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Children's healthy eating environment: Nudging and social marketing

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EDULIA

WP7 Final report

Children's Healthy Eating Environment: Nudging and Social Marketing

EDULIA

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Executive summary
Children's Healthy Eating Environment: Nudging and Social Marketing

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BACKGROUND

Childhood overweight and obesity continue to give rise to concern worldwide. These problems are closely related to poor eating habits, and the obesogenic environment of modern every-day life. The research carried out in this part of the EDULIA project is of relevance due to the major influence of the food environment on children´s food-related behaviour. This short summary thus concludes a work package concerned with factors related to children's eating environment and the food context.

In the *first* part of the work package, expectant and new parents' eating behaviour were studied from a life-course perspective, across the different stages in pregnancy and early parenthood. How internal and situational barriers can be overcome to establish and maintain healthy eating habits, and how parents act as role models for their children were also studied.
The *second* part of the work package looked into how to nudge preschoolers to try vegetables by playing with innovative eating device, that is, an illustrative serving plate and a flexible skewer encouraging visual and tactile familiarization to vegetables. Finally, the *third* part of the work package looked into the eating environment at schools to study whether making unhealthy snacks less accessible reduces snack consumption at school. This part also looked into the importance of autonomy support, the influence of parents and adolescents' perceived competence for healthy eating.

The practical, applied goal of the work package was to conduct research to inform recommendations for social marketing campaigns including digital media or 'nudging' interventions addressing children´s social and physical eating environment in order to improve dietary choices.

KEY FINDINGS

For the first part, a key finding was that becoming a parent can signify both an opportunity for more healthy eating, or a life-event that affects healthy eating habits in a less positive direction, differing for distinct groups of parents. Also, gendered parenting practices and expectations influence the adoption of healthy eating habits in the transition to parenthood. Another key finding is the fact that there is a great diversity in parents' reactions to dietary advice.

For the second part, playful eating utensils were found to increase intake of vegetables in 4-6 year old children in the context of shared kindergarten meals, compared to a traditional eating plate. However, the effect was salient on familiar vegetables only, not on unfamiliar vegetables. Playful eating was also found to increase food waste.

For the third part, perceived competence to eat healthy can act as a buffer in the challenging transition from primary to secondary school. Parents have a supporting role to play in providing healthy foods at home. Furthermore, availability nudges in the school environment appear to support adolescents in making more healthy choices.

CONCLUSIONS AND RECOMMENDATIONS

Research results on new parents suggest that it is important to consider parents' healthy eating as well when considering how to shape healthful eating environments for children over their life course. However, parents differ in both how becoming parents affects their perceived healthy eating habits, how public nutrition advice is accepted and acted upon, as well as which factors influence their dietary behaviour. Differentiated approaches when targeting expectant and new parents are thus needed, calling for more attention to this important period of transition from policy makers, health professionals and research.

Playful eating is recommended as a door-opener for children's vegetable exposure and familiarization, increasing vegetable intake without the pressure of eating. Future research is recommended to examine long-lasting effects of playful eating on intake of familiar and unfamiliar vegetables at individual level. Adverse effects of playful eating on food waste should also be further considered.

Schools can support pre-adolescents in making healthy choices by creating a healthy school environment with enhanced availability of healthy options. In addition, pre-adolescents' competence and autonomy should be supported by their social surroundings in order for them to learn to make and maintain healthier choices during transitions in their school life.

1 Introduction

1.1 Scientific background

Children and pre-adolescents' eating environment was studied as the overall context in which individual food choices are taken. In a broad sense, the eating context of children has an important influence on the formation of healthy eating habits during childhood and adolescence (Birch & Anzman, 2010), and this context may be modified or "tweaked" to support healthier dietary habits. Contexts including the family and home, day care facilities, and the school environment are critical in supporting the development of healthy eating patterns of children and pre-adolescents and these are the contexts in focus of this work package.

As regards parents and caregivers, they influence their children in many ways, but one of the most important ways is through their own behaviour (Birch, 1999; Moore, Wilkie & Desrochers, 2017). Policy makers may expect that expectant and new parents are fully aware of their influence as role models, and that they are motivated to act as 'positive' role models, leading the way for their children's healthy eating habits. But parents may lack awareness, and their possible motivation does not necessarily lead to action. The transition to parenthood can challenge the healthiness of eating habits due to resource and time constraints (Aschemann-Witzel, 2013), perceived lack of support for healthy eating from other family members, or children's requests for unhealthy food (Pocock et al, 2010).

Apart from family and parents, day care facilities and schools are important contexts for healthy eating socialization, not least because children consume a large number of meals, and one third (or even more) of their daily nutrient intake in these settings (Briefel et al., 2009; Mikkelsen et al, 2014). On the other hand, this also means that day care facilities and schools are excellent sites for healthy eating interventions.

1.2 Objectives of the Work Package

The overall aim of the research programme of EDULIA is to better understand how multiple factors act as barriers for children's healthy eating and how to tackle them. Within this overall frame, WP7 had the objectives of examining influence factors on children´s healthy eating behaviour related to the eating context and to make recommendations for social marketing campaigns or nudging interventions.

1.3 Work Package organisation

The three tasks were organised as illustrated in Table 1.

Table 1: Work Package 7. Tasks and partners

Task	Title	Leader	ESR	Partners
Task 7.1	Expectant and young parents healthy eating behaviour	Jessica Aschemann-Witzel MAPP	ESR8	MAPP; Arla Foods Amba, Kidvertising
Task 7.2	The potential of innovative eating device to nudge willingness to try new foods and mitigate food rejections in preschoolers	Valérie L. Almli NOFIMA	ESR10	NOFIMA; IPBR
Task 7.3	Exploring the eating environment at schools	Ellen van Kleef WUR	ESR4	WUR; Netherland's Nutrition Centre Foundation

Task 7.1 Expectant and young parents healthy eating behaviour MAPP-AU (ESR8 – Andreia F. Moura)

An academic secondment was carried out at INRA and industry secondment was at Arla Foods Amba. The task included an initial structured literature review on factors influencing parental dietary habits, including psychological and physiological factors and (digital) parent-to-parent interaction. In the academic secondment, a cross-cultural qualitative and content analysis study was carried out. In terms of the nudging element, a cooking intervention was conducted in connection with the industry secondment at Arla Foods Amba. Collaboration was made with Kidvertising Agency regarding intervention material (cook book) for parents.

Task 7.2 The potential of innovative eating device to nudge willingness to try new foods and mitigate food rejections in preschoolers NOFIMA (ESR10 - Abigail Pickard)

The task was to investigate the potential of innovative eating device to nudge willingness to try new foods and mitigate food rejections in preschoolers in collaboration with the work carried out in WP6 and IPBR. Pursuing an earlier collaboration with the Oslo School of Architecture and Design, eating device prototypes designed with preschoolers' motoric skills and imagination in focus were tested in kindergartens, and Task 7.2 investigated the results from this study.

Task 7.3- WUR Exploring the eating environment at schools (ESR4 – Roselinde van Nee)

A secondment at the Dutch Nutrition Center was carried out in connection with this task. Furthermore, in this task (still ongoing at the time of this report) eating environments at schools are explored through a combination of lab and field experiments that test interventions based on a nudging approach. Longitudinal surveys were conducted among both parents and children. Experiments in a real life school context examine whether making unhealthy snacks less accessible reduces snack consumption. Also, lab studies are used to examine underlying psychological mechanisms.

2 Task 7.1 Expectant and young parents' healthy eating behaviour

2.1 Background and objectives

Studying parental eating behaviours is essential, as parents determine the environment and influence eating habits and weight status of children, especially during the first years of life. Interactions and practices between parents and children during food-related activities, such as food shopping, meal preparation and mealtime, influence the development of eating patterns at early ages (Byrd-Bredbenner, Abbot, & Cussler, 2011). However, becoming a parent is a major life event that may bring considerable changes in individuals' eating patterns. Parenthood often results in strain since it requires time, finances and leads to fatigue, which can impede and interfere with motivation and ability for eating a healthy diet (Bassett-Gunter et al., 2013).

Some studies show that parenthood is associated with certain dietary improvements, such as breakfast consumption, intention to buy more organic foods, including more fruits and vegetables in the diet and setting regular mealtimes (e.g. Aschemann-Witzel, 2013; Hartmann, Dohle, & Siegrist, 2014). However, the majority of studies have reported a drop in dietary quality when adults become parents, resulting in more frequent consumption of foods rich in saturated fat, cholesterol, sodium and sugar (Nasuti et al., 2014; Wennberg et al., 2016). Consequently, the transition to parenthood and the first few years of children's lives are considered to hold great potential for preventing obesity in children and parents alike.

2.2 Methodology

In the first study (Moura & Aschemann-Witzel, 2020), face-to-face interviews were conducted with parents of young children (up to 4 years old) living in Denmark and in France, in order to gain insights into how the transition to parenthood affects the perceived healthfulness of eating behaviours, employing a problem-centred, life-course approach and interpreting findings on the background of Social Cognitive Theory.

In the second study (Moura & Aschemann-Witzel, 2021), a thematic analysis of sugar-related posts and comments on blogs and Facebook pages was conducted. Findings were set in a Social Judgment Theory analytical framework.

In the third study (Moura & Aschemann-Witzel, submitted), mothers in three countries (Argentina, France and Denmark) completed an online survey, and the data was subjected to a segmentation study. The survey was based on Social Cognitive Theory and items were developed based on a literature review and the preceding qualitative research.

In the fourth study (Moura, Grønhøj, & Aschemann-Witzel, submitted), an intervention to increase fathers' involvement with their family's healthy eating through exposure to new/disliked vegetables was developed and qualitatively evaluated. Fifteen Danish families took part. The intervention consisted of a three-week online intervention involving picture book reading, a sensory experience session, and the cooking of four recipes with the targeted vegetables and spices.

2.3 Main results

In the first study (Moura & Aschemann-Witzel, 2020), marked differences in dietary changes were perceived by parents across the four stages of becoming parents; pregnancy, first month with the baby, complementary feeding and child shares family meals. An effect which was termed 'equalizing effect' was found, meaning that becoming a parent appeared to lead to perceived increase in healthiness of dietary habits for some, in particular those stating to have eaten unhealthy, with the opposite for those who perceived to have eaten healthy before.

In the second study (Moura & Aschemann-Witzel, 2021), it was found that sugar consumption can be perceived as a two-sided experience: dangerous, sinful and addictive, but also comforting and delightful. Three main behavioral strategies of how parents deal with these ambivalences emerged: i) restriction, ii) moderation, and iii) liberation.

In the third study (Moura & Aschemann-Witzel, submitted), four segments of mothers were identified in each country, varying on work- and socio-economic status, self-efficacy and attitudes to health experts. Segments of mothers who are skeptical to nutrition advice from health professionals were identified. Stay-at-home mothers appear to face more barriers to healthy eating than mothers who work outside the home.

In the fourth study (Moura, Grønhøj, & Aschemann-Witzel, submitted), it was found that the cooking intervention motivated children and fathers to try the included vegetables, and it also increased fathers' sense of self-efficacy with regard to cooking healthy foods. These positive observations, however, were mainly seen within families who already had intentions to change to healthier eating behaviors.

2.4 Conclusion

Findings from the research on parents show that the transition to parenthood can represent a window of opportunity or a downturn with regard to perceived healthy eating among new parents. Several findings are key: First, an effect which was termed 'equalizing effect' was found, which means that those who regarded themselves as unhealthy eaters perceive to develop healthier eating behaviours, in turn, health-focused new parents perceived to decrease the healthiness of diets after becoming parents. Second, segments of new parents perceive trade-offs between individual freedom and morality of food choices when it comes to healthy eating, which can lead to negative parental reactions to health messages. Further, the direction of dietary changes after becoming parents in terms of healthiness is determined by social cognitive factors (e.g., self efficacy, social support), socio-economic factors (e.g., financial constraints, working environment and conditions) and social judgment aspects (attitudes towards public nutrition messages and nutrition guidelines). The significance of these factors varies for different segments of parents.

2.5 Further reading

Moura, A. F. (2021) Transitioning to parenthood: Factors influencing new parents' healthy eating behaviours and strategies for change. PhD-thesis. MAPP, Business and Social Sciences, Aarhus University.

2.6 References

Aschemann-Witzel, J. (2013). Danish mothers' perception of the healthiness of their dietary behaviors during transition to parenthood. Journal of Family Issues, 34(10), 1335-1355. doi:10.1177/0192513X12463688

Bassett-Gunter, R. L., Levy-Milne, R., Naylor, P. J., Symons Downs, D., Benoit, C., Warburton, D. E., Rhodes, R. E. (2013). Oh baby! Motivation for healthy eating during parenthood transitions: a longitudinal examination with a theory of planned behavior perspective. International Journal of Behavioural Nutrition and Physical Activity, 10, 88. doi:10.1186/1479-5868-10-88

Byrd-Bredbenner, C., Abbot, J. M., & Cussler, E. (2011). Relationship of social cognitive theory concepts to mothers' dietary intake and BMI. Maternal & Child Nutrition, 7(3), 241-252. doi:10.1111/j.1740-8709.2009.00232.x

Hartmann, C., Dohle, S., & Siegrist, M. (2014). Time for change? Food choices in the transition to cohabitation and parenthood. Public Health Nutrition, 17(12), 2730-2739. doi:10.1017/S1368980013003297

*Moura, A. F & Aschemann-Witzel, J. (2020). A downturn or a window of opportunity? How Danish and French parents perceive changes in healthy eating in the transition to parenthood. *Appetite*, 150, 104658.

*Moura, A. F.; Aschemann-Witzel, J. (2021). Perspectives on sugar consumption expressed on social media by French-speaking and Danish-speaking parents. *Social Science & Medicine*, 270, 113636.

*Moura, A. F. & Aschemann-Witzel, J. Socio-cognitive barriers to healthy eating among mothers: a segmentation analysis in Argentina, France and Denmark, Submitted.

*Moura, A. F., Grønhøj, A., & Aschemann-Witzel, J. My daddy is a food explorer: Development and application of food education activities for fathers and their young children. Submitted.

Nasuti, G., Blanchard, C., Naylor, P.-J., Levy-Milne, R., Warburton, D. E., Benoit, C., . . . Rhodes, R. E. (2014). Comparison of the dietary intakes of new parents, second-time parents, and nonparents: A longitudinal cohort study. Journal of the Academy of Nutrition and Dietetics, 114(3), 450-456. doi:doi.org/10.1016/j.jand.2013.07.042

Wennberg, A. L., Isaksson, U., Sandstrom, H., Lundqvist, A., Hornell, A., & Hamberg, K. (2016). Swedish women's food habits during pregnancy up to six months post-partum: A longitudinal study. Sexual & Reproductive Health Care, 8, 31-36. doi:10.1016/j.srhc.2016.01.006

3 Task 7.2 The potential of innovative eating devices to nudge willingness to try new foods and mitigate food rejections in preschoolers

3.1 Background and objective

Children's consumption of vegetables is under the recommended quantities across Europe (Kupka et al. 2020), This is worrisome for children's health today, as vegetables are an indispensable source of essential nutrients such as vitamins, minerals and fibers (Agudo et al 2002). Moreover, this is also worrisome for public health in the future as food preferences and habits formed during childhood track into adulthood (Nicklaus et al. 2005). There is a need to develop strategies to increase children's exposure to and familiarity with vegetables to induce higher acceptance of vegetables (Cooke 2007).

In this context, several authors have investigated how tactile interaction, play and crafting with vegetables can be a door opener for promoting tasting and consumption (Coulthard and Sealy 2017, Sanne et al. 2017, Hawkins et al. 2021, Nederkoorn et al. 2018). Handling vegetables in play exposes the child to their appearance, smell and texture. This increases familiarity and creates an opportunity for tasting without the pressure to eat. Exposure and familiarity to food items have been shown to increase willingness to taste and food acceptance (Cooke 2007, Aldridge et al. 2009, Heath et al. 2011).

In a previous project (Children's taste, the Research Council of Norway, no. 233831/E50), a collaboration with students from the Oslo School of Architecture and Design resulted in several prototypes of eating devices for young children promoting play and creativity, wherein two of the prototypes were selected for production in a larger scale: a landscape plate and a flexible skewer. The aim of Task 7.2 was to investigate the potential of these innovative eating devices to nudge willingness to try vegetables in preschool children. As new data collection was compromised in the COVID-19 context, the task was refocused on exploiting previously collected data.This chapter summarises the study and findings from Task 7.2.

3.2 Methodology

It was chosen to work in a kindergarten context, which is a privileged arena for affecting the development of food preferences in children across factors such as parental food neophobia, socioeconomic status, level of education or cultural background (Himberg-Sundet et al. 2018). Ninety-eight children from six kindergartens participated in the study in collaboration with the kindergarten personnel and based upon informed consent from the parents. The inclusion criteria of the children were 1) aged between 4 to 6 years, 2) attending kindergarten and 3) willing to participate in the vegetable-play session. The exclusion criterion was having allergies towards any of the vegetables served in the tests.

Two device prototypes targeted at children in preschool age were tested for their ability to engage the children in playing with and tasting vegetables (Figure 1). The study design involved three conditions 1) Landscape plate, 2) Flexible skewer and 3) White paper plate serving the role of control condition. Each kindergarten participated in the three test conditions.

Figure 1. The landscape plate (left) and the flexible skewer (right) utilised to promote willingness to try vegetables through play. Photo: Oslo School of Architecture and Design

Three commonly familiar vegetables (cucumber, red bell pepper and cherry tomatoes) and three commonly unfamiliar vegetables (squash, white cauliflower and red cabbage) in this age group were selected for the study. The vegetables were served simultaneously and in multiple separate bowls, to make sure that every child could reach every vegetable. The utensil of the day was demonstrated with a piece of cucumber before each session. The children could taste and eat what they wanted, spit out the vegetables if they did not like them, and leave vegetables they did not want to eat on the plate. One or more of the kindergarten personnel were present during the testing; they were asked to help keep the noise down, not to comment on the eating utensils, the vegetables or the children's eating, and not to taste any of the vegetables themselves. This was enforced in order to keep appraisal, pressure and role-modelling effects out of the experiment.

We captured serving amounts and leftover vegetables (vegetables children served themselves, but that were left on the plate/spitted out) to distinguish between usage in play and actual consumption. Mean weights per child for each kindergarten and session were considered for the analysis.

3.3 Main results

Vegetable servings were higher with the flexible skewer and the landscape plate than with the control white paper plate. Vegetable consumption was higher with the flexible skewer than with the control white paper plate.

Overall, the most familiar vegetables cucumber, cherry tomato and bell pepper had the highest consumption amounts and the less familiar vegetables cauliflower, red cabbage and squash had the lowest consumption amounts in all testing conditions combined. Self-servings of cucumber were significantly higher when using either the flexible skewer or the landscape plate, compared to the white plate. Self-servings of cauliflower were significantly higher when using the flexible skewer compared to the white plate. The mean consumption of cucumber per child was 32 grams higher when using the flexible skewer, compared to the white plate. Leftovers were significantly higher with the play utensils compared to the white plate.

3.4 Conclusion

Our findings advocate that playful eating utensils can increase intake of vegetables in shared kindergarten meals, compared to a traditional eating plate. However, after one exposure the playful eating utensils solely impacted the consumption of familiar vegetables, and not that of unfamiliar vegetables. The overall waste produced when using the playful eating utensils was higher, indicating a challenge for using the utensils on an everyday basis. Future research is recommended to further investigate the effects of playful eating on vegetable consumption, and to examine long-lasting effects and effects at individual level, especially for those children who show reluctance towards eating vegetables. Adverse effects of playful eating on food waste should also be further considered.

3.5 Further reading

Further information and results from Task 7.2 are in preparation for publication:

Almli, V.L., Schouteten, J., Pickard, A., Aass, J., and Gonera, A. (in prep). Can playful eating utensils increase children's vegetable intake in shared kindergarten meals?

3.6 References:

Agudo, A., Slimani, N., Ocke, M. C., Naska, A., Miller, A. B., Kroke, A., ... & Riboli, E. (2002). Consumption of vegetables, fruit and other plant foods in the European Prospective Investigation into Cancer and Nutrition (EPIC) cohorts from 10 European countries. *Public health nutrition*, *5*(6b), 1179-1196.

Aldridge, V., Dovey, T. M., & Halford, J. C. (2009). The role of familiarity in dietary development. *Developmental Review, 29*(1), 32-44.

Cooke, L. (2007). The importance of exposure for healthy eating in childhood: a review. *Journal of human nutrition and dietetics*, *20*(4), 294-301.

Coulthard, H. and A. Sealy (2017). "Play with your food! Sensory play is associated with tasting of fruits and vegetables in preschool children." *Appetite 113:* 84-90.

Hawkins, J. M., Ferringer, J., Grambo, E., Murkens, H., Smith, J., & Scifo, E. (2021). Tactile Play and Oral Acceptance of Wet Food Items. *The American Journal of Occupational Therapy*, *75*(Supplement_2), 7512505127p1-7512505127p1.

Heath, P., Houston-Price, C., & Kennedy, O. B. (2011). Increasing food familiarity without the tears. A role for visual exposure?. *Appetite*, *57*(3), 832-838.

Himberg-Sundet, A., A. L. Kristiansen, M. Bjelland, T. Moser, A. Holthe, L. F. Andersen and N. Lien (2018). "Is the environment in kindergarten associated with the vegetables served and eaten? The BRA Study." *Scandinavian Journal of Public Health*: 1403494818756702

Kupka, R., Siekmans, K., & Beal, T. (2020). The diets of children: Overview of available data for children and adolescents. *Global Food Security*, *27*, 100442.

Nederkoorn, C., Theiβen, J., Tummers, M., & Roefs, A. (2018). Taste the feeling or feel the tasting: Tactile exposure to food texture promotes food acceptance. *Appetite*, *120*, 297-301.

Nicklaus, S., Boggio, V., Chabanet, C., & Issanchou, S. (2005). A prospective study of food variety seeking in childhood, adolescence and early adult life. *Appetite*, *44*(3), 289-297.

Sanne, R., v. K. Ellen and d. V. Emely (2017). "Self-crafting vegetable snacks: testing the IKEA-effect in children." *British Food Journal 119*(6): 1301-1312.

4 Task 7.3 Exploring the eating environment in schools

4.1 Background and objectives

Adolescents are able to make more independent food decisions than children. During the transition from childhood to adolescence, previous studies have observed a change in adolescents' consumption towards more unhealthy foods and fewer healthy foods (Albani et al., 2017; Lytle et al., 2000; Winpenny et al., 2017). This is alarming, as adolescents' eating habits tend to remain stable and transmitted into adulthood (Cruz et al., 2018). Therefore, the improvement of healthy eating habits among pre-adolescents is of great importance for the promotion of long-term health, and understanding environmental and individual factors that influence pre-adolescents' eating habits is crucial to develop effective interventions.

The school environment is an important setting to promote healthy eating habits, as approximately one-third (35%) of daily intake is consumed at school (Briefel et al., 2009). The transition from primary to secondary school is a major life event for pre-adolescents which may impact their healthy eating habits. Nudging may help to facilitate healthy choices by changing the physical environment in such a way that it is easier to make certain choices (Cadario & Chandon, 2020; Thaler & Sunstein, 2008). Autonomy support, based on the Self-Determination Theory, may enhance pre-adolescents' motivation to make healthy choices (Deci & Ryan, 1985; Joussemet et al., 2008).

Task 7.3 aimed to explore how schools can support pre-adolescents in making healthy choices. More specifically, the objectives of Task 7.3 were to develop influential nudging interventions to lead children to healthier eating habits, to examine the impact of nudges on feelings of autonomy and intrinsic motivation for healthy food choices and to understand the effects of nudging interventions over time.

4.2 Methodology

4.2.1 Study 1: Healthy eating habits at school: The transition from primary to secondary school

A longitudinal study was conducted to examine how the school environment during the transition from primary to secondary school influenced Dutch pre-adolescents' food consumption. In addition, the influence of parenting practices, autonomy, motivation and competence were measured. At primary school (T1), 142 pre-adolescents from nine schools and 81 parents participated and completed a questionnaire. At secondary school (T2), 66 pre-adolescents completed a questionnaire.

Due to corona, secondary schools were closed and further data collection was cancelled.

4.2.2 Study 2: Nudging healthier beverage choices

An experimental study was conducted to examine the effects of an availability nudge and economic incentives on pre-adolescents' healthy beverage choices. A 2x2 between subject experimental study design was used (availability nudge: absent/present & economic incentives: absent/present). The experiment was part of Science Live at a Dutch science museum (NEMO). A total of 299 parent-preadolescent dyads participated in the study. Pre-

adolescents (between 8 and 14 years old) were allowed to independently buy two drinks with simulated money (Figure 1). Afterwards, they received a questionnaire and were asked to play a sugar cubes game about sugar content in beverages. In addition, one of their parents was asked to complete a questionnaire.

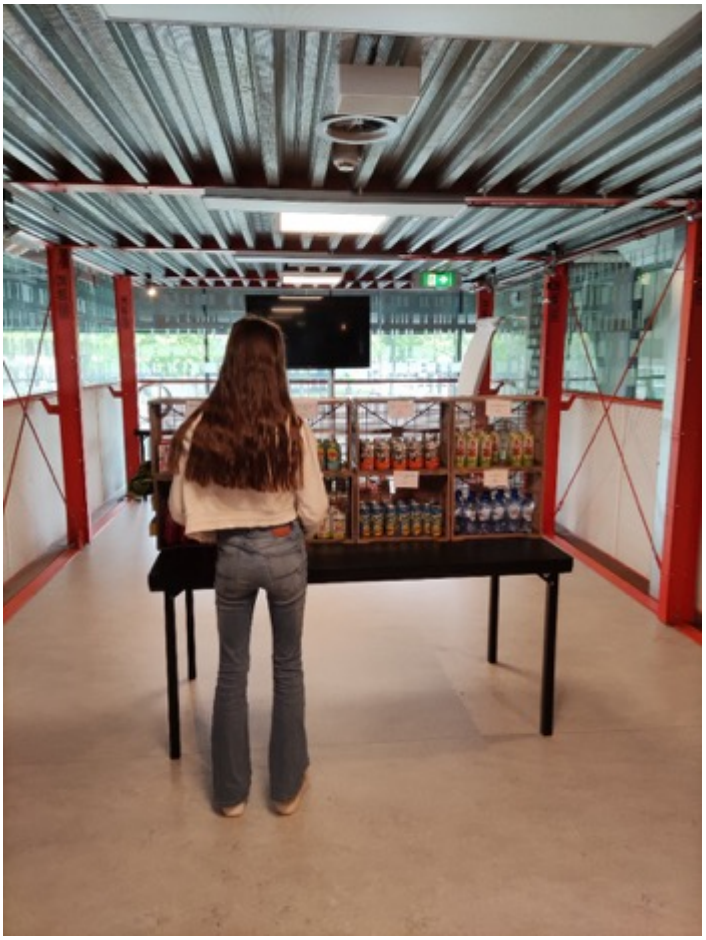

Figure 2. Pre-adolescent choosing two drinks from the shop

4.2.3 Study 3: Autonomy support and motivation for healthy snack choices

An observational study was conducted to examine how parents provide food-related autonomy support and how parental autonomy support was related to pre-adolescents' motivation for healthy snack choices and their actual independent healthy snack choices. The experiment was part of Science Live at a Dutch science museum (NEMO). A total of 202 parent-preadolescent dyads participated in the study. Pre-adolescents (between 8 and 14 years old) and one of their parents were asked to select snacks for a week (Figure 2). Their conversations were audio recorded. Afterwards, pre-adolescents were allowed to independently choose three snacks to take home. In addition, pre-adolescents and one of their parents were both asked to complete a questionnaire. Autonomy-supportive behaviors during the task were frequency coded based on a previous conceptual framework (Vaughn et al., 2016).

Figure 3. Parent and pre-adolescent selecting snacks during the task

4.2.4 Study 4: Promoting healthier beverage choices through nudging and an autonomy-supportive workshop at school

An experimental study was conducted to examine the effects of an availability nudge and autonomy-supportive workshop about healthy beverages on adolescents' healthy beverage choices. A 2x2 between subject experimental study design was used (availability nudge: absent/present & autonomy supportive workshop: absent/present). A total of 323 adolescents from five secondary schools in the Netherlands participated in the study. The workshop about healthy beverages was developed with experts and adolescents on how to motivate adolescents. After the 45-minute workshop (Figure 3), adolescents were allowed to choose two beverages to take home and were asked to complete a questionnaire. Adolescents who did not receive the workshop could immediately choose two beverages and complete a questionnaire. The healthiness of the drink assortment differed depending on the presence of the availability nudge.

Figure 4. Workshop about healthy beverages at secondary school

4.3 Main results

4.3.1 Main result Study 1: Healthy eating habits at school: The transition from primary to secondary school

At primary school, pre-adolescents in general felt competent to engage in healthy eating behavior challenges and were motivated to eat healthily, which was related to higher healthy intake at school (van Nee, van Kleef, & van Trijp, 2021). However, their healthy intake decreased after the transition to secondary school. Pre-adolescents who felt competent to eat healthily consumed more healthy at secondary school.

4.3.2 Main result Study 2: Nudging healthier beverage choices

Pre-adolescents made more healthy drink choices when an availability nudge was present. Economic incentives and the interaction effect between the availability nudge and economic incentives were not significant.

4.3.3 Main result Study 3 Autonomy support and motivation for healthy snack choices

Encouragement, reasoning and negotiation were the main practices parents used to help their pre-adolescent choose a healthy snack. However, parental autonomy support did not contribute to preadolescents' independent and joint parent-preadolescent healthy snack choices. Pre-adolescents who were more autonomously motivated to eat healthy made more independent healthy snack choices.

4.3.4 Main result Study 4: Promoting healthier beverage choices through nudging and an autonomy-supportive workshop at school

Data collection for the study has been finished in June 2022. The data will be analyzed to examine the effects of the availability nudge and the autonomy-supportive workshop on pre-adolescents' healthy beverage choices.

4.4 Conclusion

The eating environment at schools has a major influence on pre-adolescents' healthy eating habits. Findings show that pre-adolescents' healthy eating habits decrease during the transition from primary to secondary school. Competence to eat healthily seems to act as a buffer against the negative effects of the school transition on pre-adolescents' healthy intake. In addition, an availability nudge can help to increase healthier beverage choices. Furthermore, pre-adolescents who are more motivated to eat healthy choose healthier options. Schools can support pre-adolescents in making healthy choices by creating a healthy school environment with enhanced availability of healthy options. In addition, pre-adolescents' competence and autonomy should be supported in order to learn to make healthier choices.

4.5 Further reading

Further information and results from Task 7.3 are published or are in preparation for publication:

van Nee, R. & van Kleef, E. (2022). Expanding food worlds of pre-adolescents. Practical guidelines to support pre-adolescents in eating healthy outside home in a tempting food environment. https://edulia.eu/wp-content/uploads/sites/25/2022/03/Guidelines-Expanding-food-worlds-of-pre-adolescents.pdf

van Nee, R. L., van Kleef, E., & van Trijp, H. (in prep). Longitudinal changes in healthy intake from primary to secondary school.

van Nee, R. L., Mulder, F., van Kleef, E., & van Trijp, H. (in prep). The impact of an availability nudge and economic incentives on pre-adolescents' healthier beverage choices.

van Nee, R. L., de Groot, A., van Kleef, E., & van Trijp, H. (in prep). Parental autonomy support for pre-adolescents' healthy snack choices.

van Nee, R. L., van Kleef, E., & van Trijp, H. (in prep). Promoting healthier beverage choices among adolescents: Effects of an autonomy-supportive workshop and availability nudge.

4.6 References

Albani, V.; Butler, L.T.; Traill, W.B.; Kennedy, O.B. Fruit and vegetable intake: Change with age across childhood and adolescence. Br. J. Nutr. 2017, 117, 759–765.

Briefel, R.R.; Wilson, A.; Gleason, P.M. Consumption of Low-Nutrient, Energy-Dense Foods and Beverages at School, Home, and Other Locations among School Lunch Participants and Nonparticipants. J. Am. Diet. Assoc. 2009, 109, S79–S90.

Cadario, R., & Chandon, P. (2020). Which healthy eating nudges work best? A meta-analysis of field experiments. Marketing Science, 39(3), 465-486.

Cruz, F.; Ramos, E.; Lopes, C.; Araújo, J. Tracking of food and nutrient intake from adolescence into early adulthood. Nutrition 2018, 55-56, 84–90.

Deci, E.L.; Ryan, R.M. The general causality orientations scale: Self-determination in personality. J. Res. Pers. 1985, 19, 109–134.

Joussemet, M.; Landry, R.; Koestner, R. A self-determination theory perspective on parenting. Can. Psychol. Can. 2008, 49, 194–200.

Lytle, L.A.; Seifert, S.; Greenstein, J.; McGovern, P. How Do Children's Eating Patterns and Food Choices Change over Time? Results from a Cohort Study. Am. J. Health Promot. 2000, 14, 222–228.

Thaler, R. H., & Sunstein, C. R. (2008). Nudge: Improving decisions about health, wealth, and happiness. Yale University Press.

*van Nee, R. L., van Kleef, E., & van Trijp, H. (2021). Dutch preadolescents' food consumption at school: influence of autonomy, competence and parenting practices. Nutrients, 13(5), 1505. doi:10.3390/nu13051505

Vaughn, A. E., Ward, D. S., Fisher, J. O., Faith, M. S., Hughes, S. O., Kremers, S. P., ... & Power, T. G. (2016). Fundamental constructs in food parenting practices: a content map to guide future research. Nutrition reviews, 74(2), 98-117.

Winpenny, E.M.; Corder, K.L.; Jones, A.; Ambrosini, G.L.; White, M.; Van Sluijs, E.M. Changes in diet from age 10 to 14 years and prospective associations with school lunch choice. Appetite 2017, 116, 259–267.

5 Conclusion

The objective of Work Package 7 in the EDULIA programme was to understand the impact exerted by the eating environment on children's and pre-adolescents' healthy eating. This included identifying possible opportunities to "tweak" the environment to support healthy choices; how barriers to healthy eating in this environment may be overcome, and, in general, how these insigths may be used for nudging or social marketing. Parents were analysed as the earliest influence on preschoolers, and the 'eating environment' was analysed as the overall context in which individual food choices of pre-schoolers and pre-adolescents take place. Altogether, the work package and the tasks included in the work, represent a multi-method approach to the field, using both qualitative, in-depth studies; such as interviews, observations, and content analyses, and quantitative studies; using surveys, field and lab experiments and real-life interventions.

The findings of the research on parents in the transition to parenthood confirm that this period is challenging in terms of food-related behaviours, but they also document that such events may be perceived as a window of opportunity for some parents with regard to perceived healthy eating. An interesting 'equalizing effect' was discovered, meaning that some parents, i.e., those who regarded themselves to be unhealthy eaters before entering parenthood, perceived to develop healthier eating behaviours upon expecting and/or the advent of the child. However, health-focused new parents perceived to decrease the healthiness of diets after becoming parents. This part of the studies on parenthood also identified segments of new parents who showed reactance to what they perceived as moralising public messages regarding healthy eating. As the transition to parenthood can present both barriers and opportunities for healthier eating, this calls for more attention from health professionals as well as policy makers and researchers. Food interventions involving fathers and children, focusing on sensorial aspects of healthy foods, cooking skills and enjoyment appear as promising approaches worth exploring further to promote healthy eating in the early family food environment. The work also emphasizes the need for a differentiated approach to support new parents to improve the healthy eating environment of young children and their parents.

Regarding the nudging intervention in the context of kindergartens, the findings suggest that playful eating utensils can increase intake of vegetables in shared kindergarten meals, compared to a traditional eating plate, although only the consumption of familiar vegetables increased, and not that of unfamiliar vegetables. The overall waste produced when using the playful eating utensils was high, indicating a challenge for using the utensils on an everyday basis. Future research is recommended to further investigate the effects of playful eating on vegetable consumption, and to examine long-lasting effects and effects at individual level, especially for those children who show reluctance towards eating vegetables. However, the possible increase in food waste by using such approaches needs to be considered.

Studying the eating environment at school, the findings from the last task of this work package confirm that the eating environment at schools has a major influence on pre-adolescents' food choices. Findings show that in line with other studies, pre-adolescents' healthy eating decreased during the transition from primary to secondary school. However, competence to eat healthily seemed to act as a buffer against the negative effects of the school transition on pre-adolescents' healthy intake. In addition, availability nudges can help increase healthier beverage choices. Furthermore, pre-adolescents who were more motivated to eat healthy chose healthier options. Schools can support pre-adolescents in making healthy choices by creating a healthy school environment with enhanced availability of healthy options. In addition, pre-adolescents' competence and autonomy should be supported in order for them to learn to

make healthier choices. These results hold high relevance for policy makers, schools and parents.

6 References

Edulia references are marked with *

Agudo, A., Slimani, N., Ocke, M. C., Naska, A., Miller, A. B., Kroke, A., ... & Riboli, E. (2002). Consumption of vegetables, fruit and other plant foods in the European Prospective Investigation into Cancer and Nutrition (EPIC) cohorts from 10 European countries. *Public health nutrition*, *5*(6b), 1179-1196.

Albani, V.; Butler, L.T.; Traill, W.B.; Kennedy, O.B. Fruit and vegetable intake: Change with age across childhood and adolescence. Br. J. Nutr. 2017, 117, 759–765.

Aldridge, V., Dovey, T. M., & Halford, J. C. (2009). The role of familiarity in dietary development. *Developmental Review, 29*(1), 32-44.

Aschemann-Witzel, J. (2013). Danish mothers' perception of the healthiness of their dietary behaviors during transition to parenthood. Journal of Family Issues, 34(10), 1335-1355. doi:10.1177/0192513X12463688

Bassett-Gunter, R. L., Levy-Milne, R., Naylor, P. J., Symons Downs, D., Benoit, C., Warburton, D. E., Rhodes, R. E. (2013). Oh baby! Motivation for healthy eating during parenthood transitions: a longitudinal examination with a theory of planned behavior perspective. International Journal of Behavioural Nutrition and Physical Activity, 10, 88. doi:10.1186/1479-5868-10-88

Birch, L. L. (1999). Development of food preferences. *Annual review of nutrition*, *19*, 41.

Birch, L. L., & Anzman, S. L. (2010). Learning to eat in an obesogenic environment: a developmental systems perspective on childhood obesity. *Child Development Perspectives*, *4*(2), 138-143.

Briefel, R.R.; Wilson, A.; Gleason, P.M. Consumption of Low-Nutrient, Energy-Dense Foods and Beverages at School, Home, and Other Locations among School Lunch Participants and Nonparticipants. J. Am. Diet. Assoc. 2009, 109, S79–S90.

Byrd-Bredbenner, C., Abbot, J. M., & Cussler, E. (2011). Relationship of social cognitive theory concepts to mothers' dietary intake and BMI. Maternal & Child Nutrition, 7(3), 241-252. doi:10.1111/j.1740-8709.2009.00232.x

Cadario, R., & Chandon, P. (2020). Which healthy eating nudges work best? A meta-analysis of field experiments. Marketing Science, 39(3), 465-486.

Cooke, L. (2007). The importance of exposure for healthy eating in childhood: a review. *Journal of human nutrition and dietetics*, *20*(4), 294-301.

Coulthard, H. and A. Sealy (2017). "Play with your food! Sensory play is associated with tasting of fruits and vegetables in preschool children." *Appetite 113:* 84-90.

Cruz, F.; Ramos, E.; Lopes, C.; Araújo, J. Tracking of food and nutrient intake from adolescence into early adulthood. Nutrition 2018, 55-56, 84–90.

Deci, E.L.; Ryan, R.M. The general causality orientations scale: Self-determination in personality. J. Res. Pers. 1985, 19, 109–134.

Hartmann, C., Dohle, S., & Siegrist, M. (2014). Time for change? Food choices in the transition to cohabitation and parenthood. Public Health Nutrition, 17(12), 2730-2739. doi:10.1017/S1368980013003297

Hawkins, J. M., Ferringer, J., Grambo, E., Murkens, H., Smith, J., & Scifo, E. (2021). Tactile Play and Oral Acceptance of Wet Food Items. *The American Journal of Occupational Therapy*, *75*(Supplement_2), 7512505127p1-7512505127p1.

Heath, P., Houston-Price, C., & Kennedy, O. B. (2011). Increasing food familiarity without the tears. A role for visual exposure?. *Appetite*, *57*(3), 832-838.

Himberg-Sundet, A., A. L. Kristiansen, M. Bjelland, T. Moser, A. Holthe, L. F. Andersen and N. Lien (2018). "Is the environment in kindergarten associated with the vegetables served and eaten? The BRA Study." *Scandinavian Journal of Public Health*: 1403494818756702

Joussemet, M.; Landry, R.; Koestner, R. A self-determination theory perspective on parenting. Can. Psychol. Can. 2008, 49, 194–200.

Kupka, R., Siekmans, K., & Beal, T. (2020). The diets of children: Overview of available data for children and adolescents. *Global Food Security*, *27*, 100442.

Lytle, L.A.; Seifert, S.; Greenstein, J.; McGovern, P. How Do Children's Eating Patterns and Food Choices Change over Time? Results from a Cohort Study. Am. J. Health Promot. 2000, 14, 222–228.

Mikkelsen, M. V., Husby, S., Skov, L. R., & Perez-Cueto, F. J. (2014). A systematic review of types of healthy eating interventions in preschools. *Nutrition journal*, *13*(1), 1-19.

Moore, E. S., Wilkie, W. L., & Desrochers, D. M. (2017). All in the family? Parental roles in the epidemic of childhood obesity. *Journal of Consumer Research*, *43*(5), 824-859.

*Moura, A. F & Aschemann-Witzel, J. (2020). A downturn or a window of opportunity? How Danish and French parents perceive changes in healthy eating in the transition to parenthood. *Appetite*, 150, 104658.

*Moura, A. F.; Aschemann-Witzel, J. (2021). Perspectives on sugar consumption expressed on social media by French-speaking and Danish-speaking parents. *Social Science & Medicine*, 270, 113636.

*Moura, A. F. & Aschemann-Witzel, J. Socio-cognitive barriers to healthy eating among mothers: a segmentation analysis in Argentina, France and Denmark, Submitted.

*Moura, A. F., Grønhøj, A., & Aschemann-Witzel, J. My daddy is a food explorer: Development and application of food education activities for fathers and their young children. Submitted.

Nasuti, G., Blanchard, C., Naylor, P.-J., Levy-Milne, R., Warburton, D. E., Benoit, C., . . . Rhodes, R. E. (2014). Comparison of the dietary intakes of new parents, second-time parents, and nonparents: A longitudinal cohort study. Journal of the Academy of Nutrition and Dietetics, 114(3), 450-456. doi:doi.org/10.1016/j.jand.2013.07.042

Nederkoorn, C., Theißen, J., Tummers, M., & Roefs, A. (2018). Taste the feeling or feel the tasting: Tactile exposure to food texture promotes food acceptance. *Appetite*, *120*, 297-301.

Nicklaus, S., Boggio, V., Chabanet, C., & Issanchou, S. (2005). A prospective study of food variety seeking in childhood, adolescence and early adult life. *Appetite*, *44*(3), 289-297.

Pocock, M., Trivedi, D., Wills, W., Bunn, F., & Magnusson, J. (2010). Parental perceptions regarding healthy behaviours for preventing overweight and obesity in young children: a systematic review of qualitative studies. *Obesity reviews*, *11*(5), 338-353.

Sanne, R., v. K. Ellen and d. V. Emely (2017). "Self-crafting vegetable snacks: testing the IKEA-effect in children." *British Food Journal 119*(6): 1301-1312.

Thaler, R. H., & Sunstein, C. R. (2008). Nudge: Improving decisions about health, wealth, and happiness. Yale University Press.

*van Nee, R. L., van Kleef, E., & van Trijp, H. (2021). Dutch preadolescents' food consumption at school: influence of autonomy, competence and parenting practices. Nutrients, 13(5), 1505. doi:10.3390/nu13051505

Vaughn, A. E., Ward, D. S., Fisher, J. O., Faith, M. S., Hughes, S. O., Kremers, S. P., ... & Power, T. G. (2016). Fundamental constructs in food parenting practices: a content map to guide future research. Nutrition reviews, 74(2), 98-117.

Wennberg, A. L., Isaksson, U., Sandstrom, H., Lundqvist, A., Hornell, A., & Hamberg, K. (2016). Swedish women's food habits during pregnancy up to six months post-partum: A longitudinal study. Sexual & Reproductive Health Care, 8, 31-36. doi:10.1016/j.srhc.2016.01.006

Winpenny, E.M.; Corder, K.L.; Jones, A.; Ambrosini, G.L.; White, M.; Van Sluijs, E.M. Changes in diet from age 10 to 14 years and prospective associations with school lunch choice. Appetite 2017, 116, 259–267.