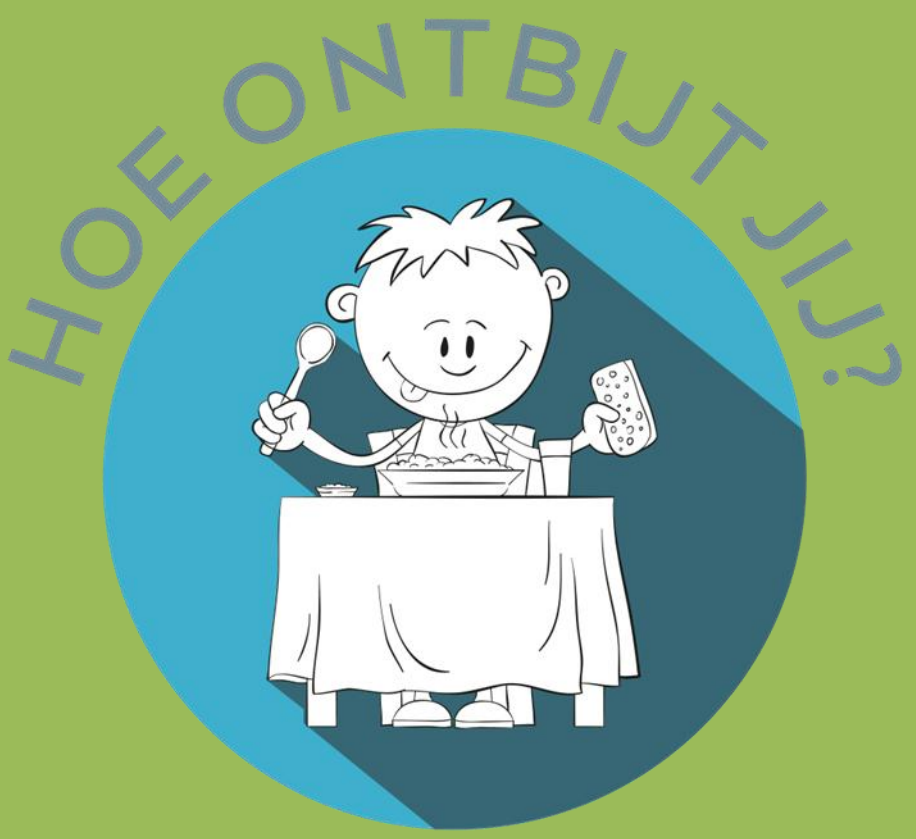

Romy Houtzager

IMPROVING BREAKFAST QUALITY OF CHILDREN: AN INTERVENTION TO CHANGE KNOWLEDGE, ATTITUDE AND BEHAVIOUR

Improving breakfast quality of children:
an intervention to change knowledge, attitude and behaviour

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Abstract

Background: Many children eat breakfast, but the quality of their breakfast should be improved. The aim of the present study is to investigate which method (i.e. tailored feedback, classroom education or the use of role models) is the most effective to improve knowledge about, attitude towards, and behaviour regarding the quality of the breakfast of children (aged 8-10) living in Dutch disadvantaged neighbourhoods.

Methods: A study with a pre-post-test design is conducted at seven primary schools in the Netherlands. The classes were assigned to one of the four conditions: tailored feedback, classroom education, use of role models or a combination of the three methods. 242 children conducted the pre-questionnaire, participated in four lessons and conducted the post-questionnaire. Knowledge was measured with the same questions in the pre- and post-questionnaire about the benefits of breakfast and classifying products in the category 'allowed to eat every day, now and then, occasionally'. Attitude was measured by comparing eight attitude statements in the pre- and post-questionnaires. Self-reported behaviour was measured by comparing the assignment 'what did you eat this morning for breakfast' in lesson one and four.

Results: Results of the intervention showed that knowledge about classifying products in the correct category was improved over time ($P<0.001$). It improved the most in the tailored feedback condition ($P<0.05$). Attitude stayed the same for the four conditions. Self-reported behaviour was improved over time ($P<0.001$) for all conditions, but tailored feedback improved more ($P<0.001$).

Conclusions: Overall, tailored feedback may be the most effective method to change knowledge, attitude and behaviour of children regarding a healthy breakfast. It is recommended to implement this tailored feedback approach after some adjustments at other schools in the Netherlands.

Keywords: breakfast quality, intervention study, role models, tailored feedback, classroom education, self-reported behaviour, healthy breakfast

Preface

This master thesis is written for the master Management, Economics and Consumer studies at the Marketing and Consumer Behaviour group at Wageningen University. During my study, I focused on consumer behaviour in combination with nutrition. For my master thesis, it was a logical choice to find a topic that fitted these interests. Therefore, the project "What do you eat for breakfast" was a great choice, because I could investigate the breakfast habits of children and could also learn more about a healthy breakfast. Besides, I could investigate which method is the most effective to improve the quality of breakfast of children. I am enthusiastic about the conclusions and I hope in the future all children in the Netherlands learn more about a healthy breakfast through tailored feedback, because it is a very important meal of the day and this study showed that tailored feedback was the most effective method.

I liked working together with colleagues from Food & Biobased Research. It was a lot of fun to collect together with them the data on the different schools in Tilburg, Rotterdam and Arnhem. Without their help, I could not have investigated this topic. Therefore a special thanks to them. Furthermore, I want to thank Ellen for her supervision during my thesis. She was really involved in my thesis and willing to help if I needed advice. Besides, I appreciated her feedback and critical questions during my thesis. I want also to thank Gertrude for her feedback on my proposal, my draft and final report. Furthermore, I want to thank my boyfriend, friends and family who supported me during this thesis too.

I hope you will enjoy reading my thesis.

Kind regards,

Romy Houtzager
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1. Introduction

Nowadays, children have a lot of unhealthy habits (Elsenburg, Corpeleijn, Van Sluijs, & Atkin, 2014). An unhealthy habit is breakfast skipping, because it is associated among others with being overweight (Berkey, Rockett, Gillman, Field, & Colditz, 2003; Moreno & Rodríguez, 2007; Niemeier, Raynor, Lloyd-Richardson, Rogers, & Wing, 2006; O 'Neil, Nicklas, & Fulgoni Iii, 2015; Szajewska & Ruszczynski, 2010). Different factors such as gender, age and socio-demographics play a role in breakfast skipping (Hallström et al., 2011; Vereecken et al., 2009). Children of parents with lower socio-economic status (SES) are likely to skip their breakfast even more often than other children (Croezen, Visscher, Ter Bogt, Veling, & Haveman-Nies, 2009; Moore et al., 2007; Raaijmakers, Bessems, Kremers, & Van Assema, 2010; Rampersaud, 2008).

Besides the breakfast skippers, 94% of Dutch children aged 7-8 eat breakfast daily and for 9-13 years old this is 89% boys and 88% girls (Van Rossum, Fransen, Verkaik-Kloosterman, Buurma-Rethans, & Ocke, 2011). However, this does not mean that children eat a healthy breakfast. Especially children living in a more urbanized area and children of ethnic minorities need more attention to improve the quality of their breakfast (Van Rossum et al., 2011). A previous study investigated how many children (aged 10-19) consumed a healthy breakfast according to the recommendations of The Netherlands Nutrition Centre (NNC). This means to eat a breakfast which includes food from all the five groups; grain, dairy, fat, liquid and fruit (Raaijmakers et al., 2010). The results showed that less than 9% of the children eat a healthy breakfast according the recommendations (Raaijmakers et al., 2010). Another study investigated how many children (aged 12-17) consumed a healthy breakfast according to a "breakfast quality index" in nine European cities (Hallström et al., 2012). This "breakfast quality index" was based on consuming cereals or cereal products, dairy products and fruits or vegetables. Only 4% of the children ate healthy according to the index.

Interventions are conducted to try to improve these breakfast habits. There are interventions aimed to improve a particular food group such as fruit, vegetables or cereals (Reynolds et al., 2000; Williams, 2014). But to my knowledge only two intervention studies (Dehdari, Rahimi, Aryaeian, & Gohari, 2014; Martens, Van Assema, Paulussen, Schaalma, & Brug, 2006) aimed to improve total breakfast quality of teenagers and no total breakfast quality interventions are conducted with children aged 8-10. Besides, most interventions focus on improving breakfast

frequency during the week or improving nutrition knowledge (Shi-Chang et al., 2004; Watson, Kwon, Nichols, & Rew, 2009). These interventions measure knowledge improvements, attitude change towards and behaviour regarding nutrition by using pre- and post-questionnaires. After these interventions, nutrition knowledge increased, but attitude and behavioural changes show mixed results. Moreover, these interventions use only nutrition education to achieve their objectives, but this does not seem the most effective method because attitude and behavioural changes show only small results (Martens et al., 2006; Shi-Chang et al., 2004; Watson et al., 2009). Therefore, it seems still unknown what the best method is to improve knowledge and behaviour regarding breakfast. Moreover, investigating breakfast quality is lacking in the past conducted interventions, but when total breakfast quality is measured it is only conducted with teenagers.

Therefore, in this study an intervention is conducted with the objective to improve the quality of breakfast choices of children aged 8-10 and increasing their knowledge about the importance of a healthy breakfast and about which breakfast products are healthy. The intervention took place in disadvantaged neighbourhoods in the Netherlands, because the children of parents with lower SES need to improve their breakfast the most (Van Rossum et al., 2011). In this study, the focus is on two promising methods: use of role models and tailored feedback. To my knowledge, these two methods have not been investigated before in a breakfast intervention study. Beside, these two methods are compared with a method used more often: classroom education.

The first promising method is the use of role models. In a previous qualitative study, making use of role models is suggested as a promising intervention strategy to improve breakfast behaviour in children (Van Kleef, Vingerhoeds, Vrijhof, & Van Trijp, n.d.). Role models are already been used in commercials to promote products and services, but are also effective in intervention studies to reduce smoking behaviour at teenagers (P. S. Lin, 2014; Woohyun, 2016). The second promising method is tailored feedback. When information is made more personally relevant, it can improve knowledge about nutrition and it can induce behaviour change (Fallaize et al., 2015). Moreover, tailored feedback in combination with communication of the desired behaviour could improve the feasibility of short term nutrition goals (Michie, Johnston, Francis, Hardeman, & Eccles, 2008). In the past, studies showed that tailored approaches are more effective than non-tailored approaches for changing eating behaviour (De Vries, Kremers, Smeets, Brug, & Eijmael, 2008; Oenema & Brug, 2003;

Wright, Sherriff, Dhaliwal, & Mamo, 2011). In this study, these two methods are compared with a third method: the classroom education method. Most children are used to learn by teacher-centred education (Bishop & Verleger, 2013). This means that they obtain new knowledge from a teacher during classroom lessons (Ros, 2007). Studies that used education courses as a method showed mostly a knowledge increase and some behavioural and attitude changes (Powers, Struempler, Guarino, & Parmer, 2005; Shi-Chang et al., 2004; Watson et al., 2009).

The aim of the present study is to investigate which method (i.e. tailored feedback, classroom education or the use of role models) is the most effective to improve knowledge about, attitude towards, and behaviour regarding the quality of the breakfast of children (aged 8-10) living in Dutch disadvantaged neighbourhoods. The following research question is formulated: Which intervention method (i.e., tailored feedback, classroom education or use of role models) is the most effective to improve knowledge about, attitude towards and behaviour regarding the quality of the breakfast of children (aged 8-10) living in a Dutch disadvantage neighbourhood?

In this study, an intervention is developed with four different conditions (i.e. use of role models, tailored feedback, classroom education and a combination of the three methods). The last condition was added to investigate if a combination of the three other conditions is more effective than one method. This intervention is conducted in Dutch schools positioned in disadvantaged neighbourhoods, because children from parents of lower socio-economic status show more unhealthy breakfast behaviour (Vereecken et al., 2009). By knowing which intervention method is the most effective, this method can reduce unhealthy breakfast habits and improve the quality of the breakfast by children living in disadvantaged neighbourhoods in the Netherlands.

2. Theoretical framework

Breakfast habits of children related to health

In order to reduce unhealthy breakfast habits, one needs to learn which breakfast habits are present in children and the reasons behind these habits. Nowadays, children have a lot of unhealthy habits (Elsenburg et al., 2014). An unhealthy habit is breakfast skipping. In the Netherlands, 1 to 5% of 1713 children are skipping their breakfast almost daily according to The Dutch National Food Consumption Survey 2007-2010 (Van Rossum et al., 2011). Skipping breakfast is associated, among others, with being overweight (Berkey et al., 2003; Moreno & Rodríguez, 2007; Niemeier et al., 2006; O 'Neil et al., 2015; Szajewska & Ruszczynski, 2010). In a study, the researchers investigated the difference in weight between children who skip their breakfast or eat breakfast daily. They found that children who skip their breakfast were heavier than children who eat breakfast every day (Giovannini et al., 2008).

Different reasons exist for skipping breakfast such as lack of time in the morning (Bruening, Larson, Story, Neumark-Sztainer, & Hannan, 2011), prefer sleep above breakfast and not feeling hungry (Rampersaud, 2005; Van Kleef, Vingerhoeds, Vrijhof, & Van Trijp, n.d.). Girls skip their breakfast even more, because girls think it makes them skinny (Raaijmakers et al., 2010; Rampersaud, Pereira, Girard, Adams, & Metzl, 2005; Vereecken et al., 2009). Besides, children with parents of low SES are also associated with irregular breakfast habits (Vereecken et al., 2009). Children with parents of low SES are likely to skip their breakfast even more than other children (Croezen et al., 2009; Moore et al., 2007; Raaijmakers et al., 2010; Rampersaud, 2008).

Other children consume breakfast, because of reasons such as hunger, the taste of the food and health concerns (Hallström et al., 2011). In a Dutch study, it was shown that children consume also breakfast more regularly when parents consume breakfast regularly (Keski-Rahkonen, Kaprio, Rissanen, Virkkunen, & Rose, 2003). Not only the breakfast behaviour of parents, but their presence during breakfast, encouragement by parents or having family meals and parenting style has also an influence on breakfast behaviour of children (Jørgensen, Pedersen, Meilstrup, & Rasmussen, 2011).

Common approaches to change eating habits of children

Nutritional education throughout the past decades

During recent years, nutrition education became more important to change breakfast habits (Contento, 2008). Health professionals needed an effective method to reduce obesity, because of the increase of obesity worldwide. Schools became an important field to provide children with nutrition education. Different interventions used the classroom as a setting and a teacher as a way to provide the information (Shi-Chang et al., 2004; Watson et al., 2009). A review of Contento et al. examined 265 nutrition education intervention studies conducted from 1980 till 1999 (Contento, Randell, & Basch, 2002). The researchers found 21 general nutrition education studies of the 265 nutrition education intervention studies focussed on information transfer and the majority (n=41) of the behaviourally focused studies (n=53) measured also information transfer. The emphasis of nutrition education was on providing new information. Although information transfer appears a lot in studies, nutrition education is more likely to be effective when it is not only focussing on providing knowledge, but when it focusses also on behaviour and when it systematically links theory, research and practice (Contento, 2008).

Current interventions and their impact

Different breakfast interventions are conducted in the past at schools. At school is an important field and it is easy to implement courses with nutritional knowledge to increase nutrition knowledge or hopefully change attitude and behaviour towards nutrition. Some interventions provided free breakfast at schools (Ask, Hernes, Aarek, Johannessen, & Haugen, 2006; Crepinsek, Singh, Bernstein, & McLaughlin, 2006; Murphy et al., 2011) to investigate if children change their behaviour after getting a free healthy breakfast. In the study of Ask et al. only males improved their food pattern who received a free healthy breakfast compared to males who did not received a free healthy breakfast (Ask et al., 2006). In the study of Crepinsek et al. breakfast skipping was not different between intervention and control group, but the intervention group was more likely to consume a healthier breakfast (Crepinsek et al., 2006). Other interventions do not provide food at schools, but provide nutritional information about food (Table 1). From these interventions that provided nutritional information about food showed an impact on knowledge, but the impact on attitude and behaviour was mixed.

Breakfast as element of study or main focus

Interventions include breakfast as element of their study, but focus also on other meals and/or

focus on intake of individual foods during the day. The study of Watson et al. focussed also, beside breakfast frequency, on fruits, vegetables, milk, soft drinks, meat, poultry and fish intakes during the day (Watson et al., 2009). The study of Shi-Chang et al. focussed on overall breakfast and lunch frequency (Shi-Chang et al., 2004). The study of Powers et al. investigated if particular foods (milk, cheese, yogurt, juice, fruit and vegetables) were consumed during breakfast, lunch or dinner and as snack (Powers et al., 2005). The study of Martens et al. investigated, beside breakfast frequency, fruit and high-fat snack intakes during the day (Martens et al., 2006). The quality of breakfast was also measured by measuring total fat, saturated fat, carbohydrates, protein, vitamin C and sugar intake at breakfast. The study of Dehdari et al. was the only study that focussed on breakfast as main focus. The researchers investigated breakfast frequency and the nutrient intake of protein, carbohydrate, dietary fibre, cholesterol, vitamin (A, B6, B12, C, E), thiamin, riboflavin, Niacin, folic acid, Pantothenic acid, Ca, Cu, Fe, Mg, P, K, SE, Zn during breakfast (Dehdari et al., 2014). The results showed that nutrient intake and breakfast frequency were higher in the intervention group than in the control group.

Table 1: overview of current intervention studies and their impact on nutrition knowledge, attitude towards and behaviour regarding breakfast frequency or nutrition during breakfast or the day

Reference	Study aim	Intervention aim	Country	Participants	Duration	Intervention	Theory/ Model	Design	Measures	Results
(Watson et al., 2009)	To evaluate the effectiveness of nutrition education in improving students' nutrition knowledge, attitudes, and consumption behaviours.	To assess nutrition knowledge, attitudes, and food consumption behaviours of students before and after a nutrition course in high school.	U.S.A. (Texas)	Students 14-19 years old. Intervention group (n=45) and control group (n=30).	18 weeks	Intervention group received nutrition-related courses and the control group received other courses.	Social Cognitive Theory	Quasi-experimental design	Pre and post questionnaire with questions about nutrition knowledge, attitude towards nutrition and food consumption behaviour.	Significant knowledge increase, limited significant changes in attitudes and food consumption behaviour occurred.
(Shi-Chang et al., 2004)	To develop a model project for nutrition interventions for the development of health-promoting schools (HPS) in China	To improve the nutrition and health status of students, school personnel and parents.	China	7500 Students (aged 10-14) and parents and 800 school personnel	1.5 year	The intervention group participated in working groups with parents and school personnel. The students in health education classes.	Health Promotion Model	School-based working groups with school personnel and parents	The survey assessed participants' knowledge of nutrition and attitudes toward nutrition and other health issues as well as their dietary and hygienic habits.	Knowledge increased and attitudes improved in the intervention group, but breakfast behaviour was inconclusive in the intervention group.

Reference	Study aim	Intervention aim	Country	Participants	Duration	Intervention	Theory/ Model	Design	Measures	Results
(Powers et al., 2005)	To investigate the effects of a nutrition education program on dietary behaviour and nutrition knowledge among school–aged children.	To learn the children skills to select healthy foods both at school and home.	U.S.A. (Alabama)	1100 students (mean age 7.58 ± 0.71 years)	6 weeks	Nutrition education program on dietary behaviour and nutrition knowledge	Social Cognitive Theory	A pre-assessment and post-assessment control group design	Pre and post assessment with 24 dietary behaviour and 16 knowledge questions. Dietary behaviour questions were yes/no questions.	Greater improvement in overall dietary behaviour and nutrition knowledge in intervention group
(Martens et al., 2006)	To assess the behavioural effects of a school-based healthful diet promotion intervention implemented in lower vocational schools.	To increase the consumption of fruit and fruit juice, to decrease the consumption of high-fat snacks and to increase breakfast frequency and quality.	Nether-lands	1613 students (aged 12-14 year old)	3 months	Intervention group participated in 8 lessons of the 'Krachtvoer' Programme and the control group in 8 usual nutrition lessons.	Intervention mapping	Cluster-random-ised pre-test-post-test experiment al design	Pre and post question-naire with food frequency questions and self-administered 24-hour recall. The quality was measured by calculating nutrient intake.	The behavioural effects related to breakfast habits were limited.

Reference	Study aim	Intervention aim	Country	Participants	Duration	Intervention	Theory/ Model	Design	Measures	Results
(Dehdari et al., 2014)	To examine the effect of nutrition education intervention based on Pender's Health Promotion Model.	To improve the frequency and nutrient intake of breakfast consumption	Iran	100 female students (age 13 years)	3 months	Both intervention and control group received classroom nutrition education. Only in the intervention group the Pender's Health Promotion Model was used.	Health Promotion Model	Quasi-experimental study	Self-administered questionnaire with questions about nutrient intake. Behaviour was measured by asking how many days they eat breakfast.	Nutrient intake and breakfast frequency were significantly higher in the intervention group.

Increasing breakfast frequency as aim of majority of interventions

Mostly, the aim of the studies is to increase breakfast frequency. In a review of Kothe and Mullan, they investigated which interventions are conducted in the past to increase breakfast eating frequency in a non-clinical sample (Kothe & Mullan, 2011). The researchers found eleven interventions including five interventions with food provision, four interventions with persuasive message without food provision and two interventions with persuasive messages and food provision. All eleven interventions were conducted in a school setting with children and students. The researchers found that only three studies resulted in an increase in breakfast consumption frequency. Another intervention wanted also to improve the frequency of breakfast consumption and the frequency of nutrient intake during breakfast (Dehdari et al., 2014). This intervention was conducted with girls aged 13 years in Iran. The researchers wanted to determine the effectiveness of nutrition education by using the Pender's Health Promotion Model (HPM). The HPM model is developed to change behaviour. The model includes three components that influence health-promotion behaviour. The first component is individual characteristics and experiences which includes prior related behaviour and personal factors. The second component is behaviour-specific cognitions and affect which includes perceived benefits of action, perceived barriers of action, perceived self-efficacy, situational influences, interpersonal influences and activity-related affect. And the third component is desirable health promotion behaviour such as commitment to a plan of action and immediate competing demands and preferences. Both intervention and control group received classroom nutrition education which included educational sessions about nutrition knowledge, modification of unhealthy dietary habits and eating healthy foods. In the intervention group the HPM was used. Behaviour was measured by investigating if the frequency of breakfast consumption during a week was increased. Results showed that the frequency of breakfast consumption was significantly higher in the intervention group.

Besides breakfast frequency, several interventions aimed to increase particular food intake during the day such as fruit intake (Drapeau, V. Savard, BA. Gallant, A. Nadeau, L. Gagnon, 2016; Silveira, Taddei, Guerra, & Nobre, 2011; Van Cauwenberghe et al., 2010) or dairy and calcium intake (Hendrie, Brindal, Baird, & Gardner, 2013). Other interventions focussed on nutrient intake during breakfast such as the intake of protein, carbohydrate, dietary fibre, cholesterol, vitamin (A, B6, B12, C, E), thiamin, riboflavin, Niacin, folic acid, Pantothenic acid, Ca, Cu, Fe, Mg, P, K, SE, Zn (Dehdari et al., 2014) and total fat, saturated fat, carbohydrates, protein, vitamin C and sugar (Martens et al., 2006).

Nutrition knowledge increased in most interventions

Another aim of nutrition interventions is to increase nutrition knowledge (Powers et al., 2005; Shi-Chang et al., 2004; Watson et al., 2009). Moreover, a review (Wang & Stewart, 2013) found that different studies showed an increase in nutritional knowledge after an intervention. Nutrition knowledge was mostly measured by asking questions during a pre- and post-questionnaire about nutrition and compared the results. For example, an intervention was conducted with children with an average age of 7 in a school setting (Powers et al., 2005). The intervention group participated in 6 nutrition classes with concepts assessed in the questionnaire. These nutrition classes were based on Social Cognitive Theory, which incorporates the interdependent relationship between personal characteristics, behavioural factors, and environmental influences. The children conducted a pre- and post-questionnaire with questions about dietary behaviour and nutrition knowledge. The dietary behaviour consisted questions about breakfast products, such as milk, cheese, yogurt, juice, fruit and vegetables, but lunch and dinner were also included. Children in the intervention group improved their overall dietary behaviour which contains increased consumption of dairy products, fruits and vegetables and nutrition knowledge more than the control group.

More difficult to change attitude towards and behaviour regarding breakfast than increasing nutrition knowledge

The behaviour change regarding nutrition during the interventions from table one is not always very clear. It is sometimes limited (Watson et al., 2009). In this study, only milk consumption and breakfast frequency showed a significant increase in the intervention group, but no behavioural change was found for intake of fruit, vegetables, soft drinks, meat, poultry or fish. Although Powers et al. showed an improvement in overall dietary behaviour; consumption of dairy products, fruits and vegetables increased (Powers et al., 2005), behaviour regarding breakfast frequency was limited. This means, the researchers examined the juice intake, but this did not improve significantly. For attitude change the results were also mixed. Watson et al. showed a limited attitude change (Watson et al., 2009). This study was conducted with students between 14 and 19 years old in a school setting. The intervention group participated in two courses that endured 18 weeks. During this course, the intervention group received information about major nutrients and their function, weight management, physical activity and healthy eating. The mean scores of nutrition knowledge, attitudes toward nutrition, and food consumption behaviours related to number of times certain food items were consumed were compared between the control and intervention groups. Attitude towards

nutrition was measured with 10 questions about their interest in nutrition/health; desire to improve eating habits; perceived impact of nutrition on their health and their reasoning for choosing specific foods. The results showed limited significant changes in attitude of the intervention group, because only the students' interest in nutrition and the perceived confidence of making good food choices significantly increased for the intervention group.

Another study showed that attitude change was improved (Shi-Chang et al., 2004). This study investigated also changes in nutrition knowledge and consumption behaviour. It was conducted with students with an average age of 13 in a school setting. Parents and school staff were also included in this intervention. The students received nutrition education during classes and the students gave also their parents information about nutrition. The school staff prepared the classes with nutrition educators. The intervention endured 10 months. The survey assessed participants' knowledge of nutrition and attitudes toward nutrition and other health issues as well as their dietary and hygienic habits. The results showed that knowledge increased more in the intervention group. Remarkably, the parents' knowledge increased the most. Nutrition-related attitudes improved in the intervention group more than in the control group. The results on breakfast behaviour were inconclusive, because eating breakfast was not well defined.

Breakfast quantity is measured more often than quality

To my knowledge, only two intervention were conducted in the past to increase breakfast quality (Dehdari et al., 2014; Martens et al., 2006). The intervention of Martens et al. was conducted with children aged 12-14 in a school setting. The intervention group participated in eight school lessons about nutrition. The aim was to decrease the intake of high-fat snacks and to increase fruit consumption, breakfast frequency and breakfast quality. The children conducted a pre- and post-questionnaire with food frequency questions and a 24-hour recall. The breakfast quality was measured by calculating total fat, saturated fat, carbohydrates, protein, vitamin C and sugar of today's breakfast. The behavioural effects related to breakfast habits were limited. Only vitamin C and total saturated fat intake showed a significant effect in the intervention group. The intervention of Dehdari studied also the nutrient intake during breakfast and compared the results with the recommended intake of these nutrients (Dehdari et al., 2014). The results showed that the intake of energy, vitamin A, vitamin C and calcium were significantly increased in the intervention group, but these amounts were still below the standards.

Related health programs show nutrition knowledge increases, but limited behavioural or attitude changes

Besides the interventions which included breakfast, more general health programs about healthy nutrition are also conducted at schools. A school program in the Netherlands is Taste lessons, in Dutch called 'Smaaklessen'. This program aimed also to increase nutrition knowledge and used also a quasi-experimental design such as other interventions (Dehdari et al., 2014; Watson et al., 2009). Taste lessons is a Dutch school program that helps children in their development of a desired eating pattern ("Wat is Smaaklessen? - Smaaklessen," 2016). The intervention and the control group completed three questionnaires in which knowledge, awareness, skills, attitude, emotion, subjective norm and intention towards behaviours were assessed. The questionnaires were conducted before the intervention, four weeks and six months after the intervention. The results showed that the intervention group increased their knowledge which persisted after six months. The intention to change their behaviour was only a short-term difference between intervention and control group. This is in line with the other intervention studies that behaviour changes are limited (Martens et al., 2006; Watson et al., 2009). In another school program called also Superchefs, nutrition knowledge increased but behaviour change was unknown. This program is a deepening of Taste Lessons ("Superchefs | Voedingscentrum," n.d.). It provided a set of eight lessons with children (aged 10-12) about healthy nutrition and how to prepare a healthy meal. Furthermore Bite&Step, in Dutch called 'Hap&Stap' was an intervention to improve awareness, knowledge and attitude of children and their parents regarding healthy nutrition and exercising. The results showed that knowledge about healthy nutrition and exercise was increased, but no change in attitude was detected (Boluijt & van Oord-Jansen, 2012).

In these programs, not only children but parents were also involved and learned a lot about healthy nutrition (Battjes-Fries, Haveman-Nies, Renes, Meester, & van 't Veer, 2014; Boluijt & van Oord-Jansen, 2012). This is in line with the intervention study of Shi-Chang et al, where parents were also involved and improved their knowledge (Shi-Chang et al., 2004).

Effectively influencing learning behaviour of children

Learning processes of children

To improve knowledge and behaviour of children during intervention studies, it is necessary to know how children learn. This depends on several aspects. Firstly, in which stage the children are of their cognitive development. According to the four stages of cognitive development, children (aged 7-11) are in the concrete operational stage (Piaget, 1952). In this

stage, children recognize processes and coherence between things. Problems are solved more logically, but they still need some concrete material.

Secondly, it depends on if the children pay attention when they could learn something. Attention is an important aspect according to the information processing model (Eling, 2014; Kauchak & Eggen, 1969; Swaab, 2011). Attention is required to get information from the sensory memory to the working memory. After the working memory, attention is required to store information for a longer period of time in the long term memory. Paying attention is very important for learning, because distraction can cause lower learning outcomes (Fisher, Godwin, & Seltman, 2014; Godwin & Fisher, 2011). During middle childhood, the ability to hold or focus attention is still developing, because the brains are also not yet fully developed (Swaab, 2011). At the age of 11, the ability to hold attention to execute cognitive tasks for extended periods starts developing. In middle childhood, therefore, it is difficult to hold the attention for extended periods.

Thirdly, it depends on children's learning styles. Children can have different preferences when it comes to learning styles (Felder & Spurlin, 2005; Kozhevnikov, Hegarty, & Mayer, 2002). Some prefer concrete information (e.g. facts) while others prefer abstract information (e.g. theories). Some prefer visual presentation instead of verbal explanations. When a learning style mismatches the teaching style, it will affect the learning processes of children (Felder & Spurlin, 2005).

Tailored feedback as promising approach

The way children are learning differs, but in general learning processes are moving towards a more experiential learning (Dever & Hobbs, 1998; Ethridge & Branscomb, 2009; Kolb, 1984; Yeong et al., 2013). Experience can help to create knowledge. By using a more tailored approach, children can reflect on their own experiences and, according to a review, this could lead to behaviour change (Contento et al., 2002). Nowadays, tailored feedback is also used more often to change eating behaviour (Adamson & Mathers, 2004; Deliens, Clarys, De Bourdeaudhuij, & Deforche, 2014; Dubois, Girard, & Potvin Kent, 2006; Lin & Dali, 2012; Wright, Sherriff, Dhaliwal, & Mamo, 2011). In the field of nutrition, it is also called personalised nutrition. Personalised nutrition identifies the nutritional needs of a person and provides a healthy eating advice (Stewart-Knox et al., 2014). When information becomes personal relevant, it can facilitate behaviour change (Fallaize et al., 2015). Studies are conducted to investigate the difference between tailored and non-tailored approaches. To my

knowledge, no intervention studies exist that examined a tailored approach during breakfast. Therefore, more general intervention studies about eating behaviour or other health behaviour are examined.

Computer tailored nutrition education seems more effective than general nutrition information

A literature study about computer-tailored nutrition education showed that a tailored approach is a promising tool to motivate people to make healthy choices (Brug, Oenema, & Campbell, 2003). It gives personalised feedback to people and this seems to be more effective than giving general nutrition information. In a randomized controlled trial with adults (aged 30-65) (Oenema & Brug, 2003), the intervention group received feedback through a computer tailored education program. The control group received a letter which included nutritional information without feedback. The researchers concluded that the computer tailored information had a greater impact on awareness and intention to change eating behaviour than the non-tailored letter.

On the other hand, an intervention study showed mixed results when using a computer-tailored approach (Bech-Larsen & Grønhøj, 2013). This intervention study aimed to increase fruit and vegetables intake by children (aged 7) (Bech-Larsen & Grønhøj, 2013). The intervention and control group received the same nutrition education, but only the intervention group was asked to set goals and received feedback through SMS. Within the intervention group, a split was made between high and low intakes. The results showed that the low intake intervention group showed small significant increases, but the high intake intervention group showed a reduced consumption intake.

When addressing other health behaviour such as smoking, computer tailored feedback seems also more effective than general nutritional information. For example, an intervention with a computer-tailored e-mail was tested to reduce smoking by Dutch adults (Te Poel, Bolman, Reubsaet, & De Vries, 2009). The intervention group received the tailored e-mail and the control group received a generic, non-tailored e-mail. The results showed more participants quitted smoking after six months when they received the tailored e-mail.

Printed tailored feedback also more effective than general nutrition information

Not only computer-tailored nutrition education seems more effective. Printed tailored feedback is also effective. For example, a randomised controlled trial with a pre and post-test design was conducted with three groups with adults (aged 40-65) (Wright et al., 2011). The

first group received a tailored, printed dietary feedback, the second group received nutrition education sessions in small groups (10-15 participants) and the third group was the control group who only participated in the pre- and post-test. The first group reported a greater increase in fruit intake than the other two groups, but all three groups were as effective in reducing total saturated fat intake. These results were in line with another printed feedback method (De Vries et al., 2008). In this study, the effect of three tailored feedback letters with information about smoking, physical activity and fruit, vegetable and fat intake was investigated in a period of nine months. The intervention group received three tailored feedback letters where the third letter was either a letter with tailored information or a letter with tailored information and action-planning feedback. The control group received three generic letters. The results showed the intervention group improved their intake of fruit, vegetables and fat and their physical activity more than the control group. No results were found on smoking.

Social modelling as promising approach

Besides a tailored approach, a role-model approach seems also promising. According to the Social Learning Theory, children can learn by observing others (McCullough, 2013). Children can observe others' behaviours, attitudes and outcomes of those behaviours and then unconsciously decide which behaviour they will reproduce for themselves. Role models can be used to promote certain behaviour. Children can imitate their behaviour, but can also learn more about their attitudes, values and emotions (McCullough, 2013). People argue that parents should serve as a role model when it comes to a healthy breakfast (Pearson, Biddle, & Gorely, 2009; Rampersaud, 2008), but media characters could also achieve a change in knowledge, attitude and behaviour of children (Kotler, Schiffman, & Hanson, 2012; Šramová, 2015). In literature, social modelling has been a primary determinant of food intake and food choice (Cruwys, Bevelander, & Hermans, 2015). The effect of social modelling can be reduced when children have clear eating routines such as breakfast and lunch. Then it could be more difficult to change this behaviour with social modelling (Cruwys et al., 2015). But to my knowledge, no intervention studies exist that examined a role-model approach during breakfast. Therefore, different studies are examined that use role models to change more general nutrition behaviour or other health behaviours.

Familiar role model preferred above non familiar role model

A study investigated the role of media characters in influencing children's food choices (Kotler et al., 2012). The researchers conducted two experiments with children aged 2 to 6. In the first experiment children choose between a product with a favoured character or without a favoured character. In the second experiment, children choose between a less preferred product with a favoured character and a more preferred product with a less favoured character. Both experiments resulted in children preferring a food product associated with a role model they liked or with whom they are familiar more than an unfavoured character.

Role models effectively promote other healthy behaviour

Social models are also used to influence children to eat novel foods. In an experiment it was investigated if children accepted novel foods and ate more of it when adults models eat the same product, the same product with a different colour or nothing (Addessi, Galloway, Visalberghi, & Birch, 2005). The results showed that children accepted the novel food and ate more of it when the adult model ate the same product.

Other studies found that role models can help to motivate young adults to reduce their smoking behaviour (Lin, 2014; Woohyun, 2016). For example in the study of Lin (2014), participants were divided in one of the four conditions 1) positive health role model 2) negative health role model 3) positive social role model, or 4) negative social role model. For example in the positive health role model, the participants received a description of a role model who wanted to stop smoking to gain a better health. An example for a negative health role model could be someone who has got a disease because of smoking. The results showed that negative role models, regardless whether they use social or health arguments, are more effective to reduce smoking behaviour.

Social modelling might be automatic, because of mimicry

Some studies argue that social modelling is automatic and unconscious, because of mimicry (Cruwys et al., 2015). For example, a Dutch study investigated if 70 pairs of females (mean age 21,6 years) adjusted their eating behaviour, because they are eating together (Hermans et al., 2012). During each 20-min session the females received a complete meal. It was investigated whether mimicry depended on time of interaction and the person who took the bite. The study resulted in the pair of females mimicked each other's eating behaviour. They

were more likely to take a bite after the other one has took a bite than eating at their own pace. This effect was more present at the beginning than at the end of the meal. Another study with alcohol sipping showed a similar result, because the participants (aged 18-28) imitated also the sip behaviour instead of drinking at their own pace. (Larsen, Engels, Souren, Granic, & Overbeek, 2010).

Non-present others showed also mimicry behaviour effects

Social modelling occurs when other people are present during the studies for the participants. Other researchers investigated also what happens when others are not present. This design is also called remote-confederate design (Robinson, Blissett, & Higgs, 2013). For example, one of the two experiments of Pliner et al. showed an effect. Both experiments were conducted with 37 women with an average age 19 (Pliner & Mann, 2004). With the first experiment, the participants received information about how many prior participants had eaten (small or large amount) or they did not received information. The results showed that participants ate more when the prior participants had eaten large amounts instead of when the prior participants had eaten smaller amounts or when they did not received information. These results were only true for palatable foods. In the second experiment, the participants were divided in three groups: 1) participants were told that prior participant had chosen the palatable cookie, 2) the unpalatable cookie, or 3) received no information. No effect was found, because almost everyone chose the palatable food to eat. Another study investigated if the results are the same for a present or non-present others (Feeney, Polivy, Pliner, & Sullivan, 2011). Three groups existed: with a present person, with a non-present person or the control group without information about another person. The results showed that both groups eat than the control group and there were no significant differences between the two modelling conditions which showed that live and remote models produce comparable effects.

Summary and hypotheses

A lot of children have unhealthy breakfast habits such as skipping breakfast (Berkey et al., 2003; O 'Neil et al., 2015) and consuming a low quality breakfast (Raaijmakers et al., 2010). Nutritional education has become more important to change these habits. The focus of nutritional education was on a more traditional way of explaining children what is healthy and which products are healthy by giving them new information during education courses. It was assumed that giving knowledge would lead to behaviour changes. Different interventions in the past are conducted with breakfast as an element and a few studies focussed at breakfast only. These interventions investigated breakfast frequency or particular food intakes during

the day(Powers et al., 2005; Shi-Chang et al., 2004; Watson et al., 2009). These studies concluded that knowledge increased when information about healthy nutrition is given, but behavioural and attitude changes seem more difficult. Only two studies examined breakfast quality and showed that it was difficult to increase total breakfast quality(Dehdari et al., 2014; Martens et al., 2006).

Children need to process this new information. In order to do this effectively, it depends on several aspects. The stage of the cognitive development (Piaget, 1952), the attention level (Eling, 2014; Swaab, 2011) and the learning style of the child (Felder & Spurlin, 2005) are three aspects that can influence the quality of the information processing.

Two promising approaches could help to improve the breakfast quality: tailored feedback and the use of role models. In different studies, tailored feedback showed a bigger impact than giving general nutrition information(Brug et al., 2003; Oenema & Brug, 2003). Using role models seems also promising, because studies showed that the use of role models helped with other health related behaviour such as smoking (Lin, 2014; Woohyun, 2016) and tasting novel food (Addessi et al., 2005).

Based on this theoretical framework, it is expected:

H1: Tailored feedback is a more effective method than classroom education to change knowledge about, attitude towards and behaviour regarding the quality of the breakfast of children.

H2: Using role models is a more effective method than classroom education to change knowledge about, attitude towards and behaviour regarding the quality of the breakfast of children.

3. Method

In order to test the hypotheses, the intervention study was conducted from March until June 2016 in Dutch schools in three cities: Rotterdam, Tilburg and Arnhem. These schools were selected because they are positioned in disadvantaged neighbourhoods.

Participants

Seven schools agreed to participate in this study. From each school, two or three classes (5th and 6th grade) participated in this study, which resulted in 15 classes in total. These classes were selected because they were able to fill in a questionnaire without help. The age of the children varied between seven and eleven years. Parents were informed about the study through a letter. Parents could refuse participation of their child, which occurred for three children.

Design

The classes were distributed to one of the four conditions (Table 2): tailored feedback (A), classroom education (B), use of role models (C) and a combination of the three (D). This distribution was controlled by the researcher to obtain an equal distribution across grade, city and as much as possible the same numbers of children per condition.

Table 2: Distribution of children in 5rd and 6th grade to the three conditions

Condition	Number of participating schools	Number of participating classes	Grade[1]	Number of participating children
A: Tailored feedback	2 (Tilburg; Rotterdam)	2	5	38
		2	6	47
B: Classroom education	2 (Tilburg; Arnhem)	1	5	13
		3	6	46
C: Use of role models	2 (Tilburg; Rotterdam)	2	5	45
		1	6	28
D: Combination of approaches (C, B, A)	2 (Tilburg; Rotterdam)	2	5	43
		2	6	32

[1] In the Netherlands 5th grade include children aged 8-9 and 6th grade children aged 9-10.

The intervention had a pre-and post-test design. All four conditions consisted of 4 lessons and had the same themes and learning goals per lesson, but differed in which way the information was given (Figure 1). Condition A was based on a tailored feedback approach. During this condition, children received personal feedback according to their own breakfast habits. The feedback was given by using smiley stickers in the colours green, blue and orange. These colours represented how often they were allowed to eat this product; green (every day), blue (now and then) and orange (occasionally). The children placed, by themselves, the correct smiley stickers to gain knowledge about how healthy their breakfast was. After placing the stickers, the researchers explained how healthy the breakfast was by using a visual tool: the thermometer (Appendix 1). This method was different from the others, because in condition B and C the children do not get feedback at all. In condition D, in the third lesson only the children received feedback regarding their own breakfast. Condition B focussed on providing new knowledge in a classroom setting. The knowledge is provided by explaining the new knowledge by a researcher and sometimes the researcher used a PowerPoint presentation. Condition C made use of role models. In this condition, the children received their knowledge by watching video fragments which include Dutch famous people who explain the new knowledge. Condition D was a combination of all three conditions. It started with the same lesson as condition C. Then, the second lesson was the same as condition B. In the third and fourth lesson, the children of condition D received feedback similar as lesson one and four of condition A.

The pre- and post-questionnaire and the four lessons were conducted in a time period of ten weeks. The conditions had overlapping and different measurements per lesson (Figure 2). In each condition a breakfast box was used. In this breakfast box 25-30 products were included that are most consumed by this target group during breakfast. The box was used to explain differences between the products, but to make also the information more visual.

The setting

The setting was the same for each condition. The lessons were given in the school classroom with the usual setting as during other courses. Researchers (number varied from 2-5) were present and had the task to give the lessons and explain the assignments. The teacher was also present during the four lessons to support the researchers by keeping the order in class.

Figure 1: overview of the content of four lessons per and across condition(s)

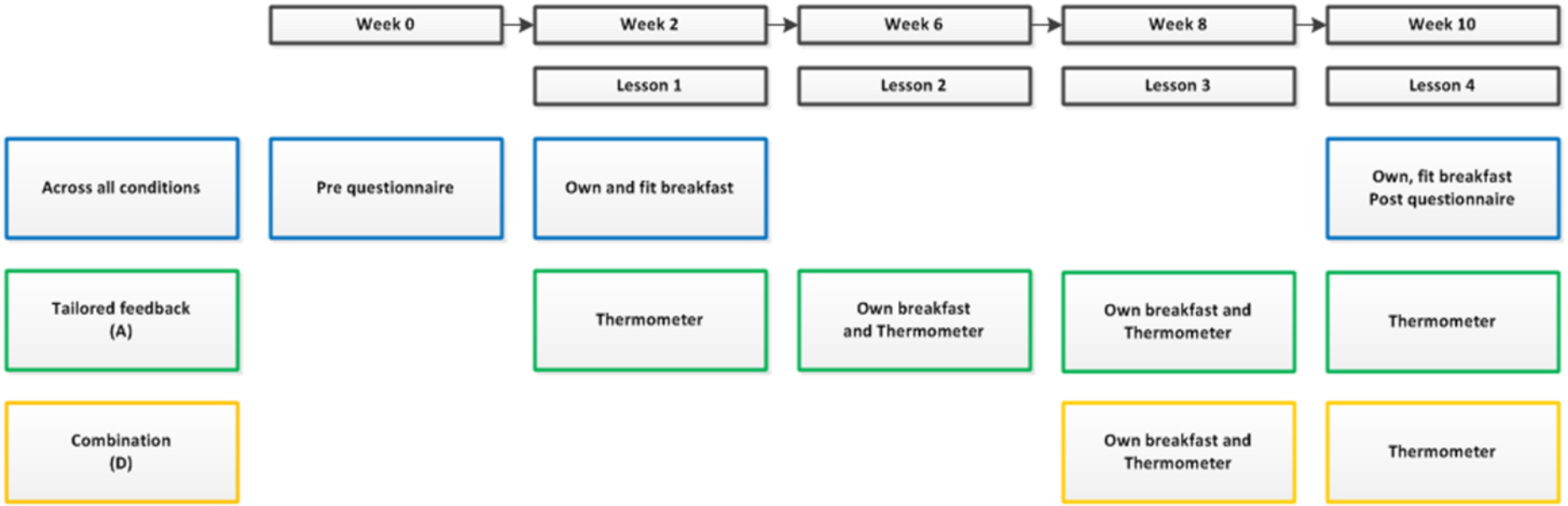

Figure 2: overview of measures during four lessons per and across condition(s)

Procedure

Pre-questionnaire

All participants started with the same pre-test which was collected with Qualtrics Software on an IPad or computer. This pre-test was conducted two weeks before the first lesson to avoid lesson 1 took too long. During this pre-test, a questionnaire was conducted under supervision of two researchers in a separate room. The questionnaire contained questions to test knowledge about breakfast and attitude towards breakfast. More questions were asked but were not included in this thesis. The total questionnaire took approximately 25 minutes. The children got the instruction to be quiet when filling in the questionnaire and if they had questions, they could raise their hand. Furthermore, they were been told that it was not a test and no wrong answers existed.

First lesson

The first lesson took approximately one hour for all conditions. This lesson contained aspects that were the same for all the conditions. All the participants got two assignments. The first assignment they received a paper on which they had to select the products that would fit in a fit breakfast (Appendix 2). They were instructed that this breakfast should be eaten in one moment. The second assignment was the same paper (Appendix 3), but now they had to select the products they consumed at breakfast that morning. After the first two assignments, three categories were explained. This categorization is based on guidelines from the Netherlands Nutrition Centre (Netherlands Nutrition Centre, 2011). Their guidelines are based on a report of the Dutch Health Council (Health Council of the Netherlands, 2006) and categorize foods into three groups. For this intervention study, the groups were called ‘every day’, ‘now and then’ and ‘occasionally’. The first category is the green one which is allowed to eat every day. The second category is the blue category that is recommended to eat now and then and the third category is the orange category that is recommended to eat occasionally. These three categories were explained by the researcher in condition A and B or through a role model in a video fragment in condition C and D. For each category, examples of breakfast products were showed out of a breakfast box which included 25-30 products that are most consumed by this target group during breakfast.

Only in condition A, the children received feedback. They received a paper with all the products in combination with the colour (green = every day, blue = now and then, orange =

occasionally) that fitted the product (Appendix 4). They received also stickers to place the right colour with the product that was eaten that morning. There is chosen for a visual feedback tool, because it is easy for kids and easy to implement (Gibney & Walsh, 2013). At the end, they had to count the numbers of green, blue and orange products. Then they received from a researcher a visual line on the thermometer with a scale from zero till one hundred. When the line was high (close to the one hundred), the child had a high quality breakfast. The level of quality was calculated by a researcher. Each colour had a score (green = 1, blue = 0.5 and orange = 0). The researcher used the following formula '(total points / number of products) x 100' to calculate the level of quality to draw a line on the thermometer. The children could receive only a zero when they did not eat breakfast that morning. The minimum score was set on 10 points to avoid demotivating the children, because they eat breakfast which is good.

Second lesson

The duration of the second lesson was between 45 -60 minutes. In this lesson, the theme was the five benefits of eating breakfast. The five benefits of eating breakfast are: gives energy, helps you grow, good for your stool, better learning performance and it helps maintaining your weight. The researcher explained the five benefits in condition A, B and D. For condition C, a video fragment with a role model was used again who explained the five benefits. In condition A, the children practiced the knowledge of lesson one. Besides, they had again to fill in their own breakfast and have to place the correct stickers at their breakfast products on the form. Then they received feedback with a line on the thermometer and had to compare this line with the line on the thermometer of lesson one. Then they had to set a target how they want to improve the quality of their breakfast.

Third lesson

The duration of the third lesson was also between 45 – 60 minutes. In this lesson the three categories were explained again, but now the emphasis was on explaining why products are in a particular category. Again this was explained by the researcher in condition A, B and D or through a video fragment with a role model in condition C. In condition A, the own breakfast and thermometer were filled in again. The children in this condition had to reflect on their target if they already achieved their target or if they could change something to achieve it the next lesson. In condition D, the children had to fill in their own breakfast and received feedback with use of the stickers and the thermometer tool. Then they had to set a target to

improve the quality of their breakfast. The other two conditions (B and C) made an assignment (Appendix 5) to practice the differences between products in different categories.

Fourth lesson

In this lesson, all four conditions had to fill in a fit breakfast and their own breakfast, similar as in lesson one. Only the conditions A and D reflected on their target if they achieved it, but conditions B and C reflected also if they noticed differences in their breakfast eating behaviour. Besides, all four conditions filled in the post-questionnaire. This was the same as the pre-questionnaire plus questions about Ramadan and their opinion were added. The same constructs and items were assessed, except demographic data. This lesson took an hour for each condition.

Measures

Children were asked to fill in the questionnaire at school with the help of researchers. Questionnaires were online administrated using survey software (Qualtrics) to simplify the questionnaire for children. Accurate responses on breakfast quality and quantity are greatly dependent on the ability of the child to read, write and recall the information.

Knowledge about breakfast benefits and healthiness of breakfast options

Health and cognitive benefits of breakfast

Based on the literature overview of Vingerhoeds (Vingerhoeds, 2015), we selected seven breakfast benefits: 'if you have breakfast every day, you have more energy', 'breakfast helps to concentrate at school', 'During weekend you can skip breakfast', 'breakfast is needed to grow well', 'if you have breakfast every day, you will get fat' (negatively framed), 'if you have breakfast, you will be less hungry later in the morning', 'Breakfast is unnecessary if you eat something before you go to bed'. Children were asked whether each statement was 'true' or 'not true'. They could also answer 'I do not know'. These questions were asked during the pre- and post-questionnaire.

Classification of breakfast foods as 'preferred, 'now and then', and 'by exception'

To test children's knowledge on breakfast quality, they had to read the following instruction: 'There are foods and drinks you need to grow and stay healthy and fit. These foods and drinks can best be chosen for breakfast. These foods and drinks are allowed *every day*. There are also foods and drinks you take because they taste nice, but it is less good for you. These foods and

drinks are allowed *now and then*. There are also foods and drinks that are not good for you for breakfast. These foods and drinks are better chosen very *occasionally* for breakfast. Now indicate for each food or drink whether you can best take it 'every day', 'now and then' and 'occasionally'. Put a cross in the correct box.' Then children were exposed to a subset (44 products) of food and drink items that were also part of the dummy box and asked to indicate which foods belonged to which category. They could also answer 'I do not know'. These questions were asked during the pre- and post-questionnaire.

Attitudes, motivation and self-efficacy regarding breakfast

Attitude was assessed by eight statements and measured on a 5-point Likert scale in the pre- and post-questionnaire. Children had to select if they agreed or disagreed with the statements. The first three statements started with 'having breakfast every day is...' followed by 'good for you', 'healthy', 'tasty'. Other statements were 'There is enough healthy food for breakfast available at home' and 'I know what a healthy breakfast is'. Two motivation items were included in the study (Kothe, Mullan, & Amaratunga, 2011). Children were asked to indicate how strongly they agreed with the following statements: 'I like to have breakfast every day' and 'It is a lot of work to prepare breakfast'. Self-efficacy expectation towards eating breakfast on a regular basis was added by the item 'I can easily have a healthy breakfast every day'.

Quality score through self-reported behaviour regarding breakfast

Breakfast was defined for the children as 'the first meal on a day after waking up'. The quality of food consumption at breakfast in the present morning was asked by the question 'What did you eat at breakfast this morning?' with the assignment 'own breakfast' during lesson one and four (Appendix 3). Children were asked to check all that apply. Children had the opportunity to add foods that were not included in the lists. A similar question was asked for drinks.

Questions to characterize sample and connect participants across datasets

Demographic variables including gender, age, and group at school were assessed. To be filled in by researcher: School, code per child respondent number, condition and date. Other variables were asked in the questionnaire. The researcher created a code by linking the child number to the right school and condition. For example a code was 1304 which means number 1 was the school number, number 3 condition C and 04 was the number of the child. These

codes were filled in by the researcher. Therefore, the children were not aware that they received a code.

Data analysis

The statistical software package IBM SPSS Statistics version 22 was used to analyse the data. First, a flow chart was made to give an overview of the drop out of participants per condition (Figure 3).

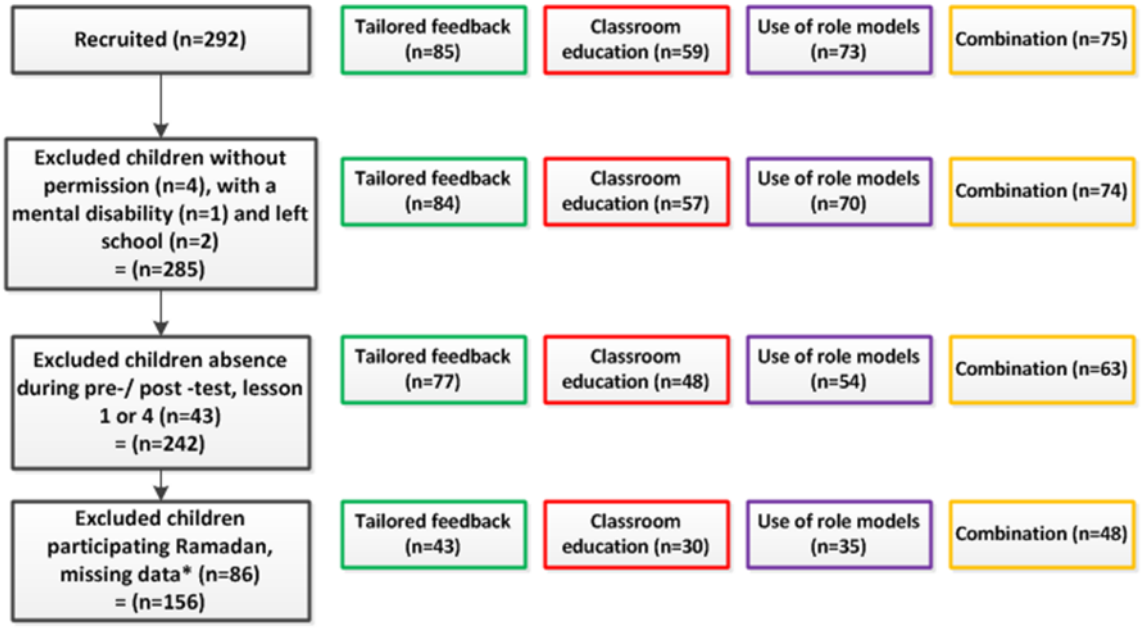

Figure 3: Flow chart of the numbers of participants after drop out.
* Missing data caused by distribution misunderstanding with teacher.

Before testing the hypotheses, it was first checked if the conditions were equally randomised. Background variables such as age, born in the Netherlands, gender and breakfast frequency during the week were taken into account. Born in the Netherlands, gender and breakfast frequency were measured with Chi square. Age was measured with one-way ANOVA.

To obtain an overview of descriptive statistics, the Mean and SD were calculated for each knowledge, attitude and behaviour questions. This was measured for the pre-test and the post-test per condition. The children who participated in the Ramadan were excluded of the self-reported behaviour question, but included in the knowledge and attitude questions.

For the quality score, the thermometer scores were calculated. For each child, the number of ‘every day’, ‘now and then’ and ‘occasionally’ products they ate was calculated. Each

category had a score (every day = 1, now and then = 0.5 and occasionally = 0). The researcher used the following formula (total points / number of products) x 100 to calculate the score for the own breakfast in lesson one and four. In the end to measure behaviour, these scores were compared to investigate if a difference existed. In this way, a breakfast food index was created as indicator of breakfast quality (Contento et al., 2002). If a child did not eat breakfast that morning, then he/she received zero quality points. These children were not excluded, because progress could be measured if they do eat breakfast the next time.

Independent variables included conditions and dependent variables included knowledge questions (number of correct benefit questions and number of correct classification questions), attitude questions and self-reported behaviour for pre and post-tests. For the knowledge questions, the amount of right answers was counted for the 7 benefit statements and for the 44 classification questions. The classification questions were the questions where children had to select the right category for 44 products. All these variables were tested with Repeated Measures ANOVA. The within-subjects variable was the pre-test score and post-test score of each knowledge, attitude or self-reported behaviour question and for the between-subjects factor condition was added. When the interaction effect was significant, the post hoc test Bonferroni was conducted to investigate which conditions differ from each other. The main effect of condition was excluded from the results, because the conditions differ at the baseline and therefore this main effect is biased.

4. Results

Characteristics of the study population

Before running the analysis, first for each condition the mean age, gender, ethnicity and breakfast frequency percentages were calculated (Table 3).

Table 3 Mean age (SD), percentages of gender, ethnicity and breakfast frequency were measured per condition

	Tailored feedback (n=77)	**Traditional Education (n=48)**	**Role models (n=54)**	**Combination (n=63)**
Mean age (SD) (scale 7-11)	9.3 (0.8)	9.4 (0.8)	9.2 (0.8)	9.1 (0.8)
Gender %				
Male	37.7	47.9	51.9	42.9
Female	62.3	52.1	48.1	57.1
Born in Netherlands %				
Yes	84.4	91.7	85.2	82.5
No	14.3	6.3	13.0	17.5
Do not know	1.3	2.0	1.8	0
Breakfast frequency %				
Every day	76.6	58.3	66.7	76.2
5 or 6 days	10.4	20.8	11.1	17.5
3 or 4 days	7.8	10.4	13.0	3.2
1 or 2 days	5.2	8.3	7.4	3.2
never	0	2.1	1.9	0

There was not a significant association between gender and conditions (χ^2 (3) = 2.93, p = 0.402) and between born in Netherlands and conditions (χ^2 (6) = 4.20, p = 0.650). Also no significant association between breakfast frequency during the week and condition existed (χ^2 (12) = 12.90, p = 0.377) or for age and condition (F (3,241) = 1,85, p = 0.139). Therefore, no covariates were included.

Mean (SD) of knowledge, attitude and behaviour per condition

Means and SD are shown for each knowledge, attitude and behaviour questions (Table 4).

Table 4: Means (SD) per knowledge, attitude and behaviour questions per condition in the pre-questionnaire and post-questionnaire

	Tailored feedback		Classroom education		Use of role models		Combination	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
	M (SD)	**M (SD)**	**M (SD)**	**M (SD)**	**M (SD)**	**M (SD)**	**M (SD)**	**M (SD)**
Knowledge over time (n=242)								
Number of correct benefits questions (scale 0-7)	5.0 (1.5)	5.7 (1.4)	5.0 (1.3)	5.3 (1.6)	5.4 (1.1)	5.9 (1.0)	4.9 (1.5)	5.3 (1.5)
Number of correct classification questions (scale 0-44)	14.8 (4.2)	25.6 (7.2)	13.8 (4.3)	20.4 (6.1)	13.2 (4.7)	22.5 (7.6)	13.4 (4.0)	22.9 (7.7)
Attitude towards behaviour (scale 1-5[1]) (n=242)								
It is a lot of work to prepare breakfast	2.2 (1.3)	1.6 (1.0)	2.3 (1.3)	1.8 (1.0)	2.4 (1.5)	2.2 (1.4)	2.1 (1.3)	1.9 (1.2)
I know what a healthy breakfast is	4.6 (0.7)	4.9 (0.4)	4.6 (0.9)	4.4 (0.8)	4.6 (0.9)	4.7 (0.8)	4.6 (0.9)	4.6 (0.7)
I like to have breakfast every day	4.8 (0.5)	4.6 (1.0)	4.3 (1.1)	4.2 (1.1)	4.8 (0.5)	4.7 (0.8)	4.5 (0.9)	4.5 (0.9)
Having breakfast every day is good for you	4.6 (0.8)	4.9 (0.5)	4.2 (1.2)	4.5 (1.0)	4.6 (1.0)	4.7 (0.8)	4.8 (0.6)	4.8 (0.8)
Having breakfast every day is healthy	4.5 (0.9)	4.7 (0.6)	4.2 (1.1)	4.4 (1.1)	4.5 (0.9)	4.7 (0.7)	4.5 (0.9)	4.6 (0.9)
Having breakfast every day is tasty	4.5 (0.7)	4.6 (0.8)	4.1 (1.2)	3.9 (1.3)	4.3 (1.1)	4.5 (0.9)	4.4 (0.9)	4.5 (0.8)
I can easily have a healthy breakfast every day	4.3 (1.0)	4.4 (0.9)	3.7 (1.3)	3.8 (1.2)	4.1 (1.2)	4.6 (0.9)	4.4 (1.0)	4.5 (0.9)
There is enough healthy food available for breakfast at home	4.7 (0.7)	4.7 (0.7)	4.5 (0.9)	4.4 (0.8)	4.4 (1.1)	4.7 (0.9)	4.5 (0.8)	4.7 (0.6)
Self-reported behaviour (n=157)								
Quality score of own breakfast (scale 0-100)	49.4 (21.7)	74.7 (30.0)	35.9 (17.3)	33.0 (22.5)	31.2 (25.2)	42.1 (28.0)	32.9 (26.0)	60.1 (28.0)

[1]All eight questions were measured on a 5-point Likert scale with 5 representing strongly agree and 1 representing strongly disagree

Knowledge over time changed

The mixed model ANOVA demonstrated a significant main effect of time of measurement ($F(1,238) = 19.64$, $P = 0.000$) on the number of correct benefit questions. All conditions together increased from 72.6% to 79.4%, but no significant interaction effect was found between condition and time of measurement ($F(3,238) = 0.97$, $P = 0.406$) on number of correct benefit questions. This means knowledge about the seven benefits was increased in time, but was not different between conditions.

A similar analysis was conducted for the number of correct classification questions at pre-and post-test. A significant main effect of time was observed on these classification scores ($F(1,238) = 379.03$, $P = 0.000$). Over time, the knowledge about how to classify products in the three groups "every day", "now and then" and "occasionally" increased. At the beginning a child could on average correctly classify 31.5 % of the 44 products. After the four lessons, the child is able on average to correctly classify 52.7 % of the 44 products. Besides, a significant interaction effect was observed between time and condition ($F(3,238) = 3.40$, $P = 0.018$) on classification score (Figure 4). This means a difference between conditions exists at the different time points. The Post Hoc test showed that tailored feedback condition differs from the other three conditions.

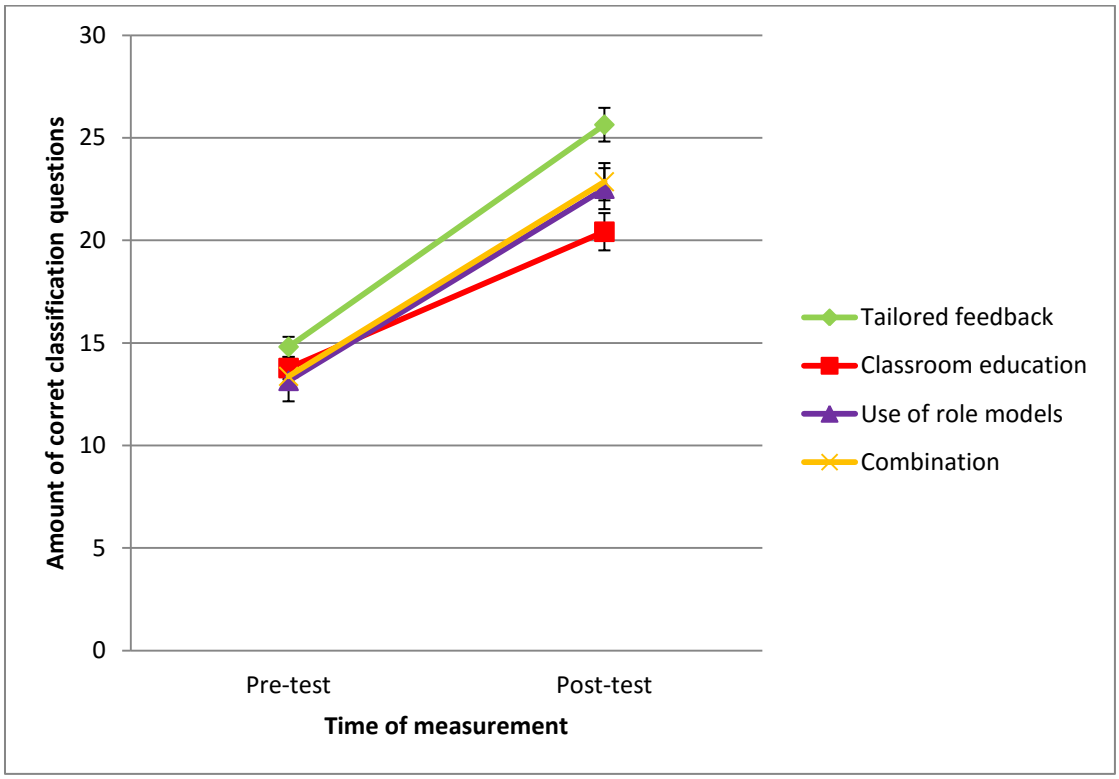

Figure 4: Significant increase of classification score (scale 0-44) for all four conditions between the pre- and post-test

Furthermore, it was analysed for which products the percentage of correct classification was the highest and the lowest (Table 5). Before the intervention, the percentages of children who could correctly classify a product were the highest for water and fruit and even more after the intervention. However, it is remarkable that the percentages of children who did not know the product fruit increased after the intervention from 0.8 till 3.3. The percentages of Brinta and low-fat margarine were the lowest before the intervention. A reason could be the high percentages of children who selected the 'I do not know this product'. Before the intervention the products low-fat margarine, Brinta and smoked shoulder ham were most unknown for the children. After the intervention Brinta, smoked shoulder ham and sausage roll were most unknown. Another reason could be these products are unknown by children or difficult.

Table 5: Eight products with the highest or lowest correct classification percentages and percentages of children who did not know the product (green is lowest, yellow is highest)

	Pre-test		**Post-test**	
Product	**Correct classification**	**Do not know**	**Correct classification**	**Do not know**
Brinta	7	59.9	14.5	53.7
Sausage roll	26.4	58.3	48.3	28.1
Fruit	73.1	0.8	87.6	3.3
Vegetables	54.5	3.7	83.1	0.4
Smoked shoulder ham	18.2	58.7	31.8	30.6
Low-fat margarine	9.5	64.5	43.8	16.5
Water	75.6	0.8	92.6	0.4

No differences in attitude towards behaviour between conditions

A mixed model ANOVA, furthermore, showed no significant interaction effects between time of measurement and condition on one of the eight attitude statements. The statement 'It is a lot of work to prepare breakfast' showed a significant main effect of time without considering the different conditions ($F(1,179) = 11.19$, $P = 0.001$) which means after the lessons all children, in whatever condition they were, thought it was not a lot of work to prepare breakfast. The statement 'Having breakfast every day is good for you' showed a significant main effect of time ($F(1,238) = 7.07$, $P = 0.008$), which means the total children agreed more with this statement in the post-test than in the pre-test. Therefore all children, in whatever condition they were, learned daily breakfast is good for you. The statements 'I know what a

healthy breakfast is', 'I like to have breakfast every day' and 'There is enough healthy food available for breakfast at home' showed both no significant main or interaction effects.

Self-reported behaviour changed for own breakfast quality

The mixed model ANOVA demonstrated a significant main effect of time on quality score (F (1,152) = 35.99, P = 0.000). Which means the quality of breakfast was different at post-test from pre-test. The percentage of the quality score of all four conditions together in the pre-test was 37.6% and in the post-test 54.9%. Although quality improved over time, quality is still not in line with the guidelines of the Netherland Nutrition Centre, because children still ate products of the orange category. Besides, a significant interaction effect was also found between time of measurement and condition (F (3,152) =7.34, P = 0.000) on quality score (Figure 5). When looking at the Post Hoc test, the tailored feedback condition differed from classroom education condition, use of role models condition and the combination condition. This means behaviour increased more over time compared to the other three conditions.

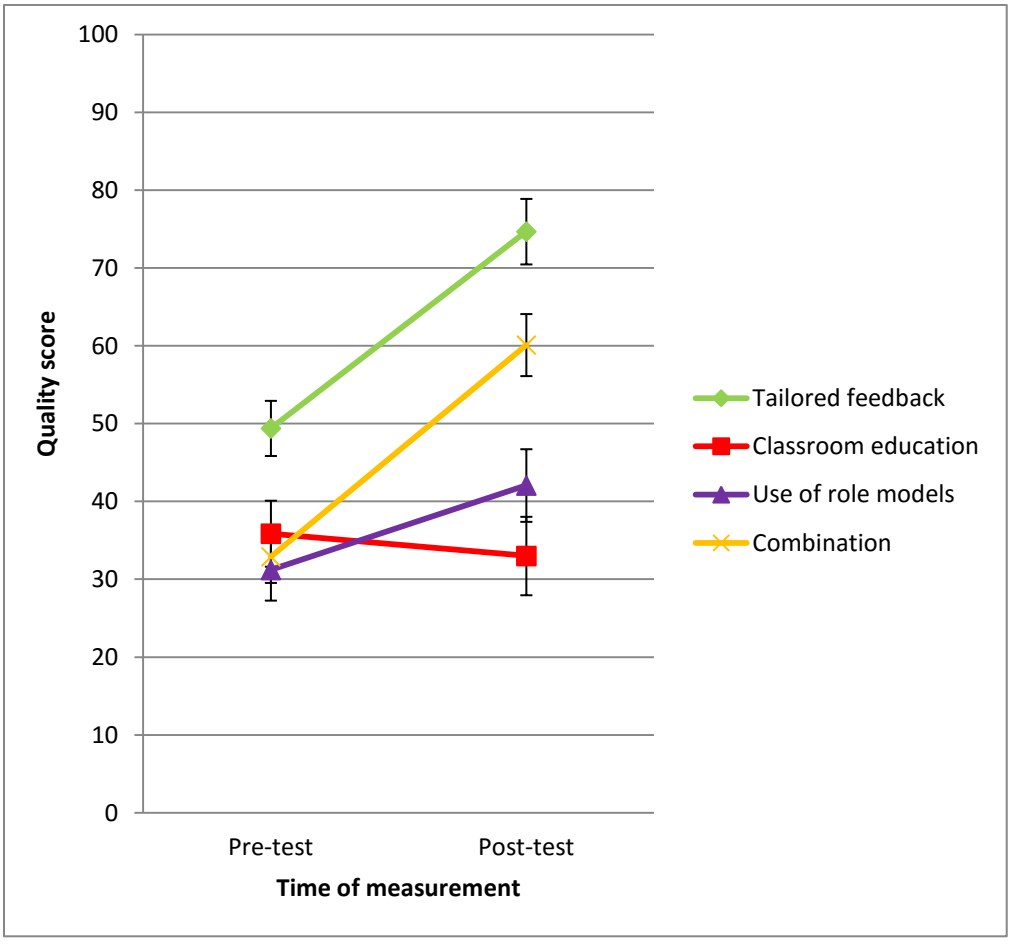

Figure 5: Means and standard deviations per condition for self-reported behaviour quality scores (scale from 0 till 100) for during assignment own breakfast in lesson 1 and lesson 4.

To sum up, hypothesis 1: tailored feedback is more effective than classroom education to change knowledge about, attitude towards and behaviour regarding the quality of the breakfast of children is accepted. Because of knowledge and behaviour is significantly different in the condition tailored feedback than for classroom education. Attitude stayed the same in both conditions. Moreover, no difference between classroom education and the use of role models was detected. Therefore, hypothesis 2: using role models is more effective than classroom education to change knowledge about, attitude towards and behaviour regarding the quality of the breakfast of children is rejected.

5. Discussion

Although a lot of Dutch children eat breakfast, the quality needs improvements (Martens et al., 2006; Van Rossum et al., 2011). Therefore, an intervention study was conducted with 242 children living in a Dutch disadvantaged neighbourhood. The intervention aimed to improve the quality of breakfast of children and increasing their knowledge about the importance of a healthy breakfast. The intervention contained four conditions with different methods: tailored feedback, classroom education, use of role models and a combination of the three. The aim of the study was to investigate which intervention method (i.e., tailored feedback, classroom education or use of role models) is the most effective to improve knowledge about, attitude towards and behaviour regarding the quality of their breakfast of children (aged 8-10) living in a Dutch disadvantage neighbourhood.

First, it was investigated which method was the most effective to improve knowledge about the quality of breakfast. The children of all conditions increased their knowledge about the seven benefits of breakfast from 72.6 % to 79.4%, but no method was more effective than the other methods. This could be, because children on average already knew 72.6 % of the seven questions before the intervention. Therefore, the differences between the methods might have been too small to notice a difference.

For the classification question, the results showed children who received the method tailored feedback were better in classifying products after the intervention than the other three methods. A reason could be that they received more repetition than the other conditions. And according to the Informational Processing Theory (Shiffrin & Schneider, 1977), knowledge stays longer in memory after repetition. Although, all four conditions became better in classifying products in the correct category, on average a child could only place a little more than half of the 44 products in the correct category. A reason could be that the task was unclear for the children. For example, the results showed high ‘I do not know’ rates for smoked shoulder ham which is a most-common known product, but it could be more unknown for children. Another example, a lot of children were Muslim and therefore, they belief it is not allowed to eat smoked shoulder ham because of religion reasons. It could be that these children, therefore, used the ‘I do not know’ answer, because the ‘never’ answer was lacking. Therefore it is recommended to change this question in the two new categories of the Netherlands Nutrition Centre instead of using three categories. This could make the question clearer.

Second, the attitude towards behaviour was investigated. The attitude towards behaviour was the same in all the groups and seems to be stable over time. A reason could be that a ceiling effect was present. This means that the children already received a lot of information why it is important to eat a healthy breakfast or they already know why it is important to eat a healthy breakfast. They reached a limit and, therefore, attitude cannot be improved anymore not even when giving more information to change these attitudes. Therefore it could be that a ceiling effect was present in the current study. Another reason could be that the current study was only 10 weeks with 3 lessons. This could be too short to change attitude towards behaviour. The study of Watson et al. took 18 weeks and only limited attitude changes were found (Watson et al., 2009). The study of Shi-Chang et al. took 1.5 year and resulted in attitude changes (Shi-Chang et al., 2004). The answers on the statement 'I know what a healthy breakfast is', showed no differences between the children, while children could better classify the products in the correct category after the intervention. A reason could be that children were thinking that they already knew what a healthy breakfast was, because this could be a social desirable answer. But the results of the classification question suggest that they improved their knowledge of what a healthy breakfast is. Another reason could be that the scale was measured on a 5-point Likert scale which could be too short. Although it could have been better if it was a 7- or 9-point Likert scale, but it could be too difficult for children to understand (Mellor & Moore, 2014).

Third, the results of the self-reported behaviour question showed children ate healthier after the intervention than before the intervention. Their attitude was already positive towards healthy food which helped to change behaviour. The results showed that behaviour changed the most for children who received tailored feedback. This can be explained by the information was compared with their own breakfast to make it more personal (Wright et al., 2011). Another reason could be that it was clearer how they could change their behaviour, because with the smiley stickers it was made more visual how they could improve the quality of their breakfast.

The conditions use of role models, classroom education and the combination were not significantly different from each other. A possible reason why the use of role models was not different from the other methods could be that the role models were not appealing to the children. It could be that the three role models were not familiar enough. In the study of Kotler et al. they concluded children preferring food products associated with a role model

they liked or with they are familiar with (Kotler et al., 2012). A second reason could be that the three video fragments used in this intervention study were too short (approximately 5-10 minutes) to have enough time to learn children new knowledge or show desired behaviour. Besides, the video fragments were viewed only once during one lesson. If the video fragments were repeated in other lessons, it could have improved the behaviour and knowledge more. A third reason could be that the role models used positive arguments, but negative arguments could have been more effective such as with smoking behaviour (Lin, 2014). Other studies found also classroom education less effective and therefore, it was expected to not be the most effective method (Brug et al., 2003; Oenema & Brug, 2003). Another reason could be that the lessons for the classroom education were some shorter than the other conditions. Therefore information could be more easily forgotten. Another reason could be that there was less repetition in this method and repetition helps to maintain information in the memory. The combination method was included to combine the best of all three methods, because children can have different learning styles and this method could combine all preferences. However, the results showed that this method was not significantly different from classroom education or use of role models. A reason could be that the intervention was too short for this condition, because the set-up for this condition was one lesson with use of role models, one lesson classroom education and two lessons tailored feedback. This method could be more effective when all four lessons had elements of the three other conditions or the children received also three lessons of each method.

This study is the first study that focussed on improving breakfast quality of children aged 8-10. Moreover, it is also the first study that focussed on improving breakfast quality of children living in Dutch disadvantaged neighbourhoods. Besides, the set-up is strong, because after only four lessons the children showed improvements on knowledge, attitude and behaviour. Another striking point of this study is that Ipad's were used to collect data. This reduced missing data, because everything is collected online and could be transported to SPSS software. However, there are some potential limitations about this study. This study does not include a control group. Progress was measured by the differences in pre-test and post-test. A control group could have given more information about differences in time caused by other factors. For example, the weather could also play a role why children ate healthier at the post-test, the control group could compensate for these kinds of effects. Another limitation was the post-test was conducted during the Ramadan. A lot of children ate differently, because they were fasting daily or some school days. This could influence the results. Although, all

children had to fill in if they were fasting and were excluded from the data set. But this correction could influence the results as well because the total amount of children became smaller for the behaviour question than for the knowledge and attitude questions. Another limitation was that behaviour was conducted by self-reported behaviour. This is a limitation because children could give social desirable answers instead of the truth. Therefore, the researchers emphasised that it was not a test and there were no wrong answers. For future research, it is recommended to add a third measuring point after the summer to investigate if the results are stable or were only short-term. Besides, it is also recommended to use the new guidelines with only two groups which could improve the behaviour and knowledge about breakfast even more.

On balance, the findings of this study help to make clear which method is the most effective to change breakfast quality of Dutch children. Tailored feedback was in this study the most effective method compared to classroom education, use of role models or a combination of those three. Knowledge increased most and the quality of the breakfast improved the most when tailored feedback was used. Therefore, it is recommended to focus on tailored feedback after some adjustments when implementing this breakfast programme at other schools in the Netherlands.

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Appendices

Appendix 1: thermometer assignment for tailored feedback condition

LESBLAD

WELKE KLEUR HEEFT JOUW ONTBIJT?

Voornaam: .....

Achternaam: .....

Groep: .....

Datum: .....

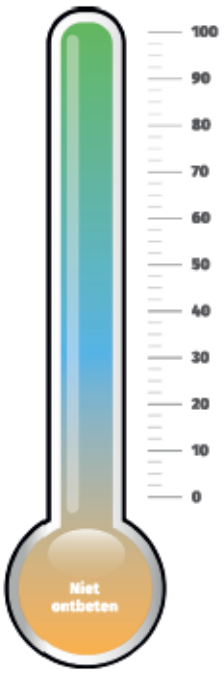
Je hebt net aangekruist wat je gegeten en gedronken hebt als ontbijt.
Ook heb je geleerd dat er producten zijn voor elke dag (groen), voor af en toe (blauw) en producten die je heel soms (oranje) als ontbijt kunt gebruiken.

Zoek op het werkblad 'Drie kleuren voor ontbijt' welke kleuren de producten van jouw ontbijt hebben. Plak de stickers in de juiste kleuren bij de producten die je aangekruist hebt op het lesblad 'Jouw eigen ontbijt'.
Tel daarna hoeveel groene, blauwe en oranje producten je at of dronk.
Schrijf dit hieronder op.

Hoeveel groene producten had jij? .....

Hoeveel blauwe producten had jij? .....

Hoeveel oranje producten had jij? .....



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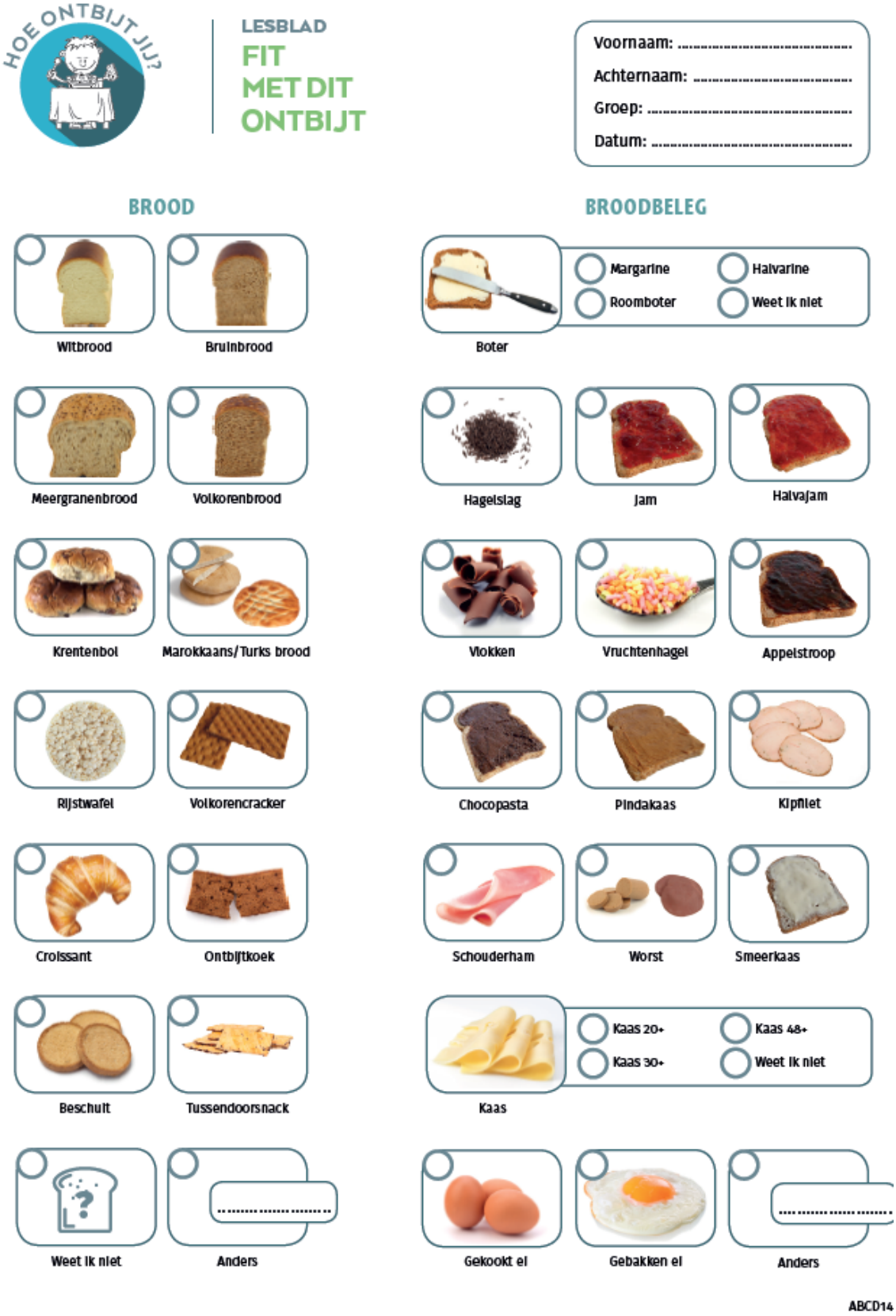
Appendix 2: Assignment select products that fit in a healthy breakfast



ONTBIJTGRANEN, PAP & YOGHURT

Volle yoghurt
Halfvolle yoghurt
Magere yoghurt
Weet ik niet

Yoghurt

Vruchtenyoghurt zonder vet met suiker

Pap van volkorenontbijtgranen

Cornflakes

Chocopops

Cruesli

Muesli

DRINKEN

Volle melk
Halfvolle melk
Magere melk
Weet ik niet

Melk

Karnemelk

Chocolademelk

Yoghurtdrank

Ontbijtdrank

Vruchtensap

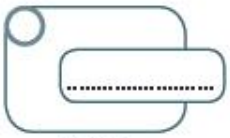
Frisdrank

Ranja/limonade

Thee met suiker of honing

Thee zonder suiker of honing

Water



Anders

ANDERE PRODUCTEN

Pannenkoek

Pizza

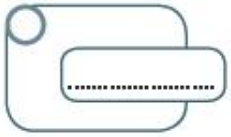
Turkse pizza

Saucijzenbroodje

Soep

Snoep of chocola

Chips



Anders

GROENTE & FRUIT

Appel

Banaan

Peer

Ander fruit

Tomaat

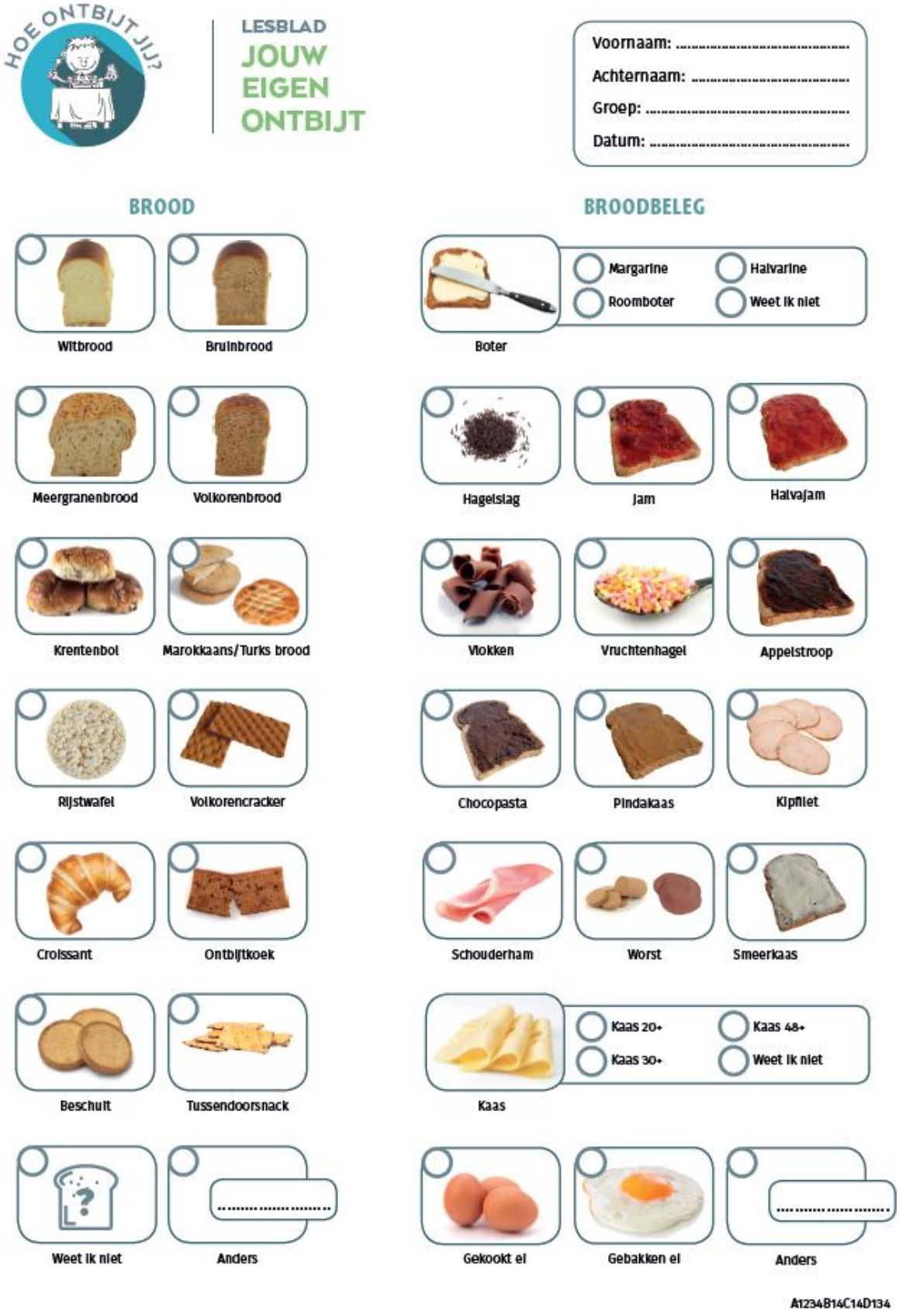
Komkommer

Sla

Andere groenten

ABCD14

Appendix 3: Assignment: select your own breakfast of this morning



ONTBIJTGRANEN, PAP & YOGHURT

Yoghurt


Vruchtenyoghurt zonder vet met suiker | Pap van volkorenontbijtgranen | Cornflakes


Chocopops | Cruesli | Muesli

DRINKEN

Melk


Karnemelk | Chocolademelk | Yoghurtdrank


Ontbijtdrank | Vruchtensap | Frisdrank


Ranja/limonade | Thee met suiker of honing | Thee zonder suiker of honing

Water | Anders

ANDERE PRODUCTEN


Pannenkoek | Pizza


Turkse pizza | Saucijzenbroodje


Soep | Snoep of chocola

Chips | Anders

GROENTE & FRUIT


Appel | Banaan

Peer | Ander fruit


Tomaat | Komkommer

Sla | Andere groenten

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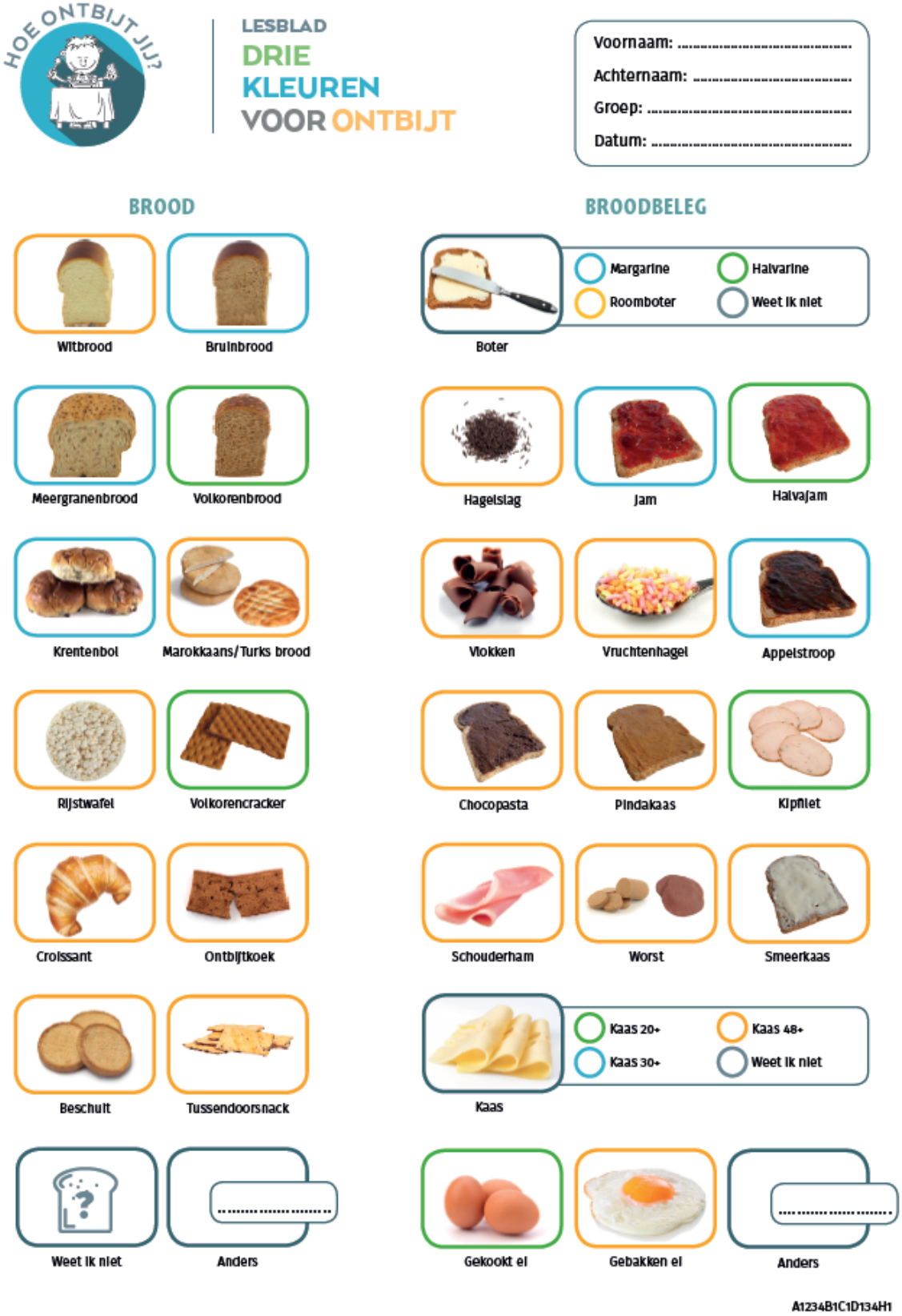
Appendix 4: product categorization with the colours green, blue and orange



ONTBIJTGRANEN, PAP & YOGHURT

Yoghurt


Vruchtenyoghurt zonder vet met suiker | Pap van volkorenontbijtgranen | Cornflakes


Chocopops | Cruesli | Muesli

DRINKEN

Melk


Karnemelk | Chocolademelk | Yoghurtdrank


Ontbijtdrank | Vruchtensap | Frisdrank


Ranja/limonade | Thee met suiker of honing | Thee zonder suiker of honing


Water | Anders

ANDERE PRODUCTEN


Pannenkoek | Pizza


Turkse pizza | Saucijzenbroodje


Soep | Snoep of chocola


Chips | Anders

GROENTE & FRUIT


Appel | Banaan


Peer | Ander fruit


Tomaat | Komkommer


Sla | Andere groenten

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Appendix 5: assignment differences between categories for condition classroom education and use of role models

HOE ONTBIJT JIJ?

LESBLAD

KEUZES WAAR JE FIT VAN WORDT

Voornaam: .....

Achternaam: .....

Groep: .....

Datum: .....

In veel ontbijtproducten zit vet. Te veel vet is niet goed voor je. Je kunt er overgewicht van krijgen.

Vet in een ontbijtproduct kun je meestal niet zien. Soms staat het duidelijk op de verpakking, zoals op een pak melk. Er staat dan bijvoorbeeld 'volle melk' of 'magere melk'. Drink je een beker melk en heb je het pak niet gezien, dan weet je meestal niet welke soort melk het is.

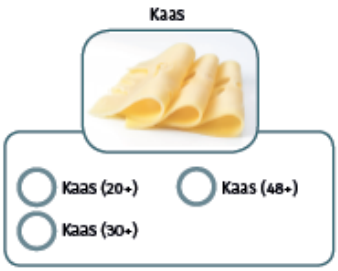
Kleur de vakjes bij de melk met het minste vet groen, de melk met meer vet blauw en de melk met het meeste vet oranje.

Melk

Hoeveel vet er in kaas zit, wordt aangegeven met een getal en een +, bijvoorbeeld 48+-kaas. Vaak staat dat op de verpakking of op een kaartje bij de kaas in de winkel.

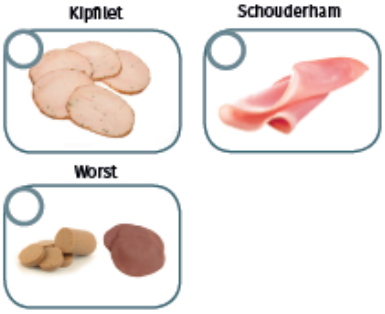
Kleur het vakje bij de kaas met het minste vet groen, de kaas met meer vet blauw en de kaas met het meeste vet oranje.

Kaas



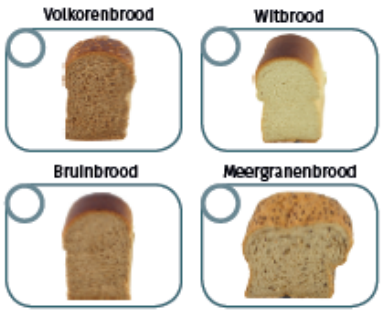
Bij vleeswaren is het lastiger. Je kunt aan de vleeswaren niet zien hoeveel vet erin zit en meestal staat het niet op de verpakking, zoals bij melk of kaas. Je moet het dus weten. Soms zit er ook suiker of veel zout in vleeswaren; ook daar moet je niet te veel van eten.

Kleur het vakje bij de vleeswaren in de juiste kleur (groen = mag elke dag; blauw = mag af en toe; oranje = mag heel soms).



In brood zit nauwelijks vet, maar het is belangrijk om te kijken naar de hoeveelheid vezels. Vezels zijn stukjes van het graan waarvan het brood gebakken is. Vezels zijn goed voor je, want vezels geven een vol gevoel en vezels heb je nodig om goed te kunnen poepen.

Kleur het vakje bij het brood met de meeste vezels groen, het vakje bij het brood met een beetje vezels blauw en het vakje bij het brood met de minste vezels oranje.



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