influence, while others are learned.

Mental models refer to consumers' knowledge, beliefs and assumptions about food and consumption [88]. Mental models save effort and mental resources by providing simplified categories, prototypes, stereotypes and explanations; they reduce uncertainty and doubt about what is the right choice. Mental models can promote conservatism and prevent change [89], and may not necessarily be influenced by diverging, inconsistent or new information [79]. Related to food choices, mental models can influence what consumers judge to be healthy and how they believe such products should be purchased and consumed, or to how internal or contextual cues activate different sets of mental models that influence healthy choices [90].

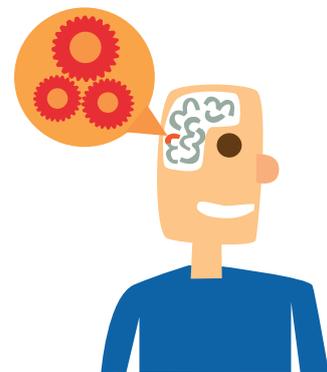
Peoples' choices can also be influenced by social relations, networks, norms and social incentives [91, 92]. Social norms can influence food choices [93]. Social networks can influence beliefs, preferences and choices [94]. Social norms increase their influence when they are clear, communicated as normal and as reminders [92]. People can be influenced by what they believe others eat, [95, 96], even if they dine alone [97, 98]. Eating with other influences peoples' consumption [99], and people will eat more if others' portions increase [100].

How do people choose food quickly and intuitively?

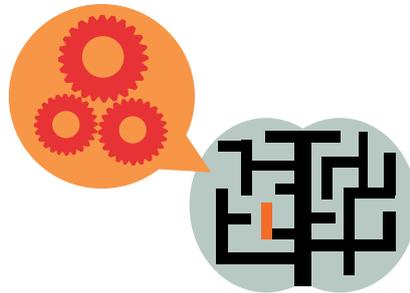
Intuitive judgments of food take place quickly, associatively and based on only parts of the available information. Some aspects of the evaluation process is perceptual, and involves limited cognitive processing [101, 102].

Three aspects of the psychological judgment process are focusing, categorization and evaluation [103]. Focusing involves selective attention so that only some elements of the available information is taken into consideration. Categorization means that the food is psychologically classified as belonging to a group of food options, and information about its characteristics is added based peoples' assumptions and beliefs. Evaluation judging the attractiveness of the food. The judgment process is automatic with limited conscious awareness, and most consumers do not know how much they actually have eaten during a typical day [102].

By understanding how consumers' intuitively judge food options, we can design more effective interventions. Changing the food context can slightly sway peoples' choices in a healthier direction, and over time produce significant health benefits – without people being aware that they have made healthier choices.



How to design effective interventions



How do peoples' beliefs about healthy foods influence them to eat better, but also perhaps less healthy decisions about what to eat?

Some people underestimate the number of calories in healthy dishes, and eat more – and can also overestimate the energy content of unhealthy options. A group believed they would gain more weight by eating a small Snickers bar every day (=47 kcal) than by consuming 2,5 dl of cottage cheese, 3 carrots and 3 pears per day (=569 kcal) [104], while another group estimated the number of calories in a hamburger to 761, but only 583 kcal in the same hamburger and a salad [105].

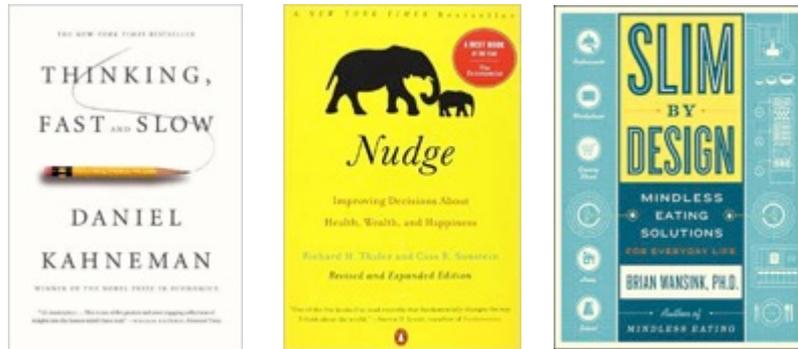
Health labels can stimulate people to eat more. One group ate 35% more of the crackers labeled a "oat" compared with "gourmet" [106]. Wansink and Chandon [107] found that people ate more and thus consumed more calories when candy was marked as "low calorie".

People who have made one healthy choice, believe that they can indulge themselves in more of the unhealthy alternatives. This effect can be enhanced by limitations in peoples' knowledge about the actual health value of different food options. A group who ordered a "healthy" sandwich with salad (containing about 900 calories) chose a dessert containing 110 calories, and another group who ordered an "unhealthy" hamburger (containing 600 calories) reduced their dessert order to half (48 calories) [108].

Health labeling can also cause resistance among consumers, so they avoid, deny, or repress such information [109]. Wansink [22] found that calorie labeling of healthier fast food options influenced overweight individuals to eat more, probably because they overestimated their energy need.

A recent study shows that people are more sensitive to reduction of portion sizes compared with increases [110]. This might influence how consumers react to changes in products, and help design changes that enable consumers to not over-eat.

What is a nudge and how to nudge food choices?



The concept of a nudge is influencing choices through changes in the decision context was introduced in the book "Nudge" [82] in 2008. A "nudge" is defined as *"any aspect of the choice architecture that alters behavior in a predictable way without forbidding any options or significantly changing their economic incentives. A nudge must be cheap and easy to avoid"*.

In this report we use the term "contextual interventions" synonymously with "nudges", as both concepts refer to designed changes in the situation where the choice is made. Our review of the literature exemplifying nudges shows a partly overlap between generic nudges and nudges that seem to influence food choices.

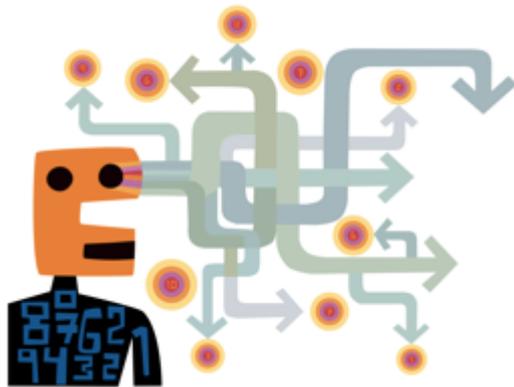
These are examples of generic nudges suggested by Cass Sunstein [111]:

- Default rules
- Require active choosing
- Prompting choice
- Simplifying active choosing
- Providing reminders
- Priming
- Eliciting implementation commitments or commitments
- Social norms
- Ordering effects
- Convenience
- Framing
- Anchoring
- Warnings
- Visual effects
- Check lists

For complete list, please see page 718 in [111].

Brian Wansink has identified several contextual and behavioral factors that influence peoples' food choices. Mindless Eating [75] explains how people in many cases are unaware of how they choose and consume, and Slim by Design [22] shows how changes in the food context can change choices.

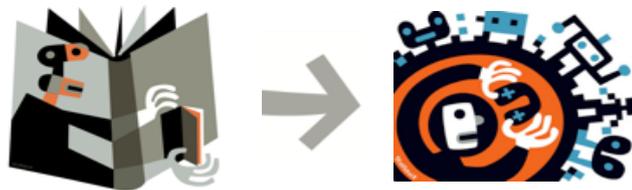
4 Method



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Main points



Research strategy

- Overview of the empirical evidence as foundation for communication and decision making
- Provide a broad overview of the proportion of studies that indicate that contextual interventions can sway choices
 - Identify the most effective contextual interventions based on analysis of 30 review articles citing 546 original studies
 - Clarify what interventions seem most effective in supermarkets, restaurants and schools. Analysis of empirical studies and review studies of supermarkets (43 studies), restaurants (42 studies), schools (84 studies), and products (40 studies).

Criteria for inclusion

- Randomized experimental studies published in peer-reviewed journals of how changes in food context or food micro environments influence purchasing or consumption behaviors
- Objective changes in food choices in terms of increased number of healthier purchases, increased proportion of healthier choices, healthier food ingredients, or conversely less unhealthy choices
- Studies of normal population in western countries
- Criteria for healthier choices based on public Norwegian guidelines

4.1 Research strategy

We have summarized and analyzed the empirical evidence on how contextual interventions can influence healthier food choices based on a rapid review approach [112-119]. This approach is suitable for providing overview of a knowledge area, particularly for decision-making, designing interventions and for communication purposes.

The main steps in the rapid review approach are systematic search in relevant data bases based on key words, selection of the most relevant studies, qualitative assessment of the results, and qualitative summary of the conclusions and recommendations.

We used two complementary search strategies for identifying relevant papers and studies – the snowball approach and open search [120], which is the same approach as a recent rapid review [121]. The snowball approach is to identify the most recent reviews and further search based on the most relevant references in these. An open search to search for studies based on defined key words in designated databases (see [120-123]).

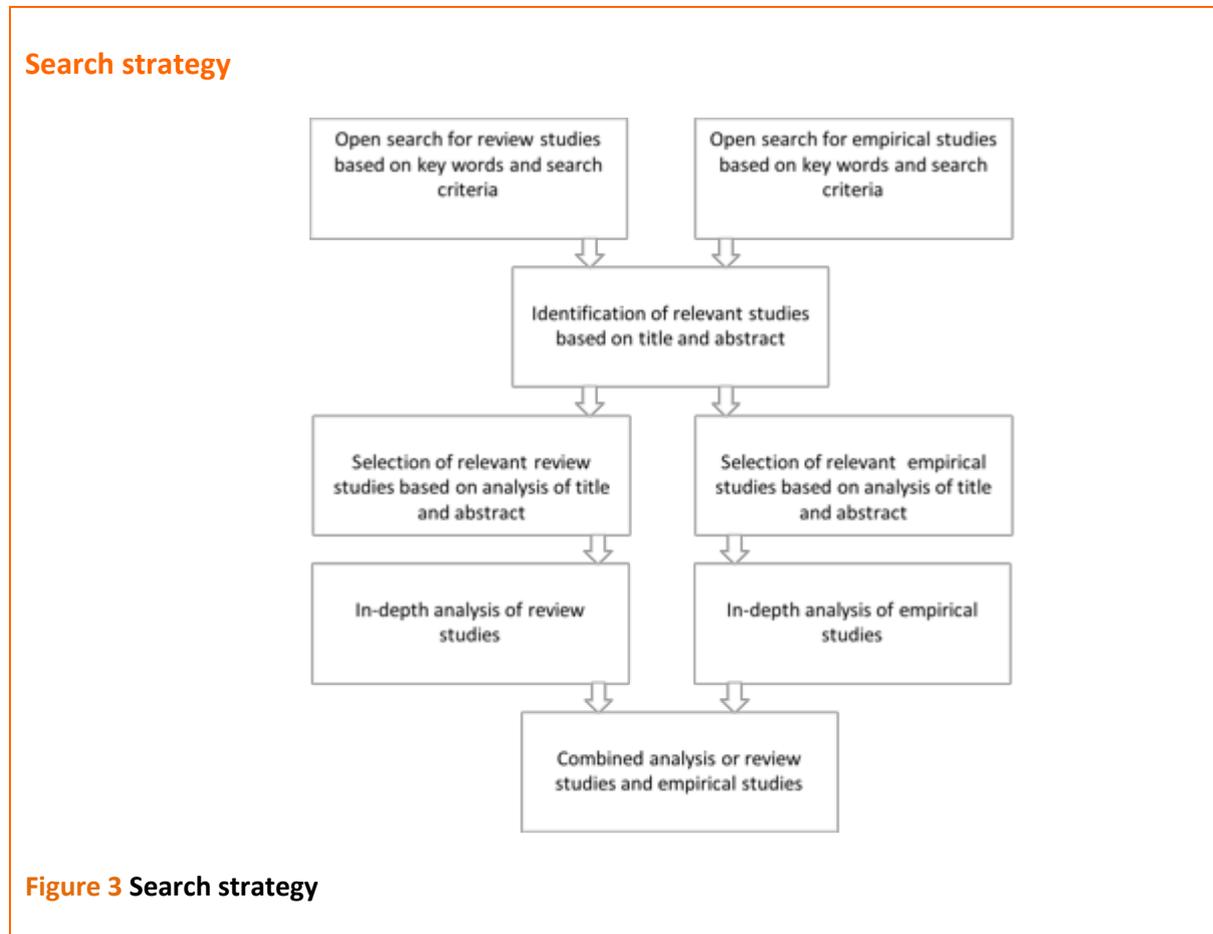
A team consisting of three research units in Norway completed the literature search. GreeNudge searched for review articles on behavioral and contextual interventions in general and for reviews related to each of the food contexts supermarkets, restaurants and schools. SIFO searched for original empirical studies in supermarkets and restaurants, while Nofima searched for original empirical studies in schools and for product design. During the search we coordinated key words, databases and results.

This search strategy provides a systematic and complementary overview of the empirical studies. The review articles provide an overview of the current scientific knowledge, based on a critical selection of the most relevant original studies, the most consistent empirical results and provide conclusions based judgments of several studies. The original studies provide more specific information about how the contextual interventions were designed and a more nuanced image of how such interventions can work in practice.

Based on the initial search, relevant papers were first selected and reviewed based on title and abstracts. Selected articles were then more thoroughly analyzed focused on research questions, methods and results. Definition of search words, identification and selection of articles was done by

two researchers in each of the research groups GreeNudge, Nofima and Sifo. In addition, the GreeNudge, Sifo and Nofima reviewed the searches done by the other partners.

Figure 3 below illustrates the research strategy.



4.2 Search criteria

The search for review papers on contextual interventions and food choices was conducted based on these search words: review, summary, food choice, health, decision architecture, nudge, supermarket, grocery, restaurants, schools, products. The search for original articles on context and food choices in supermarkets, restaurants, schools, and for food products was conducted based on these search words:

- Supermarkets: Food choice, supermarket, grocery, health, intervention
- Restaurants: Food choice, restaurant, cafeteria, health, intervention
- Schools: Food choice, school, health, intervention
- Products: Food choice, product, health, intervention

Context was defined environment, surroundings or situation where the food items were purchased or consumed, consistent with the definition of “micro environment” [121].

We included only randomized empirical studies that measured how actual changes in the environment were associated with actual changes in food choices or behavior. There were no restrictions on what categories or types of contextual changes should be included, as long as the changes were made within the physical context of the retail outlet, restaurant or school. We therefore excluded all interventions done outside the contexts and that could influence the consumers before they entered the supermarket, restaurant or school – such as public information, marketing or any other approach to change knowledge, mindsets or needs related to food choices. We also excluded studies on how consumers’ perceptions, beliefs, intentions and self-reported behaviors. In terms of product design, we included studies that investigated changes in the size, shape, price, labeling, presentation and portioning of the product, but excluded studies of how changes in product composition or product components could influence consumers’ preferences and choices. We only included scientific publications in peer-reviewed journals, and excluded studies and results from reports, popularized journals and other similar publications.

Specifically, these are the inclusion criteria for the studies:

- Randomized experimental studies
- Studies of the association between contextual interventions and purchasing or consumption choices based on objectively verifiable information about actual changes
- Studies published in scientific publications with peer review
- Studies in all categories of food outlets, including computer simulated purchasing studies
- Studies where healthier choices were defined as an increased number of healthier decisions and reduced number of less healthy decisions, or studies where the proportion of healthy versus unhealthy products changed, or where more healthy or less unhealthy products were selected. [120]. Healthier food products were defined as those with lower energy density, less salt or sugar or fat, and healthy fresh products such as fruit, vegetables and seafood and whole grain products
- Studies on a normal population, and excluding interventions focused on sub-groups of consumers or consumer segments (i.e. patients suffering from overweight or obesity, participants in weight reduction programs, patients with diagnosis such as diabetes or other illnesses)

- Studies on populations in western countries, mainly USA and Europe, but also Australia and South Africa
- Studies published mainly the last 10 years, from 2007 to 2017
- Some of the included studies applied combinations of contextual interventions, or combinations of contextual interventions and marketing and information activities. These were included in the review, but only the effects of contextual interventions included in the analysis.

4.3 Selected review and original studies

Table 1 below shows the number of review articles and original studies selected for further analysis.

Table 1 Number of identified and selected papers for analysis

| | Review articles | Supermarkets | Restaurants | Schools | Product |
|-----------------------------|-------------------|--|----------------------|--|--|
| Number of identified papers | 36 | 153 | 283 | 147 | 118 |
| Number of analyzed papers | 30 review studies | 43 empirical studies 6 review studies | 50 empirical studies | 47 empirical studies 6 review studies | 31 empirical studies 9 review studies |

We identified 36 relevant review articles. 30 of these were selected for further analysis, as they were based on original studies that matched the inclusion criteria and contained sufficient information about context, intervention, and effect sizes to be coded according to the analysis strategy for the review article described below. The 30 included review articles were based on 737 original studies, but there were several duplicates between the selected reviews. When these were removed, our analysis was based on a total of 546 unique original articles. The six review articles that were not included summarized the research literature based on qualitative approaches where it was difficult or impossible to trace and code the conclusions based on the included original studies.

For the analysis of the supermarket context, we identified 153 relevant articles, and selected 43 original studies and 6 review articles for further analysis.

For the analysis of restaurants, we identified 283 relevant articles, and selected 50 original studies for further analysis.

For schools, we identified 147 relevant articles, and selected 47 original studies and 6 review articles for further analysis.

For the analysis of product design, we identified 118 relevant articles, and selected 31 original studies and 9 review articles for further analysis.

Some of the selected review articles relevant for the overall analysis of interventions and contexts were also found to be relevant for the in-depth analysis of each context and were included here as well as the analysis strategies considered complementary. Appendix A lists which review articles included in both analyses.

4.4 Analysis of the selected review and original articles

The analysis of the review articles and original articles was done according to established procedures for rapid reviews, see Bucher et al [121] and Glanz et al [122]).

For the analysis of the review articles, we started by designing the structure and logic of the outputs and tables, and defined what information was to be extracted about each of the original studies included in each of the reviews: context, category of intervention, number of consumers and effects. Context refers to where the study took place; supermarket, restaurant, school or other sites. Category of intervention refers to placing, prompting, price, portioning or any other intervention. Below we further explain how we defined these interventions. Number of consumers refers to how many people were included in the intervention or study.

Effect refers to whether the intervention was associated with a statistically significant change in food choices. We used three codes: statistically significant effect, non-significant effect and interventions with “inconsistent” effects. Some studies tested several interventions, several versions of the same intervention, or the effects on different segments or locations of consumers. Where the studies reported interventions with some statistically significant effects and some non-significant effects, this was coded as “inconsistent”. When we started this analysis, our plan was to extract information about objective changes in consumption (i.e. how much more or less was chosen), but this information was not available in the majority of the included studies.

A colleague verified the coding of the 546 original studies. The codes for first entered a spreadsheet, and next transferred to SPSS24 for statistical analysis. Appendix A provides additional information about which original articles were included in this analysis.

For the analysis of the original articles, we started by designing the structure and logic of the outputs and tables, and defined what information was to be extracted about each of the original studies included in each of the reviews: category of intervention, effect size and any inconsistent side-effects such as overconsumption. For the original articles, we used three qualitative categories of effects: strong, medium and weak effects. Strong was defined as statistically significant effect, inconsistent as an effect on some consumers or some versions of the intervention, and weak effect as non-significant change.

The included original articles were coded, and the information entered to results tables that can be found in Appendix B-E. This information was transferred to a summary table (see the results section) and analyzed further.

GreeNudge, SIFO and Nofima first completed the analysis of the review articles and original articles for each food context as separate analyses, and we then jointly evaluated all the included research and designed the conclusions and recommendations based on the review articles and original articles.

As part of the publication process, all the included original studies have been peer reviewed and evaluated to have sufficient scientific quality. Further, all the review articles the research quality of the original studies and noted several concerns and limitations. It is beyond the scope of this report to provide an additional independent and systematic evaluation of the quality of the included studies. We have registered that the review papers note a significant variation in study quality, which and that this can limit the validity of the research findings.

To ensure the scientific quality of our review and analysis, we sought assistance from international and Norwegian researchers representing psychology, food, health, policy, and nutrition research. The international experts reviewed and commented on the selection of original and review studies to be included, and the Norwegian experts reviewed previous versions of the report. The international experts were Professor Brian Wansink (Cornell Food and Brand Lab), Professor Pierre Chandon (INSEAD) and Professor Alberto Alemanno (HEC). The Norwegian experts were Jon-Arne Røttingen (FHI), Knut-Inge Klepp (FHI), Jan Ketil Arnulf (BI), Jan Frich (UiO), Liv Elin Torheim (HiOA), Ingunn Sandaker (HiOA) og Pål Johan Karlsen (Psykologisk.no).

4.5 Analysis and definitions of contextual interventions

One of the main purposes of this report is to communicate how contextual changes in food outlets can influence consumers to choose healthier to a broad audience of policy makers, managers in the food industry, experts and advisors in the field, and researchers from different disciplines such as health, nutrition and psychology. We therefore decided to frame the interventions focused on the actual observable changes in the food context, and not describe the interventions in terms of psychology or behavioral economics. We believed it would serve the purposes of the report best to use concepts and terms that easily could be understood by lay people as well as expert readers.

Further, our goal was to allow the empirical studies to influence what categories of interventions we would define. We also aimed at identifying categories of interventions that could be relevant across the different food contexts supermarkets, restaurants and schools, also to simplify the communication of results and implications.

We applied a qualitative approach to define the main and sub categories of interventions and started by analyzing concepts and definitions in the review articles. We observed significant conceptual variations; similar interventions were named differently, or clearly different interventions were named similarly. Some definitions focused how the context was changed, while others focused on the psychological mechanisms that were assumed to influence the consumers' choices.

Two independent researchers worked to produce their lists of interventions, and these were compared and coordinated. We re-read the review articles, adjusted and updated the list.

We also reviewed concepts and terminology in popularized textbooks, such as the P's of marketing "Product, Price, Promotion & Place" [21, 22, 75, 122] and such as Professor Brian Wansink's CAN-framework (Wansink [22]): Convenient, Attractive and Normal.

To simplify communication of interventions, we decided to adjust the P-framework and ended up with four main categories of contextual interventions: Placing, Prompts, Price, and Portioning. These are the four most tested and evaluated interventions in the literature.

Placing refers to how the healthier alternatives are positioned, such as where they can be found in the food area, in which order they are presented, and how many varieties are placed together and available for the consumer. Prompts refer to signs, labels and emblems placed on or beside the food

options or presented just before the consumers enter the area. There are two main categories of prompts: signs and symbols, and information rich labels and emblems. Price refers to price level, price reductions or price increases. Portioning refers how the consumer is guided to select or consume certain amounts of the food choices.

For the other terms and concepts in the literature reviewed, we categorized changes in food product in terms of what is available as an element of Placing. As discussed above related to inclusion criteria, we did not include studies where the composition or recipes of the specific food products were changed.

For priming – referring to signs and stimuli that can influence consumers just before they enter the food context, we found relatively few studies of this intervention and decided to name this a sub-category of prompts.

Promotion, marketing and public information may influence consumers’ beliefs, purchases and consumption; as such interventions take place before the consumers enter the food context, they were not included in our analysis. One variety of marketing interventions, namely customer magazines were included in the in-depth study or supermarkets as consumers may bring these along or find them in the outlet, and can thus be influenced by the information in them.

The image, branding or identity of the place where food items are sold or presented may also influence consumption; this was considered a similar kind of intervention as marketing and not included in this analysis.

The analysis of the review articles was thus based on these categories of contextual interventions:

| Placing | Prompts | Price | Portioning |
|---|--|----------------------------------|------------|
| General Distance Order Selection | General Sign/symbol Information Priming | General Reduction Increase | Portioning |

Contextual interventions that can sway



- Placing. How available and convenient the healthier products are positioned, in which order they appear, how near the consumer they are placed and the number of options available to choose from.



- Prompts. Alle kinds of signs and labels placed on or close to the food options. The two main categories are information rich signs with nutrition information, calorie information or similar, or simple symbols or signs such as the key-hole, traffic lights, stars or smileys.

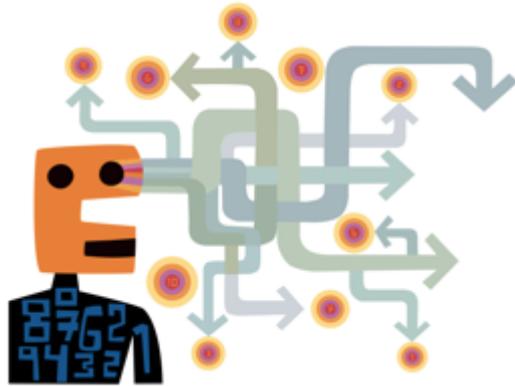


- Price. Price refers to price level, price discounts for healthier items or price increases for unhealthy items.



- Portioning. This refers to any kind of physical, visual or other cues that help consumers decide how much is sufficient to eat.

5 Results: overview of contextual interventions that influence consumer choices



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Main points

The most studied contextual interventions

There are most studies of prompts, signs and labels (39%), and then placing (15%), price (12%), and portioning (12%)

The most effective contextual interventions

- Placing. This seems to be the most effective intervention: 60-100% of the studies reported significant effects.
- Prompts. Simple signs and symbols seem most effective: 60% of the studies reported significant effects. Information rich signs are relatively less effective: 25% of the studies show significant effects.
- Price. Price levels and price changes can influence choices: 50-70% of the choices reported significant changes in choice.
- Portioning. Portioning can have an influence on healthier selections: 70% of the studies showed significant changes

5.1 Overview of the scientific evidence

This chapter provides an overview of the research on behavioral and contextual interventions for healthier food choices in supermarkets, restaurants and schools. The chapter is based on an analysis of the 30 most recent and relevant scientific review articles. In total, these reviews considered 48730 original studies focused on food choices in general and 4187 studies on contextual influences. 737 studies focused specifically on how changes in context influenced changes in consumers' choices. When we removed duplicates between the 30 reviews, our analysis included 547 original studies.

The chapter provides a general overview of effect sizes independent of the extent and quality of the included studies. We have not performed an independent analysis of the scientific quality of the original studies, and refer the review articles for further discussion of this. In general, we observed significant variation in the quality and extent of the included studies. The least extensive studies focused on the choices of less than 100 consumers during one meal, while the most extensive focused on more than 100 000 consumers' choices during several months. There is clearly need for more research on how larger population groups are influenced to choose differently over longer periods of time.

As the scientific publication process typically favors studies that demonstrate significant effects, it is reason to believe that the present analysis provides a positively biased picture of how strongly consumers are influenced by contextual interventions. Studies with negative or inconclusive results may not have been published in the first case, and are thus not represented in this analysis. Appendix A provides more detailed information about the analysis and results.

All of the included studies investigate the effects of at least one contextual intervention, while nearly half also included the effects of at least one additional intervention in combination.

Table 2 Number of studies of single interventions and combinations of interventions

| Interventions | Single Intervention | Combination Intervention |
|---------------|---------------------|--------------------------|
| Placing | 15% | 20% |
| Prompting | 39% | 24% |
| Price | 12% | 15% |
| Portioning | 12% | 6% |

Comment: Percentage of interventions that were single interventions and combinations of interventions in the 547 original studies

Table 2 shows that we found most studies of how prompts and labels can influence consumer choices, both as a single intervention and intervention in combination with other interventions. Portioning is the least studied intervention.

5.2 Overview of effects of contextual interventions

The table below summarizes how many of the included studies show a significant effect of the contextual interventions. The table provides an overview of the proportion of studies that demonstrate a statistically significant effect and the proportion of studies that show a variable effect of the contextual interventions. The table distinguishes between studies with one single intervention and studies with combinations of two or more interventions.

Significant effect refers to a statistically significant change of choice. Inconsistent effects to studies where some but not all versions of the intervention had a significant effect, or where some groups consumers were significantly influenced to change choices but others were not affected.

Table 3 Percentage of studies that show significant effects of contextual interventions

| Contextual Intervention | Single intervention | | Combination interventions | |
|-------------------------|---------------------|---------------------|---------------------------|---------------------|
| | Significant effect | Inconsistent effect | Significant effect | Inconsistent effect |
| Placing | | | | |
| • General | 80% (4) | | | |
| • Distance | 100% (10) | | 100% (1) | |
| • Order | 79% (11) | | 100% (2) | |
| • Selection | 63% (23) | 14% (5) | 54% (13) | 8% (2) |
| Prompting | | | | |
| • General | 53% (9) | 12% (2) | | |
| • Sign/symbol | 61% (17) | 7% (2) | 26% (6) | 35% (8) |
| • Information | 25% (25) | 30% (30) | 56% (5) | 11% (1) |
| • Priming | 50% (1) | | | |
| Price | | | | |
| • General | 54% (9) | 13% (2) | 67% (10) | 27% (4) |
| • Reduction | 63% (8) | 5% (1) | 73% (8) | 9% (1) |
| • Increase | 67% (10) | 13% (2) | 100% (1) | |
| Portioning | 67% (40) | 14% (8) | 60% (3) | 40% (2) |

Comment: The first column displays the proportion and number of studies that show significant and inconsistent effects for one single intervention. The proportion of studies showing non-significant effects is not reported. The second column displays the proportion and number of studies that show significant and inconsistent effects for combinations of two or more contextual interventions. The proportion of studies showing non-significant effects is not reported.

Table 3 shows that Placing seems to have the most consistent influence on consumers' choices, as a single intervention and combination intervention. Adjusting the distance, order and selection of healthier options can influence consumers to choose healthier. Placing influenced consumers in 60-100% of the included studies.

Prompting influenced choice in about 50% of the included studies. Signs and symbols seem to work best and influenced consumers in 61% of the studies, while more detailed information rich signs swayed preferences in 25% of the interventions. In combination with other interventions, information dense signs seemed to have a stronger effect, and influence choices in 56% of the studies.

Price and price changes influenced consumers in about 60% of the included studies. Price also influences in combination with other contextual interventions.

Portioning influenced consumers to choose less or healthier foods in nearly 70% of the included studies, and can also work in combination with other interventions.

Table 3 shows which behavioral interventions can influence consumers independent of which food context they are applied. Placing shows the most consistent effect across all included studies. Although many studies investigated the impact of signs and labels, relatively few signs found that information dense signs can sway consumers in a healthier direction.

Table 4 below shows the proportion of studies that found significant effects of contextual interventions in supermarkets, restaurants and schools. We found most studies of interventions in supermarkets.

Table 4 Percentage of studies that show significant effects of contextual interventions in supermarkets, restaurants and schools

| | Proportion of studies | |
|--------------|-----------------------|---------------------|
| | Significant effect | Inconsistent effect |
| Supermarkets | 46% | 17% |
| Restaurants | 60% | 20% |
| • Cafeterias | 60% | 17% |
| • Buffets | 56% | 22% |
| • Menu | 46% | 27% |
| • Cafes | - | 20% |
| Schools | 60% | 26% |

Comment: The table displays the proportion of studies that show significant and inconsistent effects for contextual interventions. The proportion of studies showing non-significant effects is not reported.

Table 4 shows that nearly half of the studies in supermarkets (46%) observe a significant effect and 17% inconsistent effects of contextual interventions.

In restaurants in general, about 60% of the studies report a significant effect. In cafeterias and buffets, nearly 60% of the studies found a significant effect, and in menu-based restaurants nearly 50% reported significant effects.

In schools, 60% of the interventions report a significant influence on children’s’ and adolescent’s food choices.

Table 4 shows that the impact of contextual interventions seems to be quite similar across the three food contexts supermarkets, restaurants and schools.

The next sections summarize the main conclusions from the review articles about contextual interventions. The purpose of is to add more perspective to the analysis of the 547 original articles.

5.3 Summary of the review articles on contextual interventions

We identified 16 review articles that focused on the effects of contextual interventions in general. These reviews provide in-depth analysis of how the four main interventions placing, prompting, price and portioning seem to influence consumers.

Placing

Two reviews studied the effects of placing. Bucher et al found [121] concluded that distance and food order can influence healthier choices, while Wilson et al [123] found that combination of placing and prompting significantly swayed food choices.

Prompting

Six reviews [124-130] studied how prompts such as labels and signs can influence consumers. Fernandez et al [125] concluded that symbols and signs can sway food decisions. Hershey et al [126] observed that symbols and text are more effective than numeric information. Kiszko et al [127], Long et al [128] and Swartz et [130] found no evidence suggesting that calorie labels lead to lower energy intake. Sinclair et al [124] concluded that calorie labeling alone does not influence consumption, and that additional information or reference points are needed to influence choices.

Price

Three reviews studied the effects of price. Epstein et al [131] found that price can influence the choice of food options, but that effects of consumers' health depend on what is purchased in stead. Powell et al [132] studied the effects of taxes on healthy and less healthy choices, and found that tax increases did not lead to lower sales of sugary drinks. Powell et al also found that higher taxes on fastfood and lower prices of fruit and vegetables were associated with lower population weight. Afshin et al [133] observed an asymmetric effect of price reductions on healthy options relative to price increases on unhealthy alternatives; 10% price reduction was associated with a 12% increase in these choices, while a comparable 10% price increase on unhealthy alternatives lead to a 6% decrease in these. Further, price reductions were associated with increased choice of fruit and vegetables, but no increase in healthier drinks. Price increases had a relatively stronger effect on unhealthy drinks compared with fast food.

Portioning

Three reviews studied how portioning can influence consumers to eat less or healthier. Zlatevska et al [134] found that doubling the portion sizes is associated with a 35% increase in consumption, but that

additional increases did not add to consumption. Two reviews investigated how plate and cutlery sizes can influence consumption; Libotte et al [135] concluded that size can influence energy intake, while Robinson et al [136] concluded that experimental studies show only a marginal effect.

General

Two reviews investigated the behavioral interventions in general. Arno & Thomas [120] concluded that contextual interventions on average influenced the number of healthy choices or the proportion of healthy calories by 15%. Liberato et al [137] found that placing and price together with nutrition education influenced healthier choices.

5.4 Summary of review articles behavioral interventions in the food contexts

We identified 9 review articles that focused on the effects of contextual interventions in specific food contexts. These reviews provide in-depth analysis of what interventions seem to work most effectively in supermarkets, restaurants and schools.

Supermarkets

One review Glanz, Bader [122] concluded that placing and price can influence consumers to choose healthier. Gittelsohn [138] found that placing and prompting influenced customer in small grocery stores to choose healthier. Escaron, Meinen [139] concluded that the reviewed studies in total show relatively small effects.

Restaurants

Two reviews focused on how guests can be stimulated to make healthier choices in self service restaurants. Skov et al [140] concluded that healthy labels, changes in selection and payment method can have effect, but that the size of plates and cutlery does not influence how much people eat. Espino et al [141] found that placing, but not prompts and labels can promote healthier restaurant choices.

Schools

Four reviews investigated how school children can be influenced to choose healthier. Kessler [142] found that childrens' food choices can be influenced by contextual factors, and Roy et al [143] concluded that placing, prompts, price and portioning can influence adolescents' food choices. Nørnberg et al [144] and Mikkelsen et al [145] concluded that the research evidence is insufficient to establish clear effects of contextual interventions.

5.5 Total evaluation of the review articles

A total evaluation of the review articles show that many studies demonstrate that contextual interventions can influence consumers to choose healthier.

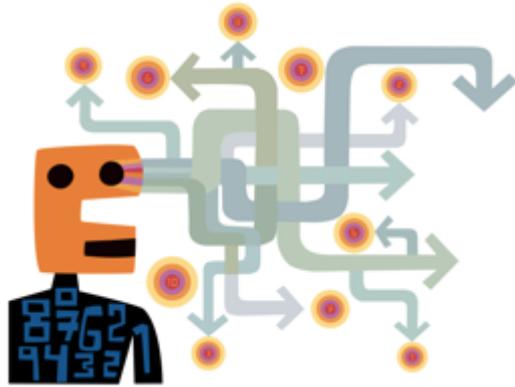
Across different food contexts, the same main interventions seem to work individually and in combination with each other: placing, prompting, price and portioning.

It seems like the percentage of successful interventions is quite similar in supermarkets, restaurants and schools. Just about the same proportion of studies report significant changes in choices in all three contexts.

Many of the review articles point to the great variation in scientific quality of the included studies, and suggest more high-quality studies to more clearly establish the effects and boundaries of contextual interventions.

To further understand how contextual interventions can influence healthier food choices, the next chapter provides an in-depth review of how these can work in supermarkets, restaurants and schools. We also investigate how food product design can stimulate preference of the healthier options.

6 Results for the food contexts: supermarkets, restaurants, schools and products



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Main points



- Customers can be influenced to choose healthier in grocery stores and supermarkets. 70-80% of the studies show medium or strong effects of the contextual interventions
- Placing. Better placing can influence consumers to purchase more of the healthier options. Increased selection seems to have a stronger effect than health labels. Minor changes such as changing the placement in shelves might not work
- Prompts. Simplified information such as symbols seems to have greater effect than detailed information. Health labels seem to have relatively weaker effect compared with price discounts
- Price. Reducing the price of healthier options seems more effective than increasing the price of unhealthy alternatives. Consumers do not necessarily switch healthy and unhealthy products if the price changes.
- The studies of prompts and price show that these interventions can work differently for healthy versus unhealthy product categories.

6.1 Results grocery stores and supermarkets (SIFO)

Number of studies

We selected 43 studies to be included in the analysis. The most studied interventions were prompts (19 studies), price (12 studies), placing (8 studies). We also included 8 studies of other interventions such as marketing. We found only two Nordic studies [146][147].

The effects of the contextual interventions

About 36% of the studies showed that contextual interventions had a significant effect, and about half (49%) had a mixed effect. It is worth noting that 4% of the studies noted unintended effects, and that several of the studies showed only shorter-term effects from the interventions.

Table 5 Contextual interventions, number of studies and effects in supermarkets

| Intervention | Number of studies | Significant effects | Inconsistent effects | Non-significant effects | Unintended effects |
|--------------|-------------------|---------------------|----------------------|-------------------------|--------------------|
| Placing | 8 | 2 (25%) | 5 (63%) | 1 (13%) | - |
| Prompts | 27 | 8 (26%) | 14 (52%) | 4 (15%) | 2 (7%) |
| Price | 12 | 8 (67%) | 3 (25%) | - | 2 (17%) |
| Portioning | 4 | - | 4 (100%) | - | - |
| Other | 4 | 2 | 1 | 1 | - |
| Total | 55 | 20 (36%) | 27 (49%) | 6 (11%) | 4 (7%) |

Comment: The table displays the proportion of studies that show significant, inconsistent effects, and non-significant effects for contextual interventions.

Placing

The 8 studies of placing showed different results: 25% showed significant effects and 63% mixed effects [56-63].

One study showed that increased availability of convenient on-the-go healthy options stimulated consumers to eat healthier [148]. The four studies of changes in product selection healthy options showed mixed effects. One study that found that changes in selection had a weaker effect than price

discounts, but stronger effect than prompts and labels [149]. Increasing the number of healthy products can be more effective than labeling [146]. Another study showed that variations in shelf localization and organization did not affect sales of healthier bread products [150]. It seems to be difficult to stimulate consumers to switch unhealthy products with specific healthy options [151]. Recent studies of webbased shopping showed that this way of shopping enabled healthier food choices [152] and less high-fat products [153].

Prompts

The 27 studies of prompts showed different results: 26% showed significant effects and 52% inconsistent effects. The most studied intervention was front-of-package labeling (FOP) such as symbols, colors and text.

Most of the studies concluded that healthy labels as a single intervention have limited effect [146, 154-157], and that combination interventions of placing, prompts and marketing can increase the effectiveness of labels [149].

Some studies conclude that healthy labels can limit the number of unhealthy options, but not increase the number of healthy ones [158-160], and it was also found that healthy labels had relatively greater effect on the sales of fruit and vegetables [159]. It seems that health labels are most appealing to consumers that already are health interested [161], and that signs communicating taste and the sensoric qualities of the products are recommended [161]. One study concluded that more knowledge on how to optimize labels is needed [162].

Research shows that simplified information in terms of symbols and colors is more effective than detailed information. Studies comparing single signs, ranked three point systems (e.g. traffic lights) or five relative points (e.g. five stars) suggest that the latter seems most effective in influencing choices [163]. One study concluded that consumers seem more concerned about avoiding the red, unhealthy labels than selecting the green healthy ones [164]. Combinations of in-store-marketing such as signs, placement, discounts and taste samples of healthy options increased the sales of these products [149, 165, 166].

Research also suggests that consumers might misinterpret health signs, and that such signs even can backfire and stimulate increased selection of the unhealthy options [167, 168]. Emojis with smiley faces can stimulate children to prefer healthier products [169]. It also argued that there are too

optimistic assumptions associated with adding nourishment information to influence consumers [170].

Some of the studies evaluated the effects of customer marketing information, and these showed that an overweight of unhealthy products were promoted in these magazines, and that other interventions such as volume discounts and combination deals also promoted unhealthy choices in these publications. One intervention showed that a combination of in-store product health information and marketing had a significant effect on customers' healthy choices [154]. One study suggested that consumers' preferences had stronger effect on consumers preferences than marketing of healthy versus unhealthy products [171]. It is recommended that health policy authorities should focus on how contextual interventions and marketing activities promote healthier versus unhealthier consumer choices [171, 172].

Price

The 12 studies of price and price changes all showed that price alone or in combination with other contextual interventions influenced consumers' healthy choices [149, 158, 166, 173-175]. Further studies are recommended to better understand how such interventions can become even more effective [176], and to prevent unintended side effects increased calorie consumption [173].

Reducing the price of healthy options seems more effective than increasing the price of unhealthy ones [177], and this seems to be the case particularly for fruit and vegetables [178, 179]. One study found that taxing carbohydrates reduced sales [180]. Reducing the price of healthy options seems more effective than health labels, but can stimulate people to buy more [149, 178]. One study found that discount programs increased spending on healthy options and reduced unhealthy ones [181].

Tips and suggestions for healthy choices in supermarkets



Placing

- Place the healthiest options first so they are easy to see and convenient to select
- Increase the number of options and selection in all categories
- Increase the attractiveness and appeal of the healthy options

Prompts

- Use simple symbols to communicate health benefits rather than detailed and complex text and numeric information
- Focusing signs (e.g. “key hole”), three point scales (e.g. traffic lights) and five point scales (5-stars) to communicate health benefits
- Consumers do not always understand signs similarly. Test signs before they are implemented. Be aware that signs can backfire if they are misunderstood, and are perceived as relevant mostly by health-conscious consumers
- Use marketing to promote the healthiest options

Price

- Reduce the price of the healthiest alternatives, particularly fruit and vegetables
- Combine price discounts with other contextual interventions

Portioning

- Design and test interventions to promote right portions
- Further search for evidence for portioning interventions beyond what is provided in this report

Source: SIFO

6.2 Results: Restaurants (SIFO)

Main points



- Guests can be influenced in restaurants: 50% of the studies reported significant effects
- Placing, food order, and increase selection of healthier options can influence guests, but the effects of prompts and labels are mixed
- Reducing or changing portion composition can help guests eat less or better
- Restaurant guests can be influenced by price levels and price changes

Number of studies

We selected 42 studies to be included in the analysis. The most studied interventions were prompts (29 studies), portioning (13 studies), placing (9 studies), and price (12 studies).

The effects of the contextual interventions

About 51% of the studies showed that contextual interventions had significant effects, about 21% showed inconsistent effects and 30% no significant effects of the interventions. 2% of the studies found unintended effects.

Table 6 Contextual interventions, number of studies and effects in restaurants

| Intervention | Number of studies | Significant effects | Inconsistent effects | Non-significant effects | Unintended effects |
|--------------|-------------------|---------------------|----------------------|-------------------------|--------------------|
| Placing | 9 | 4 (44%) | 1 (11%) | 4 (44%) | - |
| Prompts | 29 | 12 (41%) | 6 (21%) | 10 (35%) | 2 (7%) |
| Price | 7 | 6 (86%) | - | 1 (4%) | - |
| Portioning | 13 | 7 (54%) | 3 (23%) | 3 (23%) | - |

| | | | | | |
|-------|----|----------|----------|----------|--------|
| Other | - | - | - | - | - |
| Total | 57 | 29 (51%) | 10 (18%) | 17 (30%) | 2 (4%) |

Comment: The table displays the proportion of studies that show significant, inconsistent effects, and non-significant effects for contextual interventions.

Placing

The 9 studies of placing showed different results: Equally many (44%) showed significant effects and insignificant effects, and 11% found inconsistent effects of this intervention.

In a typical study, fewer guests selected the desserts placed last in the buffet, independent of whether they were healthy or not [182]. The studies suggest that minor adjustments of the interventions can influence their effectiveness. For example, one study showed that placing the dishes in the middle section of the buffet reduced their popularity, perhaps because that the distance increased slightly [183]. One study found no effects following on the sales of snacks by changing the placement, and another study observed no effects from increasing the number of healthier options on the menu [184].

Prompts

In a total of 29 studies of prompts, 41% showed significant effects, 21% inconsistent effects, and 35% no significant effects.

The most frequently studied intervention was menu labeling. Some of the studies concluded that menu information about calories, fat, sugar and salt can influence guests towards healthier choices [185-193], while other studies found that symbols such as traffic lights or smileys were effective [194-197]. One study found that the sales of healthier items increased the most when they were not health labeled [198].

Two studies found that labels that combined health and taste messages were more effective than just health messages alone [199, 200]. Even if guests notice the signs, they might not be influenced to choose differently [200]. Interestingly, one study found that guests who were on a diet increased their consumption when the menus were calorie labeled [201]. Another study suggested that health labels are more effective than general health information campaigns. [202]. Other studies suggest marketing

can stimulate healthier choices: preferences for healthy as well as unhealthy sandwiches increased by 50% following exposure to marketing [203].

Several studies found no significant effects from prompts on the sale of healthier items in restaurants [204-214]. For example, calorie labeling had no effect of guests' calorie consumption [211]. The only Nordic study found that key hole labeling had no effect on the sales of these healthier items [210].

Some of the studies found that calorie labeling can backfire. An intervention study of calorie labeling in 222 Starbucks outlets in New York observed a 6% reduction in calories per transaction. The main reason was that the guests bought less food. The nearby coffee bars without calorie labeling increased their sales [215]. Studies of calorie labeling in fast food restaurants such as Kentucky Fried Chicken og Subway have found similar effects [204, 216].

Price

6 of the 7 studies of price showed that price interventions can influence restaurant guests to choose healthier.

A couple of the studies compared combinations of price and other contextual interventions. For example, price reductions also seem more effective than price reductions in combination with health information [198]. The number of guests who chose a free sample of spring roll increased when it was labeled "healthy" compared with "new" [217]. One study concluded that price incentives had a relatively stronger effect than "social nudges" [218].

Portioning

In a total of 13 studies of portioning, 54% showed significant effects, 23% inconsistent effects, and 23% no significant effects.

One study showed that guests preferred larger portions and that these were perceived to provide the highest value for money, but that guests did not notice smaller (-10-15%) reductions in portion sizes [219]. Another study showed that the popularity of salad dishes increased more when these were presented as side orders rather than main dishes [220].

Studies of reducing portion sizes of unhealthy options and increasing portion sizes can influence calorie intake, but that the effects may also depend on food category [221, 222]. In general, increasing

portion sizes seems to be associated with increased calorie intake [222]. A study of guests' willingness to replace fat meat dishes with lean fish dishes showed that information about the low fat content of fish did not have an effect on the replacement choices, and that guests did not compensate by adding other items high on fat [223].

One study found that overweight individuals ate significantly more from buffets compared with those with normal body weight [224]. Another study found that guests who selected the healthier option bread+olive oil consumed added more oil and thus more calories, compared with guests who selected the less healthy bread+butter alternative [225]. Studies of the shape of drinking glasses indicate that guests drink 19% less from long thin glasses [226, 227].

Two of the studies found that availability of healthy alternatives does not reduce the consumption of unhealthy options containing fat, sugar and salt [228, 229], and for sugary drinks as well [230]. One study found that increasing the number of healthy options was more effective than price reductions and removing unhealthy options [231].

Tips and suggestions for healthy choices in restaurants

Placing

- Place the healthiest options first in the most prominent positions
- Increase the number of healthier options

Prompts

- Stimulate guests by signs that signal taste and sensoric qualities (e.g. tasty choice) or communicate other positive and attractive qualities (e.g. natural or new)
- Use simple symbols and signs to communicate health benefits or lower calorie content



Price

- Reduce the price of healthier options

Portioning

- Reduce portions slightly
- Change the plates, cutlery and other visual cues to help guests eat less

Source: SIFO

6.3 Results: Schools (Nofima)

Main points



- Children and adolescents can be influenced to eat healthier at school: 60% of the studies report a significant effect of contextual interventions
- Children choose more of healthier products that are easily available and that look attractive
- Use signs that signal fun and good taste
- Portioning and price can influence adolescents to eat healthier
- Combining educational and contextual interventions seems effective

Number of studies

We selected a total of 84 studies to be included in the analysis. The most studied interventions were placing (29 studies), portioning (23 studies), prompts (14 studies), and price (8 studies). In addition, we included 10 other studies of how presentation, signs and priming can influence choice.

The effects of the contextual interventions

About 60% of the studies showed that contextual interventions had significant effects, about 17% showed inconsistent effects, and 23% no significant effects of the interventions. Several of the studies suggest that combinations of interventions can be more effective than single interventions [142, 232-235].

Table 7. Contextual interventions, number of studies and effects in schools

| Interventions | Number of studies | Significant effect | Inconsistent effect | Non-significant |
|---------------|-------------------|--------------------|---------------------|-----------------|
| Placering | 29 | 17 (46%) | 4 (18%) | 8 (36%) |
| Merking | 14 | 6 (43%) | | 8 (57%) |

| | | | | |
|--------------|--------|----------|----------|----------|
| Pris | 8 | 6 (75%) | 1 (12%) | 1 (12%) |
| Porsjonering | 23 | 15 (65%) | 6 (26%) | 2 (9%) |
| Other | 10 | 6 (60%) | 3 (30%) | 1 (10%) |
| Total | 8 4 | 50 (60%) | 14 (17%) | 20 (23%) |

Comment: The table displays the proportion of studies that show significant, inconsistent effects, and non-significant effects for contextual interventions.

Placing

In a total of 29 studies of prompts, 46% showed significant effects, 18% inconsistent effects, and 36% no significant effects.

These studies show that children can be influenced by placing the healthy options so they are easily available, or by adding healthy options or removing unhealthy ones [235-241], or by presenting and naming the options in attractive ways for kids [237, 242-248]. It has also been studied how repeated exposure to fruits and vegetables can stimulate children to eat healthier.

Prompts

Of these 14 studies, 43% showed significant effect and 57% no significant effect.

Most of the studies were combinations of information/educational activities and contextual interventions, and these seem to work better in combination than alone [145, 239, 249]. Examples of combinatory interventions are education in combination with adding healthier items for bread, fruit and vegetables to the school [232, 249, 250]. A Norwegian study found that information and education alone did not influence childrens' dietary habits [251].

Price

6 (75%) of the 8 studies of price showed significant effects, while in 1 (12%) the results were inconsistent, and in the last one (12%) no significant results were found.

The studies compared a range of different payment systems, and in most of the cases lower price levels or discounted prices stimulated healthier choices [235, 252-256].

Portioning

In a total of 23 studies of portioning, 65% showed significant effects, 26% inconsistent effects, and 9% no significant effects.

Several of these studies showed that increasing the availability of healthier portions and options can increase consumption [234, 240, 242, 243, 252, 257-262]. For example, children will eat more fruits and vegetables if these provided as default elements of the meal [263].

Tips and suggestions for healthy choices in kinder gartens and schools

Placing



- Place healthy options in the most central spaces. Move the unhealthy options to the back or other places where they are more difficult to find
- Present the options in attractive ways
- Have vegetables and fruit as a default option

Prompts

- Use fun names or names that stimulate the childrens' fantasy
- Use heroes or role figures

Price

- Lower price on the healthier options compared with the unhealthy ones
- Reduce the price of healthier options

Portioning

- Slice fruits and vegetables in smaller pieces that are easy to eat

Source: Nofima

6.4 Results: Product

This is wide category of contextual interventions referring to physical or visual characteristics of the food products and how the characteristics of the products interact the micro context in which they are placed. This category of interventions partly overlaps with the supermarket and restaurant review in the previous version of the report.

Main points



- Food product design can influence consumers to choose healthier: about 70% of the studies report a significant effect
- People choose more of products that are conveniently available
- Consumers can in many cases be more stimulated by external cues (e.g. what others eat, portion sizes) than internal cues (e.g. how full or satisfied they feel)
- Consumers have difficulty judging portion sizes, and can be influenced by product and package size, shape and other visual cues
- Peoples' healthy choices are influenced by brand and product names, and by health halos associated with these

Number of studies

We selected a total of 40 studies for further analysis. The most studied interventions were portioning based on product design (36 studies), portioning using utensils (31 studies), prompts or labels (12 studies), placing (3).

The effects of the contextual interventions

71% of the studies reported significant effects, 8% inconsistent effects and 21% no significant effects.

Table 8 Contextual interventions, number of studies and effects in schools

| Interventions | Number of studies | Significant effect | Inconsistent effect | Non-significant |
|--------------------|-------------------|--------------------|---------------------|-----------------|
| Placing | 3 | 3 (100%) | - | - |
| Prompts | 12 | 12 (100%) | - | - |
| Portioning design | 36 | 24 (66%) | 3 (8%) | 9 (24%) |
| Portioning serving | 31 | 19 (62%) | 3 (9%) | 9 (29%) |
| Other | 4 | 3 (75%) | 1 (25%) | - |
| Total | 86 | 61 (71%) | 7 (8%) | 18 (21%) |

Comment: The table displays the proportion of studies that show significant, inconsistent effects, and non-significant effects for contextual interventions

Placing

All 3 studies of placing reported significant effects. Placing healthy items closer increases selection, and moving unhealthy bowls of snacks further away reduces consumption [264, 265], and so does reducing the size of the bowls of unhealthy products [135, 266, 267].

Prompts

The 12 studies of prompts all showed significant effects of this intervention. Consumers are influenced by food brands and food label [103, 105, 106, 108, 268, 269]. Consumers can believe that similar products have different healthy qualities based on the health associations to the brand name [108].

Portioning

Portioning can refer to how the product is designed or how the consumers are stimulated to portion dishes based on how the food items are served.

The studies show that consumers have difficulty judging exactly how much they take [101, 270], and have difficulties estimating energy content and matching this with how full they feel. If contextual cues catch consumers' attention such as dining with others, TV-viewing, or doing something else in parallel while eating, this also makes it difficult to estimate portion sizes [135, 228, 271]. Adding visual cues or splitting serving containers in portioned sections can signal how much is eaten [272] and

reduce amounts consumed [273]. People also judge portion sizes based on comparisons with other options and serving sizes [102, 274-276]: consumers might prefer the middle option independent of its actual size, but by comparison with the small and large alternatives.

The design of serving containers, plates and utensils can also influence consumption. Larger plates can increase serving portions by 30-100% [102, 264, 277, 278], but reducing plate sizes too much can lead people to serve themselves multiple times instead [279]. Studies suggest that reducing the size of serving bowls may be more effective than serving plates [135, 280], applicable to serving bowls [228, 265, 281] and bowls people eat from [270, 282]. One study showed plates providing contrast color to the food served influenced how much people took [278], and that lower contrast increased consumption.

Consumers have difficulty estimating size changes if several dimensions change at the same time, e.g length, depth, height [226, 264, 277, 283].

Tips and suggestions for how product design can stimulate healthier choices



Placing

- Present ready sliced ready-to-eat fruit and vegetables close to people
- Place the unhealthy options further away and make them less convenient to grab
- Present healthy snacks and options in see-through containers. Pack unhealthy options in foil or similar wrapping that conceals visual cues that can stimulate consumption

Prompts

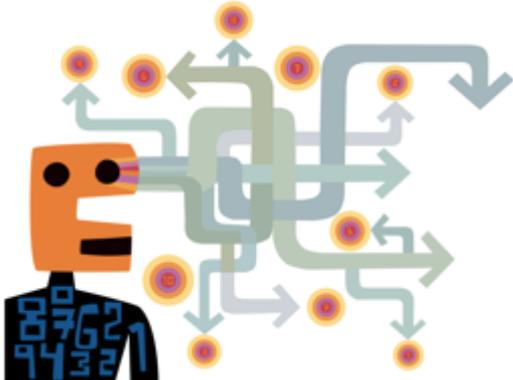
- Present the smallest portion as default or the dish of the day
- Use attractive names and labels to catch attention

Portioning

- Use smaller serving bowls, plates and utensils
- Use tall thin glasses

Source: Nofima

7 Analysis and discussion of the empirical results

| | |
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|---|--|

Main points



Variable effects of contextual interventions

- The empirical evidence reviewed in this report shows that contextual interventions change choices in 40-100% of the studies
- In the sample of studies reviewed in this report, there is probably an overrepresentation of successful interventions. It is therefore difficult to provide clear conclusions about the likelihood of success based on this sample of studies
- There is great variation in the extent and duration of the studies: some report what a limited number of people select during a few meals, while others report what many thousand select during a period of several months. It is therefore unclear how different consumer groups respond to contextual interventions and for how long the effects last
- Most the studies do not report the substantial value of the changes in choice; it is therefore unclear how large effect sizes can be expected

Sufficient empirical evidence to invest in further testing in contextual interventions

- The high number of studies that show how contextual interventions can change food choices provide sufficient evidence to justify further investments in testing this approach. It is important to learn more about opportunities and constraints of such strategies for promoting population health
- The four interventions placing, prompts, price and portioning seem to work effectively in most types of food contexts: supermarkets, restaurants and schools. The effect sizes vary

significantly, so more studies are needed

7.1 Overall evaluation of the empirical results

This report has identified and analyzed the results from more than 700 empirical studies of the impact of contextual interventions on consumers' healthy food choices. The studies clearly suggest that people's food choices can be swayed in a healthier direction by contextual cues, signals and designs.

The four most studied interventions are placing, prompts, price and portioning. Placing seems to have the most consistent effect: 80-100% of the studies show that distance and order promote healthy choices, and 60% of the studies show that changes in assortment promotes healthier consumption. Prompts such as signs and labels are the most studied intervention. The results show that simpler symbols work in about 60% of the interventions and information-rich labels work in only 25% of the studies. Price influences choices in 50-60% of the studies, and seems to work even more effectively in combination with the other contextual interventions. Portioning influenced healthier choices in 50-60% of the studies. Our analysis shows that the four contextual interventions can work individually and in combination with one another.

The studies of how behavioral interventions influence choices in supermarkets, restaurants and schools report significant effects in 40-60% of the interventions, with a somewhat higher success rate in cafeterias, buffets and schools than in supermarkets and menu based restaurants. As Norwegian and Nordic consumers purchase most of their food intake in supermarkets, there were relatively fewer studies of this compared with the other food contexts.

Our review does not provide a clear answer to how much the choices are swayed by contextual interventions; most of the studies report only level of significance and not the substantial amounts of change. A recent review reported an average of about 15% healthier choices, but it is unclear how representative these results are.

There were only a few studies of Nordic consumers, and more research on how this population group can be influenced is needed. The studies on western consumers in this review, suggest further studies on placing, prompts, price and portioning may be effective in swaying Nordic consumers as well, but we need empirical studies to verify this assumption.

Some of the included studies have investigated combining contextual interventions with other interventions such as information and education. There is need for more studies to draw clear implications of how strongly this can influence food choices.

It has been argued that contextual interventions can be particularly effective in targeting vulnerable population groups [24, 111]. As our review has included studies aimed at all population groups, we cannot draw any conclusions about this question.

7.2 Analysis and discussion of different contextual interventions

To understand how effectively and consistently contextual interventions can influence consumers' choices, we analyzed 30 of the most recent review articles using two complementary approaches. First, we extracted more detailed information about more than 500 original studies included in these, and counted how many of the studies showed significant results, inconsistent results and no effects. Secondly, we evaluated the abstracts and conclusions of the reviews, and compared these with our quantification of the results.

Prompts such as labels and signs are the most studied intervention, individually (39% of the studies) and in combination with other interventions (24%). There were roughly similarly many studies of placing, pricing and portioning as single interventions (12-15% of the studies), but relatively more studies of placing (20%) and price (15%) as combination interventions than portioning (6%).

We found that placing seems to have the most consistent effect on choices, both as a single intervention and combination intervention. Placing is a broad category of interventions, referring to where the healthiest items are placed in the consumption context, in what order they are found, and the assortment of healthy options placed together. The specific design of placing interventions will vary between food contexts. The two reviews that specifically focused on placing interventions found that distance and order can stimulate healthier choices [121] and that combinations of placing and prompts had significant effects [123]. Bucher et al [121] reported significant effects of placing in nearly 90% of the studies, and Wilson et al [123] in 70% of the interventions. These authors also noted that we need more specific measures on how consumption is actually changed and how consumers make replacement decisions [121]. The effects across studies are not comparable as different measures of healthy choices are applied [123].

Our quantitative analysis show that symbols and signs influence choices in about 60% of the interventions, and that information-rich labels sway choices in about half as many studies (25-30%). This is consistent with the conclusions in the six review papers on prompts and labels [124-130]. One review discusses variations in how effectively symbols might work [125]. Four reviews conclude that calorie labels have an insignificant influence on consumers' choices [126-128]. In Norway and the Nordic countries, the green keyhole-symbol has been implemented and endorsed as a health promoting intervention, but we did not find any empirical evaluations of this intervention.

Our quantitative analysis found that price interventions influence consumption in 50-70% of the studies. The three reviews on prices and price changes [131-133] suggest that these interventions in many cases can sway choices, but that the effects on healthy and unhealthy options may differ. Powell et al [132] found that small discounts on healthy choices increased healthy purchases, but did not influence the choices of unhealthy alternatives. Afshin et al [133] found that price discounts on healthy options were twice as effective as price increases on unhealthy options. None of the studies included a Nordic population; it is yet unknown how this group of consumers responds to price levels and price changes.

The three reviews on portioning [134-136] reveal that this intervention can include many different changes to the food context and presentation. Our quantification of study effects show that about 60% of the interventions are reported to produce significant effects on consumption. The main impression is that larger portions seem to increase consumption across contexts, and that smaller ones may seem to limit consumption.

7.3 Analysis and discussion of behavioral interventions for different food contexts

This analysis focused on the effects of contextual interventions in general, and not considering specific food contexts.

Two reviews of the supermarket context suggest that placing, prompts and price can sway choices. Glanz, Bader [122] found that placing and price can influence choices and Gittelsohn [138] found that placing and prompts can work, but Escaron, Meinen [139] concluded that the studies in total showed quite weak effects. Our analysis of the original studies shows a significant variation in how consistently and effectively consumers are influenced by contextual interventions.

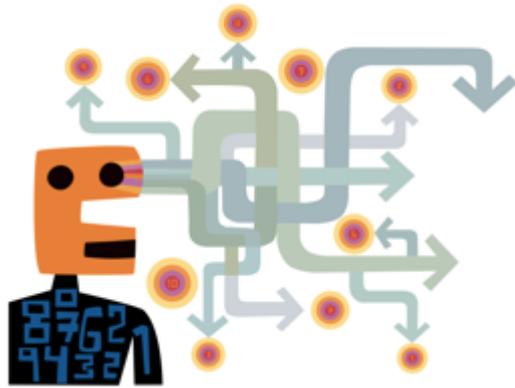
The reviews of the restaurant context show variations in how consistently guests are influenced to choose healthier. Skov et al [140] concluded that healthy labels, changes in assortment and payment options seem to work, but not changes in cutlery and plate sizes, while Espino et al [141] concluded that placing but not prompts promote healthier restaurant choices. Our analysis of the original studies shows a significant variation in effect sizes, depending on restaurant context and how the interventions specifically are designed.

The four reviews on the school context show significant variations in how contextual changes can influence children and adolescents to eat healthier. Kessler [142] found that childrens' food choices were influenced by contextual interventions, and Roy et al [143] concluded that placing, prompts, price and portioning can influence adolescents. However, Nørnberg et al [144] and Mikkelsen et al [145] argued that there is insufficient evidence to draw any clear conclusions. The in-depth analysis of interventions in schools show that a wide range of educational, behavioral, contextual and other interventions have been tested, but that many of the studies are not directly relevant for a Norwegian context.

Our analysis of product design did not include any review articles. The in-depth analysis of original studies show that the four interventions placing, prompts, price and portioning can influence consumer choices, that there is significant variation in how the interventions specifically are designed and how strongly they influence what is selected.

To conclude, our review of the research literature shows that contextual interventions in many cases can influence consumers to choose healthier. As there is significant variation in how these are designed, we need more research to how the interventions can work best.

8 Implementation strategies: roadmap for healthier food choices



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Main points

Policy collaboration between health authorities and the food industry

- Shared understanding of how contextual interventions in food outlets can promote healthier consumer choices
- Promote common understanding of how Norwegian outlets today influence consumers' choices, and identify opportunities stimulating healthier choices.
- Define common goals for improvement and monitor how outlets over time change in a healthier direction
- Communicate success and achievements

Action plan for food providers

- Define objectives and strategies for promoting consumer health
- Benchmark current situation on their food outlets. Define improvement objectives. Test interventions and measure progress.
- Educate and train managers and staff in how to implement contextual and behavioral measures to influence consumers

Action plan for health policy and educational policy authorities

- Evaluate how contextual interventions can be integrated in health and food policies
- Stimulate and engage food industry and food providers to implement contextual interventions that promote healthier choices
- Stimulate further knowledge generation through financing research
- Evaluate how contextual interventions can be integrated in the school health agenda and plans for promoting healthy school environments

The scientific evidence reviewed in this report can help design several different implementation strategies for healthier food choices. We suggest implementation strategies for 1) policy collaboration between health authorities and the food industry, 2) food industry, 3) health policy authorities, and 4) for the educational sector.

8.1 Policy collaboration between health authorities and the food industry

In 2016, the Norwegian Directorate of Health and the Norwegian food industry formalized the “Intention Agreement for promoting healthier diets”. The purpose of the agreement is to promote healthier consumer food choices through cooperation between the health authorities and the food industry. The agreement states that interventions for healthier diets should be evidence based and that interventions should be based on stimulating rather than regulating consumers’ choices. The dietary focus areas of the agreement are to increase the consumption of fruit and vegetables, fish and seafood, and whole grains- and to reduce the amount of sugar, salt and saturated fat. The food industry commits to promoting healthier food choices through developing and promoting healthier options, and the health authorities will contribute through information activities and other consumer influence activities, better consumer understanding, and through research.

This report may be of help when implementing the intention agreement. Potential areas of relevance can be:

- Enable shared understanding of how the design of food outlets can stimulate consumers to make healthier choices, and acknowledge how contextual interventions can influence consumers
- Agree on which specific characteristics of food outlets stimulate consumers to choose healthier. Define baselines for to what extent food outlets today promote healthier choices
- Define ambitions and objectives for how food outlets and food products can be changed to promote healthier and prevent less unhealthy choices. Enable setting of specific objectives for how healthy and unhealthy food categories can be changed to sway consumers towards healthier diets
- Monitor how food outlets over time improve their influence on consumers in a healthier direction
- Communicate positive practices and achievements by the food industry, and motivate future investments in health promoting initiatives among food producers and food providers

8.2 Implementation opportunities for the food industry

Food producers and food providers can use the report to design strategies and approaches that promote the sales of healthier options, and to communicate progress and achievements.

We have these suggestions for how the report can be useful:

- Define measurement criteria and measurement tools to form baselines for how food products and outlets today stimulate consumers' choices. Specifically, food providers can define observable measurement criteria related to how placing, prompts, price and portioning influence consumers.
- Define objectives and plans for improving the health footprint of food outlets. Test and measure how changes in placing, prompts, price and portioning influence sales and consumption
- Evaluate and document how implemented interventions and changes in outlets have influenced consumers' choices. Compare sales of healthier items before and after the changes were implemented, and judge how the consumers were influenced. Examples can be:
 - How the sales of fruits, vegetables and fish have increased after these categories have been moved to more prominent positions in food outlets
 - How discounts and price reductions on fruit and vegetables have influenced sales volumes
 - How introduction of more whole grain bread options and price reductions have influenced consumers to purchase more
- It is recommended to involve independent researchers and advisers to ensure verification changes, and promote credible communication of the results.
- Define competence and training programs for promoting healthier choices using behavioral insights. Design tools and methods that managers and staff can use to design their outlets

8.3 Implementation opportunities for the health- and educational authorities

The report suggests how food contexts can influence people to make healthier choices. We suggest that behavioral interventions in combination with other policy tools such as information, regulation and incentives can promote healthier life styles. The report provides evidence base for interventions that can be further tested and implemented.

Suggestions for relevant applications for behavioral insights are:

- Health policy authorities can design more targeted interventions based on insights about how people perceive and judge the situation where the health promoting choice is made. This can involve adjusting existing policy tools based on behavioral insights, or testing novel and innovative interventions. Suggestions:
 - Adjusting taxes, evaluating how these influence product price levels, and consumers perceive the attractiveness of food options, and how sales volumes are influenced
 - Evaluate existing food label systems (e.g. the green key hole, a Norwegian label) focused on how consumers perceive it, and invent and test adjustments that might make it even more effective
 - Invent and test interventions for portioning of food options, which is considered as one of the most cost-effective interventions for influencing population level dietary behaviors

These suggestions are in line with recent recommendations for behavioral health policy [6, 30, 87].

- Educational authorities can use the report to design health-promoting schools and educational institutions. Behavioral interventions are relevant for the food provided in schools and in kindergartens. They could also be used to influence parents to make healthier food for their children. In Norway most children bring home-prepared food to school, and the schools are considered important for learning life-long healthy food habits [8]. The report can also be used to design training and competence development interventions aimed at personnel providing food for children and adolescents.
- Health- and educational authorities can use the report as input for what kind of future research projects that can be prioritized. The report suggests we need more research based knowledge about how effectively contextual interventions work, and the Norwegian authorities could support this by providing funding.

8.4 Research opportunities on the behavioral insights of food choices

Scientists and researchers can use the report to design and implement studies of consumer behavior based on a behavioral and contextual perspective. We suggest that such projects are organized as collaborative research interventions between the food industry and researchers, and focused on testing the effects of contextual interventions on larger groups of consumers over time.

This report points to several future research areas, such as:

- Future studies of how supermarket design can promote healthier food choices, using contextual interventions. These can include attractive placing of the healthier options, prompts and labels on the healthier alternatives, price reductions for healthy items, price increases for healthy versus unhealthy options, and correctly portioned meals.
- Future studies of how restaurants, work place buffets, cafeterias and other outlets can influence guests to eat healthier, using the placing, prompts, price and portioning. The design of these interventions may vary between different categories of restaurants. We suggest studies how interventions can be adapted to different food micro environments.
- Future studies of interventions aimed at helping children and adolescents eat healthier in educational settings.
- Future studies of how product design can stimulate consumers to select the healthiest alternatives.

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