



# Adaption and Evaluation of a Self-Efficacy Intervention for Parental Feeding Practices

HANNAH VOGEL

GILL TEN HOOR

ENRIQUE MERGELBERG

BARBARA MULLAN

\*Author affiliations can be found in the back matter of this article

EMPIRICAL PAPER

][ubiquity press

## ABSTRACT

**Background:** A healthy parental feeding program consisting of six sequential modules was developed to improve parental feeding behaviours. The six modules focusing on various parental feeding behaviours were found to be moderately effective in changing behaviour. In this study, one of those modules (the self-efficacy module) was systematically adapted and evaluated using Intervention Mapping (IM).

**Methods:** In a literature review (Study 1), the relevance of self-efficacy as a determinant for parental feeding habits was examined. In study 2, the behaviour change techniques used in the original healthy parental feeding program were analysed and adapted to fulfil the related parameters of effectiveness. In study 3, the effectiveness of the new module was pilot-tested among parents ( $N = 27$ ). Parents received either the original self-efficacy module (group 1), the adapted self-efficacy module (group 2), or no additional module (group 3/control-group). Parental self-efficacy was measured at baseline, post-intervention and at one-week follow-up.

**Results:** In study 1, self-efficacy was identified as a relevant (i.e., important and changeable) determinant for parental feeding habits. In study 2, parameters for effectiveness of the used behaviour change techniques were added where necessary, and texts were changed to improve understanding. In study 3, both the original and new module appeared to increase self-efficacy compared to the no-intervention control group.

**Discussion:** This study was an attempt to adapt existing behaviour change programs based on theory and evidence. However, we were not successful in changing self-efficacy more as compared to the original module.

## CORRESPONDING AUTHOR:

Gill ten Hoor

Maastricht University, NL  
gill.tenhoor@  
maastrichtuniversity.nl

## KEYWORDS:

healthy feeding; parenting;  
children; self-efficacy;  
habits; behaviour change;  
Intervention Mapping

## TO CITE THIS ARTICLE:

Vogel, H., ten Hoor, G., Mergelsberg, E., & Mullan, B. (2022). Adaption and Evaluation of a Self-Efficacy Intervention for Parental Feeding Practices. *Health Psychology Bulletin*, 6(1), pp. 1–12. DOI: <https://doi.org/10.5334/hpb.38>

Early in life eating habits are established when taste preferences are being formed. Children's healthy eating behaviours and children's dietary intake are influenced by parental feeding practices (Mallan & Miller, 2019). Previous studies have found that problematic feeding practices lead to unhealthy dietary habits which negatively impact a child's overall health (Costarelli et al., 2021), including an increased risk of childhood obesity and other chronic illness with enduring psychological and physiological consequences (Wright et al., 2016).

McKee et al. (2019) identified habits as an important predictor linking intention and behaviour in parental feeding behaviour. To tackle and shape the intention-behaviour link towards a healthier parental feeding style, a healthy parental feeding program was developed to establish an efficient change in feeding behaviour in parents with children aged 2–5 years. All parents with children aged 2–5 years were included in the intervention. No difference between habits for parents of 2-year-olds and parents of 5-year-olds was expected as, without intervention, parental feeding habits strongly rely on culture and tradition (Daniels, 2019), which do not change over time (Savage et al., 2007).

The healthy parental feeding intervention was developed using the Intervention Mapping (IM) framework (Bartholomew et al., 2016) and evaluated in a proof-of-concept study (currently under review). In short, we found a positive effect of the intervention on parental feeding behaviours for serving vegetables and unsweetened drinks, of habit strength on healthy feeding behaviour and an improvement in parental perceived behavioural control. A limitation was a high dropout rate of 85% causing attrition bias. For this reason, we decided to adapt and improve the intervention focusing on the Self-Efficacy Module (Module 3: Facing barriers), as participants of the proof-of-concept study reported most difficulties with this module.

## A HEALTHY PARENTAL FEEDING PROGRAM

A habit-based online program for parents with children aged 2–5 years was developed to improve parental feeding behaviours (CHEETAH, 2020). Over six weeks, parents completed six sequential modules with a focus on various parental feeding behaviours (i.e., habit formation, habit change, habit strength, self-confidence, self-efficacy and social support). Each week, modules were offered to change unhealthy feeding behaviours and to reinforce new healthy habits. The modules were selected and developed based on theories in the field of health psychology (e.g., Ajzen's Theory of Planned Behaviour) to predict which factors influence health behaviours (McEachan et al., 2016). Moreover, McKee et al. (2019) suggested that predictors like intention, perceived behavioural control, habit strength, past behaviour and parental self-efficacy influence parental feeding behaviour.

Module 1 (Habits everywhere) is an introduction to habits and (un)healthy feeding practices. This module aims to increase awareness about unhealthy feeding habits, as habits are usually performed automatically. Habits must be perceived mindfully before habit change can occur. In Module 2 (Be a smart planner) SMART (Specific, Measurable, Achievable, Reasonable, Time-Bound) goals are set and evaluated to establish healthy feeding practices. The best way to replace old with new habits is by setting clear goals. As achieving these goals (i.e., perform healthy feeding behaviours) will aid habit formation in the long term. In Module 3 (Facing barriers), possible obstacles are identified. In this module, parents learned how to overcome barriers by targeting their self-efficacy. This was done by introducing if-then plans (Hsieh et al., 2019, Hagger et al., 2016) and by providing ideas on helpful meal preparation. Module 4 (Stronger together) is about social support and conflict resolution in the progress of parental habit change with giving advice on how to behave in difficult situations (staying calm, finding a solution by remembering the initial goal, perspective taking and active listening, making statements from one's perspective). In Module 5 (Be confident) self-confidence and children's picky-eating are addressed. By making parents aware of picky-eating, they learn that by altering influential cues in the environment, parents can gain back control over their feeding behaviour, which can improve their confidence and perceived control over their feeding behaviours. Module 6 (Reinforcing habits) is a reflection on the parent's progress and goal adjustment. This module aims to enhance repetition of behaviours to strengthen healthy parental feeding habits (Harvey et al., 2022). A more elaborate description of the Modules can be found in Appendix 1 or online on Open Science Framework (<https://osf.io/2k8fe/>). The goal of the intervention is to help parents to create healthy feeding habits and offer a healthy food environment for their toddler (Mullan et al., 2020).

## ADAPTING THE PROGRAM BY USING INTERVENTION MAPPING

The current study is a showcase on how to adapt, evaluate and redesign one module of the intervention, with the goal to further improve the intervention based on theory and evidence. This study specifically focused on Module 3, as self-efficacy and self-regulation play a crucial role in integrating healthier nutrition into lifestyles (Hammersley et al., 2019). When self-efficacy is enhanced, parents can become more aware of essential behaviours crucial for a healthy diet such as buying and eating healthier foods (Anderson, 2007, Möhler et al., 2020).

To further develop Module 3, an Intervention Mapping approach was used. Intervention Mapping is a theoretical framework serving the purpose of providing intervention planners and developers with tools to make effective

and evidence-based decisions in the intervention's development and progress (Kok et al., 2016). The Intervention Mapping approach follows six iterative steps. In Step 1 (the needs assessment), the problem is analysed, and related behavioural and environmental causes are identified. Step 2 focuses on stating behavioural and environmental outcomes for problem reduction, which in combination with the determinants form the program objectives. In Step 3 theory- and evidence-based change methods are chosen to address program objectives. In Step 4 the methods from the previous step are translated into practical applications resulting in program production. In Step 5 the program implementation plan is constructed. Lastly, in Step 6 the program evaluation plan is set up by writing evaluation questions specified for process and effect evaluation (Bartholomew Eldredge et al., 2016).

## RESEARCH QUESTIONS

Using the Intervention Mapping approach, the core processes for planning behaviour change interventions first point to the need to pose initial questions in order to ascertain causes of the health problem (Ruiter & Crutzen, 2020). To identify determinants of behaviour and environmental conditions and to help to develop interventions and anticipate implementation subsequent questions are formulated. Based on that the following three research questions were proposed: 1) Is self-efficacy is an important and changeable determinant related to the parental healthy feeding outcome behaviours?; 2) Were the right methods used to change self-efficacy in the original Module 3?; and 3) Does the newly developed model increase parental self-efficacy as compared to regular care and as compared to the current module? The three questions were answered in three separate consecutive studies.

## STUDY 1: A RAPID SCOPING LITERATURE REVIEW

Perceived self-efficacy is a central component of Social Cognitive Theory (Kelder et al., 2015). Previous studies have shown that self-efficacy plays a major role in influencing health behaviours. Previous literature found self-efficacy as predictor for children's nutrition (Möhler et al., 2020). The objective of the present study was to examine whether parental self-efficacy is a relevant (i.e., important and changeable) determinant of parental feeding habits in parents with children aged 2–5 years. To identify what has been published so far on this topic, we conducted a rapid scoping review as part of Step 1 and Step 2 of the Intervention Mapping approach (note: in parallel, Bahorski et al., 2019 published a more elaborate

review on the same topic). The aim of the scoping review was to define the problem (i.e., the effect of self-efficacy on feeding behaviours) and the intervention outcomes (i.e., how to increase self-efficacy in parents to reduce unhealthy feeding behaviours). The scoping review was used to identify related behavioural and environmental determinants and find possible ways to reduce the problem. This information was used to adapt the intervention module.

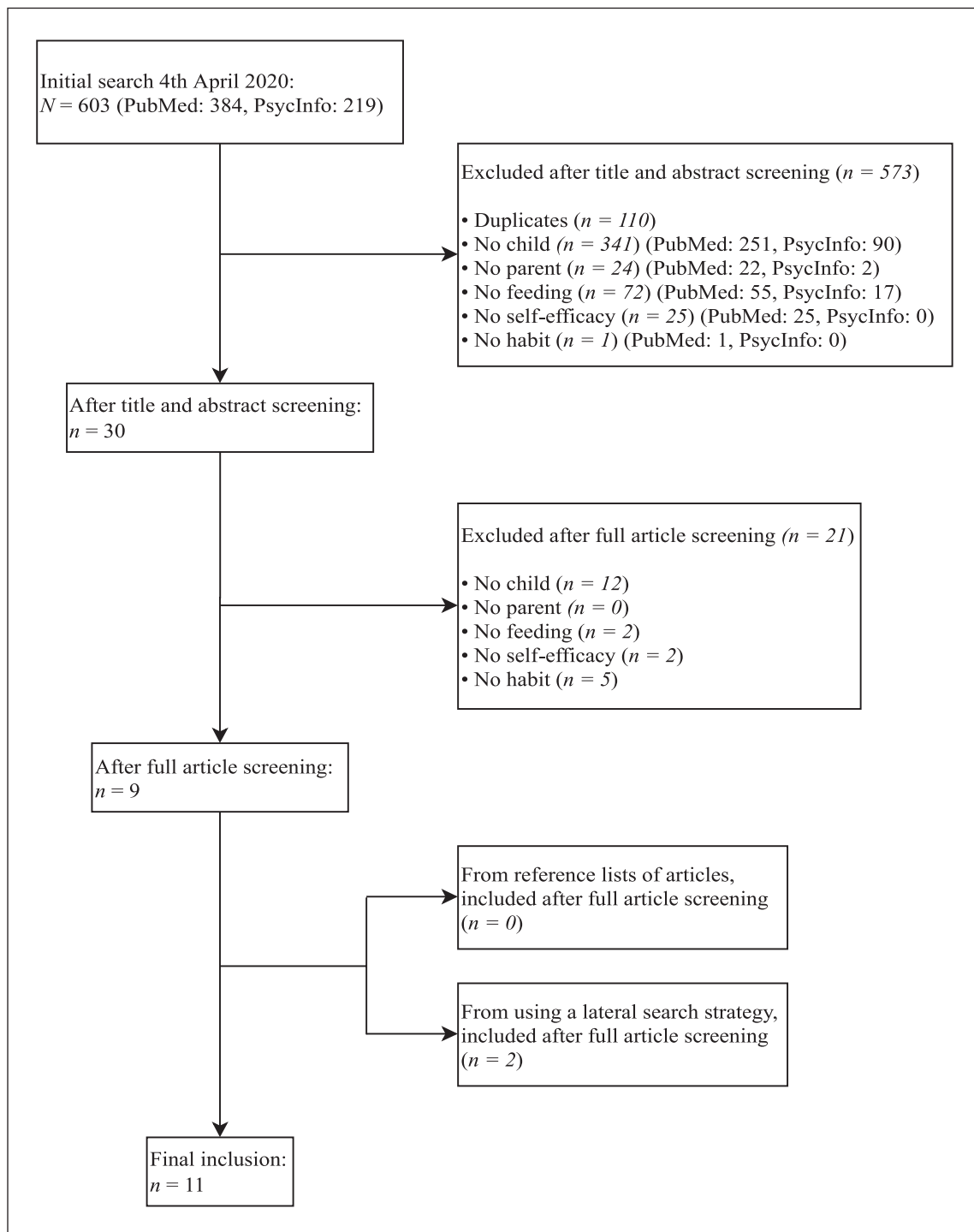
## METHODS

A literature search was carried out in April 2020. The databases PubMed and PsycInfo were used. The search strategy developed aimed to locate all studies addressing parental self-efficacy related to their feeding behaviours, thus included a combination of the following terms: words related to self-efficacy, variations of the word “parent”, and possible variations of the word “feed”. The full search strategy can be found in Appendix 2 on (<https://osf.io/2k8fe/>). No restrictions were made regarding the publication or document type, the year of publication, the publication status, the study design or the language used. Lastly, we checked the reference lists of all included studies, to check whether we missed potentially relevant records in our search. The following data were extracted from each paper and included in Appendix 2: Author, title, year, country, introduction and main content, self-efficacy definition, feeding behaviour, habit definition, intervention design, study design, age, participants (m/f), measurements, secondary outcomes, conclusions and limitations. The influence of self-efficacy on parental feeding habits from the included papers is summarized. No further comparisons were made between the papers.

We screened records in two phases, first title/abstract only, then full text. We only included studies that focused on (aspects of) habit change and publications examining the role of self-efficacy in studies investigating habitual feeding behaviours studies in parents of 2- to 5-year-olds. Articles were excluded if it was a duplicate (I), if it was not about children aged 2–5 years (II), if no parents were included (III), if no information was given on feeding behaviour (IV), self-efficacy (V), and habits (VI). Figure 1 demonstrates the search process represented in a flowchart with numbers of records excluded and their reason for exclusion.

## RESULTS

A total of 603 records were found (PubMed:  $n = 384$ , PsycInfo:  $n = 219$ ). Thirty papers were included after a first screening of the articles' title and abstract. Based on the full article screening, 21 more papers were excluded. Additionally, in a lateral search, two articles which met the inclusion criteria after full-text screening were added (Chen et al., 2018; Sun et al., 2017). No new articles were found relevant from the reference list of all included articles. All articles found were written in English. Finally,



**Figure 1** Flowchart Showing the Research Progress.

11 publications were included. An elaborate summary-table of results of the included articles can be found in Appendix 2 (<https://osf.io/2k8fe/>). All papers were published between 2010 and 2018. Five studies were conducted in the USA, four in the UK and two in China. In all of the studies, parents reported on their child's behalf. The number of participants ranged from 32 to 420 and in six studies the participants were exclusively mothers (Chen et al., 2018; Rohde et al., 2018; Sun et al., 2017) or mostly mothers (Baranowski et al., 2016; Diep et al., 2015; Morin et al., 2013). Nine of the studies entailed information about the development of future interventions and

suggested improvements for these interventions. Two of the eleven studies were interventions (Sun et al., 2017 used a RCT and Tabak et al., 2012 used a pre-post design without a control group). Seven studies were cross-sectional (surveys: Baranowski et al., 2016; Chen et al., 2018; Diep et al., 2015; Morin, 2013; Rohde, 2018; Shriver et al., 2010; Taverno-Ross, 2018). Lastly, one study used mixed methods (Foster, 2018). Duncanson et al., 2012, was a design document without additional data on the link between self-efficacy and parental feeding habits. All studies defined self-efficacy and provided information on the type of feeding behaviour investigated.

## Outcomes of the Included Studies

Nine studies reported a significant effect of the influence of high parental self-efficacy with the habitual behaviour. These include allowing active child involvement in vegetable selection and positive communications about vegetables (Baranowski et al., 2016; Diep et al., 2015). Others looked at encouraging healthy eating behaviour (Chen et al., 2018; Foster et al., 2018; Sun et al., 2017), increasing fruit and vegetable consumption (Shriver et al., 2010), planning a menu for the upcoming week, preparation of healthy meals with only a few ingredients on hand, and preparation of meals in advance (Morin et al., 2013). Two further studies examined children's dietary intake and their physical activity (Rohde et al., 2018), and modelling behaviour through family recipe preparation (Taverno Ross et al., 2018).

Baranowski et al. (2016, p. 1980) found that "the barrier of the child not liking vegetables was positively related to parental self-efficacy, while the barrier of the respondent not liking vegetables was negatively related with parental self-efficacy". Parental practices had the most significant effect on feeding behaviour (Baranowski et al., 2016). Maternal self-efficacy showed a medium effect for promoting healthy eating (Sun et al., 2017). Moreover, Rohde et al. (2018) found that maternal self-efficacy for promoting healthy dietary behaviour was associated with higher fruit and vegetable intake in children. Tabak et al. (2012) reported a negative association of self-efficacy on vegetable intake of kids, but not when adjusted for age.

## CONCLUSION STUDY 1

In this study, the effect of self-efficacy as a possible predictor of parental feeding habits was investigated. The literature showed that in addition to parenting practices, parental self-efficacy had a direct correlation with healthy eating behaviours in their children. In most of the studies, self-efficacy was found to be a relevant determinant in creating and maintaining healthy feeding habits. A limitation was that we included and compared findings of different types of study designs (i.e., RCT, pre-post, cross-sectional and mixed-method studies). This makes it difficult to compare, quantify, and generalize the effect of self-efficacy on feeding behaviours. While randomized controlled designs (RCTs) would be the best type of studies to infer this effect, as we found only one published (Sun), it was pragmatic to include other study designs.

## STUDY 2: METHODS FOR CHANGING BEHAVIOUR IN MODULE 3

It was suggested that Module 3 was the least favourite module and hard to comprehend, based upon consultation with the target audience. Therefore, the

methods and techniques that were used to develop the original Module 3 were analysed and the translation from theoretical method to practical application was reconsidered (Bartholomew Eldredge et al., 2016; Ten Hoor et al., 2014). Bartholomew Eldredge et al. (2016) identified and defined behaviour change methods, including the parameters of effectiveness, which defines the condition(s) under which the theory-based behaviour change techniques can be effective. For this reason, the parameters of effectiveness were further examined to increase the likelihood of a positive change in the desired behaviour (Bartholomew Eldredge et al., 2016). Following the Intervention Mapping approach, the goal of study 2 was to focus and adapt the program's design. We chose theory and evidence-based change methods to address program objectives (Step 3 of IM), which were then translated into practical applications (Step 4 of IM). Lastly, we constructed an implementation plan (Step 5 of IM) (Bartholomew Eldredge, 2016).

## METHODS

A study by Ten Hoor et al. (2014) served as a reference on how to apply behaviour change theories and increase the program's comprehensibility. The first step was to inspect the text elements of Module 3. The text from Module 3 of the intervention website was copied from the webpage. The text was divided into separate text sections. These text sections were assigned to the corresponding Intervention Mapping behaviour change methods. Associated with the behaviour change method used, the method's description by Bartholomew Eldredge et al. (2016) was added. Subsequently, the parameters of effectiveness were matched with the text content, evaluating whether the parameters of effectiveness were met or not.

Next, the understandability of the text of the original Module 3 was examined by using interviewing seven people who were diverse in their social-economic status. Semi-structured interviews were used. Participants were university staff and students, and people from the community recruited in Perth, the capital city of Western Australia. The total sample consisted of seven people, four women and three men with an age range between 20 and 54 years old. Three were parents (2 mothers and 1 father), three were students (2 post- and 1 undergraduate), and one was unemployed. Four were native Australians, and three were born outside Australia. Their task was to complete the original Module 3 step-by-step while reading it out loud. After each of the previously divided text sections (in terms of behaviour change methods), they stopped and gave their opinion and, if desired, made suggestions for improvement. For this purpose, a table was created containing the text passages as well as comments of the participants and their suggestions for improvement (see Appendix 4-10 on <https://osf.io/2k8fe/>).



The third step was to systematically describe how the text could be improved, incorporating the parameters of effectiveness (Bartholomew Eldredge et al., 2016) and the suggestions by the participants.

## RESULTS

Each text paragraph of the original Module 3 was assigned to one of four categories of behaviour change methods. These methods were labelled as “Methods to Change Skills, Capability, and Self-Efficacy and to Overcome Barriers”, “Methods to Change Awareness and Risk Perception”, “Methods to Change Habitual, Automatic, and Impulsive Behaviours” and “Methods to Change Attitudes, Beliefs and Outcome Expectations”. The first method addresses self-efficacy as a behavioural determinant, which was the main component of Module 3. The other two methods address habit change and increasing awareness of healthy feeding behaviour, which were secondary components of Module 3.

During the interviews, five out of seven participants thought that the technical terms were presented reasonably. They also confirmed that they liked when technical terms were used because this contributed to the credibility of the methods and made the program more interesting. On the other hand, two participants stated that they were confused by technical terms (such as “if-then statements”). All participants remarked that there was too much text. They commented that the program lacked clear paragraphs and structure, making it challenging to identify differences between the four topics in Module 3. Furthermore, all participants mentioned that the given examples were redundant and sometimes inappropriate. To make the module more appealing, one participant suggested changing the pictures. Additionally, one participant proposed including a role model in the program for parents to identify with. For all feedback and suggestions, see Appendix 4–10 on <https://osf.io/2k8fe/>.

Based on the systematic categorization of methods and the interviews, the module was revised (Appendix 11; <https://osf.io/2k8fe/>). All methods, parameters, and systematic changes can be found in Table 1 (Appendix 3).

## CONCLUSION STUDY 2

The inspection of the text sections of the original Module 3 showed that self-efficacy was sufficiently targeted. In all text sections, behaviour change methods were identified, but the parameters of effectiveness for these methods were not always fulfilled adequately. Furthermore, the interviews with people from our target audience indicated that the text in Module 3 was lengthy, unclear, and sometimes inappropriate. This may explain why previously Module 3 was chosen as the least favourite module (Mullan et al., 2020). Hence, to improve the efficiency and the acceptability of the methods used, the text sections were adapted in a systematic and theoretical way.

## STUDY 3: TESTING EFFICACY OF THE NEW MODULE – A PILOT STUDY

In our literature search (Study 1), self-efficacy was identified as a relevant determinant in parental feeding practices. Study 2 used the theory-based application of behaviour change methods with self-efficacy and habits as underlying determinants, and a new Module 3 was designed. Thereupon, Study 3 pilot-tested whether parental self-efficacy was increased after having received the new Module 3 compared to the original Module 3 and a control-condition.

## METHODS

### Participants and Recruitment

Participants included primary caregivers of children aged 2–5 years. Two methods of recruitment were used. Participants were recruited by emailing directors of 22 childcare centres in Perth, WA. From the 22 childcare centres answers were received from six of them (average response rate: 27%). Secondly, recruitment took place on Amazon.com’s Mechanical Turk (MTurk). MTurk is an online marketplace where workers (mostly Americans) are paid for completing Human Intelligence Tasks (HITS; Boas, Christenson, & Glick, 2018). The study was approved by Curtin University’s Human Research Ethics Committee (HRE2019-0094). Every parent having one or more children between 2–5 was eligible to participate in the study.

### Intervention Design

A randomized-control trial was designed to test the efficacy of the newly developed Module 3 over three weeks. The intervention consisted of Module 1, an introductory module to the CHEETAH program delivered during the first week of the intervention and Module 3, the CHEETAH module aiming to improve parental self-efficacy, delivered after Module 1 in week 2 and 3 of the intervention. Participants were randomly but evenly assigned to three different conditions: they either received the original version of Module 3, the new version of Module 3 or were assigned to a control-condition. In the control-condition, they were directed to the webpage of either the Australian (Australian Government) or the American guidelines (American Heart Association) for the recommended serving sizes for fruits and vegetables for children, depending on where the parents were recruited.

### Protocol of Study

Data were collected via Qualtrics at baseline (T0: week 0), directly after the intervention (T1: week 3), and after 1 week follow up (T2: week 4). Prior to the beginning of the study, informed consent was provided by participants. The inclusion criteria for participation in the study was (1) being a parent of a 2–5-year-old, (2) understanding English, and

(3) having access to the internet. Moreover, parents were informed that their participation was completely voluntary and they could withdraw from the project at any time. Before parents started the survey, they were instructed that if they had multiple children in the target age group, they should only keep one of their children in mind when answering the questions in the study. Furthermore, a reader-check was added to the survey to ensure that parents read all instructions carefully.

At T0, parents' eligibility was checked, and demographic and self-efficacy measures were assessed (see Measures). Participants were then randomised into the three groups and received the intervention over three weeks. At T2 and T3, parental self-efficacy was measured again. The questionnaires took approximately 30 minutes to complete and the intervention could be completed in 10 minutes, however, participants were instructed to take as much time as they needed or wished to use. Participants were reimbursed with a \$20 gift voucher after completing the whole study.

**Measures**

**Demographic Measures.** Parents indicated their child's age and age group (1: 2–3 years, 2: 4–5 years), as different fruit and vegetable recommendations applied for each age group. In addition, they indicated their gender, the child's gender and the number of children they have.

**Time Spent on Intervention.** The time spent to complete the intervention modules and the questionnaire was measured in seconds at T0, T1, and T2.

**Parental beliefs (including Self efficacy).** Parental beliefs (including self-efficacy) was measured regarding fruit and vegetable feeding behaviour. Parents were asked to report whether they provided their child with the recommended serving size for fruit and vegetables (American Heart Association; Australian Government) on an average day over the last two weeks (Strachan & Brawley, 2009).

The questionnaire consisted of 34 questions covering direct measures of self-efficacy, attitude, subjective

norm, normative beliefs, intention, past behaviour, motivation to comply, outcome evaluations, behavioural beliefs, control beliefs, and power of control factors (Ajzen, 2017). All items were rated using an eleven-point Likert scale where 0 = strongly disagree/extremely unpleasant/not at all likely/extremely bad/never and 10 = strongly agree/extremely pleasant/extremely likely/extremely good/always. As the number of participants in this pilot-study was low, it was decided to not further focus on determinants other than self-efficacy in this paper. For the full questionnaire and additional analyses, please see Appendix 12; <https://osf.io/2k8fe/>.

**GLMM Data Analysis**

Data were analysed using a Generalised Linear Mixed Model (GLMM). GLMM was used in preference to the traditional ANOVA approach because it is better at accommodating violations concerning normality, linearity, and homogeneity of variance (Stroup, 2012). Nevertheless, it must be noted that the assumptions may have been violated. The data were transformed from a repeated-measures ANOVA to the long format of the GLMM analysis. Participants' ID was included as a random factor. Moreover, 'gender', 'condition', 'child age', 'number of children', 'time\*condition' were included as continuous fixed effects, and self-efficacy as a fixed within-groups factor (Appendix 13).

**RESULTS**

**Participant Demographics**

In total, 34 participants registered to take part in the study, and 27 parents (*n* = 15 mothers) completed the whole program. Those parents were then assigned to one of the treatment conditions (original module-condition: *n* = 10, new module-condition: *n* = 9, control condition: *n* = 8). Seven participants had one child, 13 parents had two children, six participants had three children, and one parent had five children. Fifteen children were in the age group 2–3 years and 12 children were aged 4–5 years. Children's mean age was 2.11 (*SD* = 0.91) years. Table 2 shows the distribution of parental gender, children's mean age and children's age

VARIABLE	T0 (WEEK 0)				T1 (WEEK 3)				T2 (WEEK 4)			
	TOTAL	ORIGINAL MODULE	NEW MODULE	CONT-ROL	TOTAL	OLD-MODULE	NEW-MODULE	CONT-ROL	TOTAL	OLD-MODULE	NEW-MODULE	CONT-ROL
<b>N</b>	27	10	9	8	27	10	9	8	27	10	9	8
Gender (M:F)	(12:15)	(6:4)	(3:6)	(3:5)	(12:15)	(6:4)	(3:6)	(3:5)	(12:15)	(6:4)	(3:6)	(3:5)
Child-age group (2–3 years: 4–5 years)	(15:12)	(6:4)	(7:2)	(2:6)	(15:12)	(6:4)	(7:2)	(2:6)	(15:12)	(6:4)	(7:2)	(2:6)
Mean age children <i>M(SD)</i>	2.11 (.92)	2.40 (1.27)	1.89 (.60)	2.00 (.71)	2.11 (0.92)	2.40 (1.27)	1.89 (0.60)	2.00 (0.71)	2.11 (0.92)	2.40 (1.27)	1.89 (0.60)	2.00 (0.71)
Self-efficacy	6.85 (1.73)	6.80 (1.03)	7.61 (.89)	5.56 (2.54)	7.05 (1.16)	7.30 (1.16)	7.22 (1.23)	6.65 (1.11)	7.21 (1.38)	7.65 (0.97)	7.67 (0.83)	6.28 (1.81)

**Table 2** Means and Standard Deviations of Participants' Determinants at Time 0 (week 0), Time 1 (week 3) and Time 2 (week 4).

Note: Gender (F) = female, Gender (M) = male, M = Mean, SD = Standard Deviation.

group per condition. The majority of participants lived in the US ( $n = 25$ ) and two participants lived in Western Australia.

**Time Spent on the Intervention**

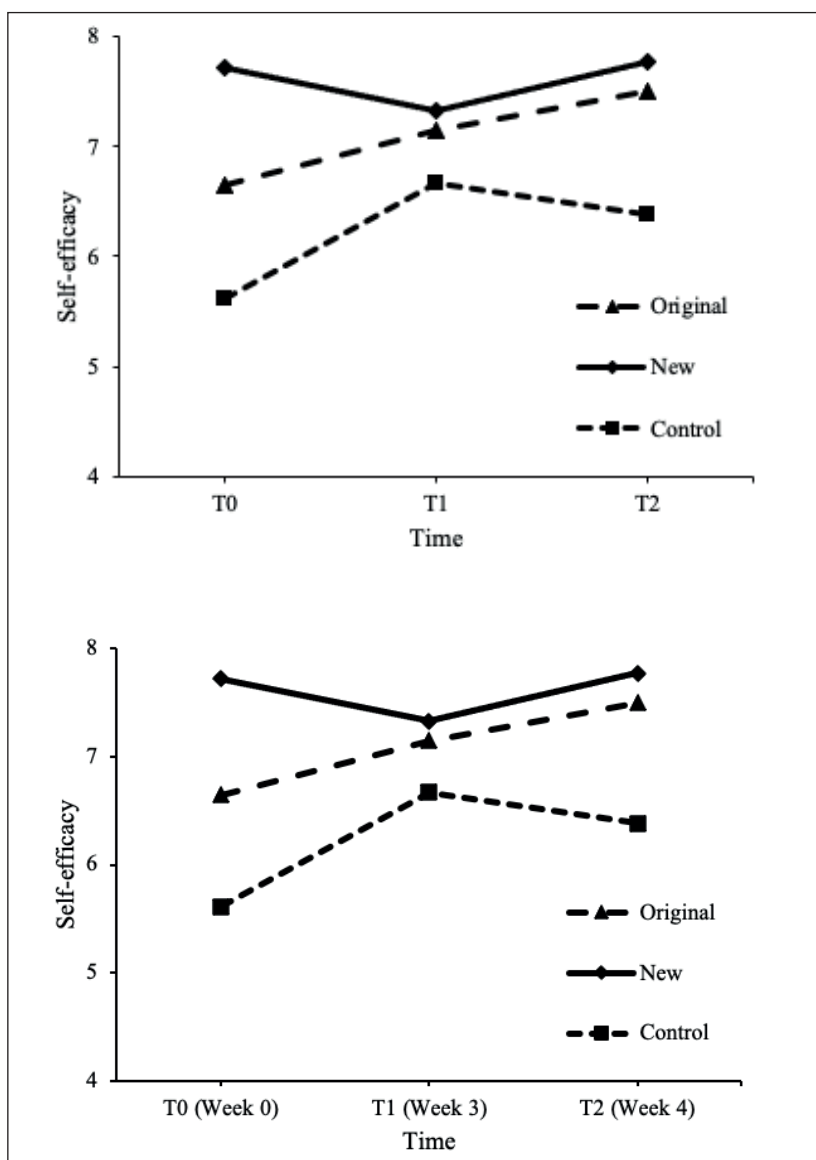
At T0, the average time spent on Module 1 and the baseline questionnaire was 606.97s (10.12 minutes). At T2, participants spent 481.70s (8.03 minutes) in the original module-condition, 427.33s (7.11 minutes) in the new module-condition and 325.50s (5.42 minutes) in the control condition. Due to the adaptations, which were made to the new module, as expected, the average duration time was longer in the original-module-condition compared to the adapted-module-condition and the control-condition. The average duration was 561.68 (9.35 minutes) at T2.

**Self-Efficacy**

A significant main effect of condition,  $F(2, 71) = 3.88, p = .025$ , partial  $\eta^2 = .098$  and a significant interaction of time and condition were observed,  $F(6, 71) = 2.65, p = .022$ , partial  $\eta^2 = .180$ , indicating different self-efficacy patterns

over time between the three conditions. Figure 2 suggest that participants' perceived self-efficacy increased over the three time points in the original-module-condition, however in the new-module-condition self-efficacy seems to decrease from T0 to T1 and increase from T1 to T2. Lastly, in the control-module-condition, self-efficacy seems to increase from T0 to T1 and decrease from T1 to T2.

Pairwise comparisons, however, showed that there were no differences in trajectories over time between the three conditions, all  $t < .393, p > .766$ . We found that the two-way interaction was significant because there were different levels of self-efficacy at T0 between the new-module-condition and the control-module-condition,  $t(15) = 2.28, p = .030$ , but not between the new-module-condition and the original-module-condition,  $t(17) = 1.18, p = .085$ . At T1, no significant effects were reported between any of the conditions, all  $t < .998, p > .334$ . At T2, we found that the people in the control-module condition had significantly lower self-efficacy compared to the other two modules, both  $t > 2.58, p < .010$ .



**Figure 2** Changes in Self-Efficacy as a Function of Time and Condition.



### CONCLUSION STUDY 3

Parental self-efficacy was not significantly enhanced at post-treatment and follow-up compared to the baseline measurement in the new-module-condition. This was likely the case because of the higher self-efficacy levels at baseline suggesting a ceiling effect. People in the original-module-condition showed an increase of self-efficacy over time; a positive linear increase in the self-efficacy score was observed. Given there was no difference between the new- and original-module post-treatment and at follow-up, and self-efficacy levels in both these conditions were significantly higher than in control at follow-up, we can conclude that both self-efficacy modules increased self-efficacy compared to the control-module-condition one week after engaging with the modules. A limitation was that we did not check whether feeding behaviour or eating was found as moderator. Another limitation is that with only 34 participants in total (and only 27 completing the program), the response rate was very low, and a strong selection bias has likely occurred.

### GENERAL DISCUSSION

Parent-based interventions promoting healthy eating for preschool children have proven to be successful in effectively targeting healthy eating behaviours to reduce overweight and obesity (Nader et al., 2012; Hammersley, 2017). The healthy parental feeding program was developed as an online intervention to improve parents' feeding behaviours. This study proposed an approach to further improve the program's effectiveness, starting with a literature review, followed by theory- and evidence-based application of behaviour change methods, concluding with data collection to test the changes that were made in the previous steps. We found in our literature review that different researchers used different questionnaires to measure self-efficacy and feeding behaviour. Furthermore, some studies used a quantitative data collection approach except for three studies using qualitative interviews, which made it problematic to compare the results. Hence, we recommend that future studies use standardized assessments using validated measures of self-efficacy (e.g., following suggestions by Fishbein and Ajzen, 2010) and feeding behaviours (e.g., following suggestions by Musher-Eizenman et al., 2007). Moreover, we found that the new module was not more effective in increasing self-efficacy compared to the original module. A reason for why there was no difference between the original- and new-module may be due to the shortening of the original Module 3 in Study 2, not all of the intended behaviour change techniques and the corresponding methods of change could be implemented. However, both interventions (original and

new) seem to improve self-efficacy, while self-efficacy in the no intervention control group did not.

### LIMITATIONS AND FUTURE DIRECTIONS

The main limitation to this study was the high baseline self-efficacy level in parents in the original module condition. As a result, changes over time in this condition were not possible (i.e., a ceiling effect). This made it difficult to compare the effectiveness of the new model in increasing self-efficacy compared to the old model. In addition, this makes it difficult to generalize the sample to parents who may have lower self-efficacy. The results suggest that it is important that we target parent with lower self-efficacy levels, as they are most likely to benefit from the program compared to parents' high in self-efficacy. More research is needed to determine how we can reach parents who are low in self-efficacy. Another limitation was that we did not include a human role model as was suggested by participants in Study 2. We had to make concessions as other feedback related to the length of the Module suggested that less was more, thus including a description of a role model would make the module very long possible decreasing engagement. Creating a video was not possible at the time of this study due to practical limitations of COVID-19 lockdown measures. Additionally, because participants took less time to complete the study than previously expected (i.e., 30 vs 9 minutes), future research should consider investigating to what extent duration influences the effectiveness of the module. Furthermore, it should be acknowledged that this study focused only on one module of the intervention in isolation. It must be conceded that the results of a single module of the program tested here could differ from when we would test the effect of this module as a part of the whole intervention. Intervention modules likely interact and engaging with multiple modules may enhance the effects found of this module tested in isolation. Besides improving the actual module, this study is a showcase on how other modules of this or other programs could be improved by using the Intervention Mapping approach. Future research could test the effects on habit change of the new Module 3 as part of the whole program.

Another limitation of study 3 was the online data collection method. Because of the COVID-19 lockdown measures in place at time of data collection, there was no opportunity to collect data other than online. Nevertheless, we are aware that previous research found that data collection on MTurk could be influenced by low data quality leading to data invalidity (Chmielewski & Kucker, 2019). To reduce the effects of this limitation, we implemented an instructional manipulation check, nevertheless, the data could be biased due to an unrepresentative sample (Chmielewski & Kucker, 2019). Lastly, a limitation was the small sample size affecting the reliability and generalizability of the study. The study

was initially designed to do a well powered-RCT, but as the recruitment took place in the beginning of the Covid-19 pandemic, it was not possible to follow the recruitment plan as intended. Based on the small sample size the results have to be interpreted with caution as the margin of error increases with a smaller sample. A sensitivity power calculation with GPower (Faul et al., 2009) showed we had power of .51 with the current sample size to find a large effect (based on our interaction effect with  $\eta^2 = .180$ ). Given that a power of .51 is not enough (.80 is preferred), a larger sample size is needed to replicate and validate the results of this study. Nevertheless, our large effect may be true as we used a systematic and rigorous approach to improve the module. Moreover, a previous intervention study (only slightly underpowered) has found a medium to large effect on self-efficacy previously ( $d = 0.73$ , Sun et al. 2017).

## GENERAL CONCLUSION

As general strength, the results of the three studies provided greater insights into the effectiveness of one module of the program. Study 1 successfully identified self-efficacy as a changeable determinant to increase healthy feeding habits. Study 2 effectively adapted the module by applying evidence-based behaviour change methods. Contrary to the expectations, Study 3 showed that the newly adapted module did not improve self-efficacy above and beyond the improvements found in those completing the original module. Given the positive effects of the adapted and the original module on self-efficacy and the acceptability of the program in the United States of America and Australia, we recommend that the effectiveness of the new module should be assessed over a longer period of time while using a larger sample with lower levels of self-efficacy at baseline.

## DATA ACCESSIBILITY STATEMENTS

All materials and data are available in online appendices. The related Appendix 1 – Appendix 12 data is available online at <https://osf.io/2k8fe/>. A guide to understanding the file names is provided.

## ACKNOWLEDGEMENT

The authors thank Jessica Charlesworth for her help with some of the analyses, and helpful feedback.

## COMPETING INTERESTS

The authors have no competing interests to declare.

## AUTHOR AFFILIATIONS

**Hannah Vogel**

Maastricht University, NL

**Gill ten Hoor**  [orcid.org/0000-0001-5500-1893](https://orcid.org/0000-0001-5500-1893)

Maastricht University, NL

**Enrique Mergelsberg**  [orcid.org/0000-0002-7048-830X](https://orcid.org/0000-0002-7048-830X)

Curtin University, AU

**Barbara Mullan**  [orcid.org/0000-0002-0177-8899](https://orcid.org/0000-0002-0177-8899)

Curtin University, AU

## REFERENCES

- Ajzen, I.** (2017). Constructing a Theory of Planned Behavior Questionnaire.
- American Heart Association.** Fruit and Veggie Toolkit for Kids. Retrieved from [https://www.heart.org/idc/groups/heart-public/@wcm/@fc/documents/downloadable/ucm\\_480006.pdf](https://www.heart.org/idc/groups/heart-public/@wcm/@fc/documents/downloadable/ucm_480006.pdf)
- Anderson, E. S., Winett, R. A., & Wojcik, J. R.** (2007). Self-regulation, self-efficacy, outcome expectations, and social support: social cognitive theory and nutrition behavior. *Annals of Behavioral Medicine: a publication of the Society of Behavioral Medicine*, 34(3), 304–312. DOI: <https://doi.org/10.1007/BF02874555>
- Australian Government.** Healthy eating for children: Teach your child habits for a healthy life. Retrieved from [https://www.eatforhealth.gov.au/sites/default/files/content/The%20Guidelines/n55f\\_children\\_brochure.pdf](https://www.eatforhealth.gov.au/sites/default/files/content/The%20Guidelines/n55f_children_brochure.pdf)
- Bahorski, J. S., Childs, G. D., Loan, L. A., Azuero, A., Morrison, S. A., Chandler-Laney, P. C., Hodges, E. A., & Rice, M. H.** (2019). Self-efficacy, infant feeding practices, and infant weight gain: An integrative review. *Journal of child health care: for professionals working with children in the hospital and community*, 23(2), 286–310. DOI: <https://doi.org/10.1177/1367493518788466>
- Baranowski, T., Chen, T. A., O'Connor, T. M., Hughes, S. O., Diep, C. S., Beltran, A., ... Brand, L., Nicklas, T., & Baranowski, J.** (2016). Predicting habits of vegetable parenting practices to facilitate the design of change programmes. *Public Health Nutrition*, 19(11), 1976–1982. DOI: <https://doi.org/10.1017/S1368980015003432>
- Bartholomew Eldredge, L. K. B., Markham, C. M., Ruiter, R. A., Fernández, M. E., Kok, G., & Parcel, G. S.** (2016). Planning health promotion programs: an intervention mapping approach. John Wiley & Sons.
- Boas, T. C., Christenson, D. P., & Glick, D. M.** (2018). Recruiting large online samples in the United States and India: Facebook, Mechanical Turk, and Qualtrics. *Political Science Research and Methods*, 8(2), 232–250. DOI: <https://doi.org/10.1017/psrm.2018.28>
- CHEETAH: Creating Healthy Eating Environments For Toddlers By Adopting Habits.** (2020). Retrieved from <https://cheetahprogram.com>

- Chen, J.-L., Guo, J., Esquivel, J. H., & Chelsea, C. A.** (2018). Like Mother, Like Child: The Influences of Maternal Attitudes and Behaviors on Weight-Related Health Behaviors in Their Children. *Journal of Transcultural Nursing*, 29(6), 523–531. DOI: <https://doi.org/10.1177/1043659617736883>
- Chmielewski, M., & Kucker, S. C.** (2019). An MTurk Crisis? Shifts in Data Quality and the Impact on Study Results. *Social Psychological and Personality Science*, 11(4), 464–473. DOI: <https://doi.org/10.1177/1948550619875149>
- Costarelli, V., Michou, M., Panagiotakos, D. B., & Lionis, C.** (2021). Adherence to the Mediterranean diet and weight status in children: the role of parental feeding practices. *International Journal of Food Science and Nutrition*, 72(1), 112–122. DOI: <https://doi.org/10.1080/09637486.2020.1765151>
- Daniels, L. A.** (2019). Feeding Practices and Parenting: A Pathway to Child Health and Family Happiness. *Annals of Nutrition and Metabolism*, 74(2), 29–42. DOI: <https://doi.org/10.1159/000499145>
- Diep, C. S., Beltran, A., Chen, T. A., Thompson, D., O'Connor, T., Hughes, S., ... Baranowski, J., & Baranowski, T.** (2015). Predicting use of effective vegetable parenting practices with the Model of Goal Directed Behavior. *Public Health Nutrition*, 18(8), 1389–1396. DOI: <https://doi.org/10.1017/S1368980014002079>
- Duncanson, K., Burrows, T., & Collins, C.** (2012). Study protocol of a parent-focused child feeding and dietary intake intervention: the feeding healthy food to kids randomised controlled trial. *BMC Public Health*, 12(1), 1–10. DOI: <https://doi.org/10.1186/1471-2458-12-564>
- Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G.** (2009). Statistical power analyses using G\*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, 41, 1149–1160. DOI: <https://doi.org/10.3758/BRM.41.4.1149>
- Fishbein, M., & Ajzen, I.** (2010). *Predicting and changing behavior: The reasoned action approach*. New York: Psychology Press. DOI: <https://doi.org/10.4324/9780203838020>
- Foster, B. A., Aquino, C. A., Mejia, S., Turner, B. J., & Singhal, A.** (2018). Identification and Characterization of Families That Are Positively Deviant for Childhood Obesity in a Latino Population: A Case-Control Study. *Journal of Obesity*, 2018, 9285164. DOI: <https://doi.org/10.1155/2018/9285164>
- Hagger, M. S., Luszczynska, A., de Wit, J., Benyamini, Y., Burkert, S., Chamberland, P. E., Chater, A., Dombrowski, S. U., van Dongen, A., French, D. P., Gauchet, A., Hankonen, N., Karekla, M., Kinney, A. Y., Kwasnicka, D., Hing Lo, S., López-Roig, S., Meslot, C., Marques, M. M., Neter, E., ... Gollwitzer, P. M.** (2016). Implementation intention and planning interventions in Health Psychology: Recommendations from the Synergy Expert Group for research and practice. *Psychology & health*, 31(7), 814–839. DOI: <https://doi.org/10.1080/08870446.2016.1146719>
- Hammersley, M.** (2017). Childhood Studies: A sustainable paradigm? *Childhood*, 24(1), 113–127. DOI: <https://doi.org/10.1177/0907568216631399>
- Hammersley, M., Okely, A., Batterham, M., & Jones, R.** (2019). An Internet-Based Childhood Obesity Prevention Program (Time2bHealthy) for Parents of Preschool-Aged Children: Randomized Controlled Trial. *Journal of Medical Internet Research*, 21(2), e11964. DOI: <https://doi.org/10.2196/11964>
- Harvey, A. G., Callaway, C. A., Zieve, G. G., Gumpfort, N. B., & Armstrong, C. C.** (2022). Applying the Science of Habit Formation to Evidence-Based Psychological Treatments for Mental Illness. *Perspectives on psychological science: a journal of the Association for Psychological Science*, 17(2), 572–589. DOI: <https://doi.org/10.1177/1745691621995752>
- Hsieh, H.-S., Kanda, Y., & Fujii, S.** (2019). Incorporation of coping planning into the behavior change model that accounts for implementation intention. *Transportation Research Part F: Traffic Psychology and Behaviour*, 60, 228–244. DOI: <https://doi.org/10.1016/j.trf.2018.10.025>
- Kelder, S. H., Hoelscher, D., & Perry, C. L.** (2015). How individuals, environments, and health behaviors interact. *Health behavior: Theory, research, and practice*, 159, 144–149.
- Kok, G., Gottlieb, N. H., Peters, G. J., Mullen, P. D., Parcel, G. S., Ruiter, R. A., ... Fernández, M. E., Markham, C., & Bartholomew, L. K.** (2016). A taxonomy of behaviour change methods: an Intervention Mapping approach. *Health Psychology Review*, 10(3), 297–312. DOI: <https://doi.org/10.1080/17437199.2015.1077155>
- Mallan, K., & Miller, N.** (2019). Effect of Parental Feeding Practices (i.e., Responsive Feeding) on Children's Eating Behavior. *Nestle Nutrition Institute workshop series*, 91, 21–30. DOI: <https://doi.org/10.1159/000493675>
- McEachan, R., Taylor, N., Harrison, R., Lawton, R., Gardner, P., & Conner, M.** (2016). Meta-Analysis of the Reasoned Action Approach (RAA) to Understanding Health Behaviors. *Annals of Behavioral Medicine*, 50(4), 592–612. DOI: <https://doi.org/10.1007/s12160-016-9798-4>
- McKee, M., Mullan, B., Mergelsberg, E., Gardner, B., Hamilton, K., Slabbert, A., & Kothe, E.** (2019). Predicting what mothers feed their preschoolers: Guided by an extended theory of planned behaviour. *Appetite*, 137, 250–258. DOI: <https://doi.org/10.1016/j.appet.2019.03.011>
- Möhler, R., Wartha, O., Steinacker, J. M., Szagun, B., & Kobel, S.** (2020). Parental Self-Efficacy as a Predictor of Children's Nutrition and the Potential Mediator Effect between the Health Promotion Program “Join the Healthy Boat” and Children's Nutrition. *International Journal of Environmental Research and Public Health*, 17(24), 9463. DOI: <https://doi.org/10.3390/ijerph17249463>
- Morin, P., Demers, K., Turcotte, S., & Mongeau, L.** (2013). Association between perceived self-efficacy related to meal management and food coping strategies among working parents with preschool children. *Appetite*, 65, 43–50. DOI: <https://doi.org/10.1016/j.appet.2013.01.012>
- Musher-Eizenman, D., & Holub, S.** (2007). Comprehensive feeding practices questionnaire: validation of a new measure of parental feeding practices. *Journal of pediatric psychology*, 32(8), 960–972. DOI: <https://doi.org/10.1093/jpepsy/jsm037>

- Mullan, B., Engels, L., Mons, C., & Mergelsberg, E.** (2020). Can we improve parents' feeding behaviours? A proof of concept study? *Australasian Society for Behavioural Health and Medicine (ASBHM)*. Perth, Australia (Online because of COVID-19).
- Nader, P. R., Huang, T. T., Gahagan, S., Kumanyika, S., Hammond, R. A., & Christoffel, K. K.** (2012). Next steps in obesity prevention: altering early life systems to support healthy parents, infants, and toddlers. *Childhood Obesity*, 8(3), 195–204. DOI: <https://doi.org/10.1089/chi.2012.0004>
- Rohde, J. F., Bohman, B., Berglind, D., Hansson, L. M., Frederiksen, P., Mortensen, E. L., ... Rasmussen, F.** (2018). Cross-sectional associations between maternal self-efficacy and dietary intake and physical activity in four-year-old children of first-time Swedish mothers. *Appetite*, 125, 131–138. DOI: <https://doi.org/10.1016/j.appet.2018.01.026>
- Ruiter, R. A. C., & Crutzen, R.** (2020). Core Processes: How to Use Evidence, Theories, and Research in Planning Behavior Change Interventions. *Frontiers in Public Health*, 8, 247. DOI: <https://doi.org/10.3389/fpubh.2020.00247>
- Savage, J. S., Fisher, J. O., & Birch, L. L.** (2007). Parental influence on eating behavior: conception to adolescence. *The Journal of law, medicine & ethics: a journal of the American Society of Law, Medicine & Ethics*, 35(1), 22–34. DOI: <https://doi.org/10.1111/j.1748-720X.2007.00111.x>
- Shriver, L. H., Hildebrand, D., & Austin, H.** (2010). Determinants of fruit and vegetable availability in Hispanic head start families with preschool-aged children living in an urban midwestern area. *Journal of Nutrition Education and Behavior*, 42(5), 299–306. DOI: <https://doi.org/10.1016/j.jneb.2009.07.001>
- Strachan, S. M., & Brawley, L. R.** (2009). Healthy-eater identity and self-efficacy predict healthy eating behavior: a prospective view. *Journal of Health Psychology*, 14(5), 684–695. DOI: <https://doi.org/10.1177/1359105309104915>
- Stroup, W. W.** (2012). Generalized linear mixed models: modern concepts, methods and applications. CRC press.
- Sun, A., Cheng, J., Bui, Q., Liang, Y., Ng, T., & Chen, J.-L.** (2017). Home-Based and Technology-Centered Childhood Obesity Prevention for Chinese Mothers With Preschool-Aged Children. *Journal of Transcultural Nursing*, 28(6), 616–624. DOI: <https://doi.org/10.1177/1043659617719139>
- Tabak, R. G., Tate, D. F., Stevens, J., Siega-Riz, A. M., & Ward, D. S.** (2012). Family ties to health program: a randomized intervention to improve vegetable intake in children. *Journal of Nutrition Education and Behavior*, 44(2), 166–171. DOI: <https://doi.org/10.1016/j.jneb.2011.06.009>
- Taverno Ross, S. E., Macia, L., Documet, P. I., Escribano, C., Kazemi Naderi, T., & Smith-Tapia, I.** (2018). Latino Parents' Perceptions of Physical Activity and Healthy Eating: At the Intersection of Culture, Family, and Health. *Journal of Nutrition Education and Behavior*, 50(10), 968–976. DOI: <https://doi.org/10.1016/j.jneb.2017.12.010>
- Ten Hoor, G., Hoebe, C. J., van Bergen, J. E., Brouwers, E. E., Ruiter, R. A., & Kok, G.** (2014). The influence of two different invitation letters on Chlamydia testing participation: randomized controlled trial. *Journal of Medical Internet Research*, 16(1), e24. DOI: <https://doi.org/10.2196/jmir.2907>
- Wright, D. R., Lozano, P., Dawson-Hahn, E., Christakis, D. A., Haaland, W. L., & Basu, A.** (2016). Parental Predictions and Perceptions Regarding Long-Term Childhood Obesity-Related Health Risks. *Academic Pediatrics*, 16(5), 475–481. DOI: <https://doi.org/10.1016/j.acap.2016.02.007>

## PEER REVIEW COMMENTS

Health Psychology Bulletin has blind peer review, which is unblinded upon article acceptance. The editorial history of this article can be downloaded here:

- **PR File 1.** Peer Review History. DOI: <https://doi.org/10.5334/hpb.38.pr1>

## TO CITE THIS ARTICLE:

Vogel, H., ten Hoor, G., Mergelsberg, E., & Mullan, B. (2022). Adaption and Evaluation of a Self-Efficacy Intervention for Parental Feeding Practices. *Health Psychology Bulletin*, 6(1), pp. 1–12. DOI: <https://doi.org/10.5334/hpb.38>

**Submitted:** 04 January 2022    **Accepted:** 11 July 2022    **Published:** 10 October 2022

## COPYRIGHT:

© 2022 The Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC-BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited. See <http://creativecommons.org/licenses/by/4.0/>.

*Health Psychology Bulletin* is a peer-reviewed open access journal published by Ubiquity Press.