



# HabEat

Determining factors and critical periods in food habit formation and breaking in early childhood: a multidisciplinary approach

Grant agreement number: FP7-245012

**Medium-scale Collaborative Project**

**SEVENTH FRAMEWORK PROGRAMME**

**Priority: Food, Agriculture and Fisheries, Biotechnology**

## **Deliverable D11**

### **Guidelines for relearning through social learning**

**Due date:** M32

**Actual submission date:** M47

An interim report was submitted in M38.

**Project start date:** 1<sup>st</sup> January 2010    **Duration:** 52 months

**Work Package concerned:** WP3

**Concerned work package leader:** DLO-FBR

**Dissemination level:** CO. The summary will be Public. The references of the papers, the abstracts and the links to the journal will be added to the public summary after any paper related to the data presented in this deliverable has been accepted for publication.

## **Executive Summary**

Vegetable intake at a young age is important for health and continued consumption of a healthy diet at later ages. Data from various countries consistently show poor intake of vegetables in children. WP3 of the HabEat project aims to address different strategies to increase vegetable intake in the specific age group of 2- to 6-year-olds. This age group shows a particular rejection of vegetables, presumably due to a peak in neophobia and pickiness. Breaking this early rejection of healthy foods is a difficult task. Task T3.3 aims to look into three social learning strategies to reach this goal.

This report describes the results of the eight intervention studies that have been performed for Task T3.3. These were all performed in real-life settings such as nurseries, primary schools or the home setting, and vegetable intake was the main outcome.

In Task T3.3.1, imitation of a child idol and imitation of a teacher was investigated as a means to increase vegetable intake in nursery and primary school children aged 3 to 6 years. These studies were executed in two countries, Greece (HUA) and The Netherlands (DLO-FBR), and had a similar design. Raw carrot was used as the target vegetable (portion of 100 grams). There were three experimental conditions: a positive-restriction group, a convivial-eating-only group and a control group. The positive-restriction group participated in five days of positive restriction, in which the idol consumed carrots, whereas the children did not receive carrots at that moment. After that, the children participated in eight convivial eating sessions (twice a week), where the idol and children ate carrots together. The children in the convivial-eating-only group did participate in the eight convivial eating sessions only, they were not exposed to positive restriction. The children in the control group were never exposed to the model; they did not participate in positive restriction nor in the convivial eating sessions. Choice tests were included to measure changes in children's preference for carrots. In each country, two studies were executed. In one study, a child idol acted as the model, whereas in the second study, the children's own teacher acted as a model. For the idol study, a movie was specifically developed for this project. In The Netherlands, two well-known Dutch children's TV characters acted in this movie, whereas in Greece, two non-existing characters were used.

In The Netherlands, no immediate effects on intake were found for the idol or teacher imitation strategies. In both studies, intake remained fairly stable during the eight convivial eating sessions. However, it was remarkable that opposite intake patterns were found for classes in the same condition. During the follow-up measurement at nine months, the idol imitation study showed a higher intake in the two intervention conditions as compared to the

control condition, but in the teacher imitation studies all groups - including the control group - increased their vegetable intake at the follow-up measurement of nine months. The highest increase in intake was seen in the group of children that participated in a week of positive restriction, in which only the model consumed carrots.

In the Greek idol imitation study, there was a difference between the three groups in children's vegetable intake, right after the positive restriction period. Carrot intake was highest in the positive-restriction group and the lowest in the control group. In the Greek teacher imitation study, no differences in vegetable intake were found between the groups during the intervention. For both Greek studies, there was no increase in vegetable intake over the eight convivial eating sessions, which is similar to the Dutch results. At follow-up, the intake of carrots increased significantly in the positive-restriction group and the control group in the idol imitation study (8-9 months after the intervention), but no increase in vegetable intake during follow-up was seen for the three groups in the teacher imitation study (4-5 months after the intervention).

In both countries, children's vegetable intake was larger during the choice tests (about 60-80 grams) than during the convivial eating sessions (about 25-40 grams), which may have been due to a positive effect of having a choice, an easier-to-chew effect or a preference effect.

In Task T3.3.2, the effect of freedom of choice of vegetables on vegetable intake was investigated in Denmark (UCPH), Greece (HUA) and The Netherlands (WUR).

The studies in Denmark and Greece had a similar design and were executed in pre-school settings with children aged 3-5 years. A within-subject design was used and children were visited seven times (twice per week). The first session was to assess liking and familiarity, whereas in the next six sessions, children participated in vegetable eating sessions with or without choice. Three vegetables were used in the study: snack carrots, baby corn, and sugar snaps in Denmark and cucumber, carrot and tomato (raw) in Greece. Four of the six sessions were without choice (3x single stimulus; 1x mixture of three stimuli) and two were choice sessions (1x single stimulus; 1x mixture of two stimuli).

The results from the Danish study pointed in opposite directions depending on whether comparisons were made per vegetable type or across all three vegetables. These contrasting findings may be partly due to different numbers of subjects in these comparisons. It is therefore concluded that the Danish study showed no clear positive effect of choice-offering on children's vegetable intake. The Greek results showed significantly higher intakes in the freedom of choice condition compared to the no choice condition for three pairwise comparisons, whereas there was no difference for the other five comparisons. It is therefore concluded that freedom of choice condition can positively affect children's intake of vegetables compared to the no choice condition.

The Dutch choice study was executed in the home-setting with children aged 2-5 years. A between-subject design was applied. Children in the no-choice condition were offered one vegetable as part of their regular evening meal, whereas children in the choice condition were offered two vegetables as part of their regular evening meal. Six target vegetables were used in both groups: peas, carrots, broccoli, French beans, cauliflower and string beans. All vegetables for the family evening meal were provided by the WUR with cooking, serving and weighing instructions. Results showed a positive trend of freedom of choice on vegetable intake when corrected for gender, age and vegetable liking prior to the intervention.

In Task T3.3.3, the effect of participating in vegetable preparation was investigated as a strategy to increase consumption of vegetables. This study was done in The Netherlands (DLO-FBR) among 4-6-year-old children and executed at the 'Restaurant of the Future'. A between-subject design was used. All children participated in four evening meal sessions, where they consumed a typical Dutch meal consisting of mashed potatoes, meat and vegetable (boiled carrot or boiled French beans). Before the second meal, children in the intervention group participated in an interactive cooking session preparing boiled carrots, whereas the control children participated in a book reading activity not related to food. Results of this study showed no increase in vegetable intake due to participation, and measures at one and three months also showed no longer-term effect of the intervention. Directly after the intervention (second session), there was a slight tendency that children in the intervention group were more likely to choose carrots in comparison with children in the control group, which may indicate that their interest in carrots was maintained after preparing carrots. In addition, 'involvement in meal preparation' of the children that participated in the cooking session remained stable three months later, whereas this declined in the control group. Changes in habitual vegetable intake before the intervention and one year later were not significantly different between the two groups, indicating that the intervention had no effect on long-term vegetable intake.

Table 1 shows the results of Task T3.3 summarized. Overall, task T3.3.1 showed that imitation of a child idol or teacher did not increase vegetable intake among 3-6-year-old children during the intervention period. The long-term measures showed increased vegetable intake for some groups, which may indicate that the effect of the intervention appears on the longer-term, but it may also indicate an age effect. When children of this age become 8-9 months older, they simply eat more. Despite a similar design, the results slightly differed between the countries (The Netherlands and Greece). This may have been due to slight differences in study design such as the age of the children, or the eating moment for the sessions, but it is also likely that cultural and situational differences have played a role.

Taking the results of the consumption sessions and the choice sessions together, the results point to some promise for positive restriction, but more research about this strategy is required to substantiate our findings.

*Table 1: Overview of studies within task T3.3.1 where the effectiveness of three different social techniques is investigated with regard to children's vegetable intake*

<b>Task</b>	<b>Study</b>	<b>Country*</b>	<b>Subjects + setting</b>	<b>Result concerning vegetable intake</b>
<b>T3.3.1: Imitation of idol or teacher who eats vegetables</b>				
	Idol	NL	4-6y, primary school	Intake remained stable during eight convivial eating sessions, different time effects for school classes in same condition.
	Teacher	NL	4-6y, primary school	Intake remained stable during eight convivial eating sessions, different time effects for school classes in same condition.
	Idol	GR	3-5y, nursery	Positive-restriction group highest intake and control group lowest after positive restriction period. Intake remained stable during eight convivial eating sessions.
	Teacher	GR	3-5y, nursery	Intake remained stable during eight convivial eating sessions.
<b>T3.3.2: Freedom of choice of vegetables</b>				
	Choice	DK	3-5y, kindergarten	Positive effect of choice for comparisons across vegetables: vegetable intake 12 grams higher. No or negative effect on vegetable intake when comparisons were done per vegetable.
	Choice	GR	3-5y, nursery	Freedom of choice condition seemed to lead to higher vegetable intake. Three pairwise comparisons showed positive effect of choice, no difference in vegetable intake for the other five comparisons.
	Choice	NL	2-6y, home	Positive trend for freedom of choice when corrected for gender, age and vegetable liking.
<b>T3.3.3: Experiencing food preparation and eating self-prepared food</b>				
	Vegetable preparation	NL	4-6y, Restaurant of the Future	Vegetable intake remained stable across eating sessions, no effect of intervention.

\* NL = The Netherlands; DK = Denmark; GR = Greece

The three choice studies indicate that freedom of choice has the potential to positively contribute to children's vegetable intake. The results suggest also that specific groups may benefit more from choice offering than others since the Dutch study indicated that age and level of vegetable liking may be moderators of the effect of choice-offering. In this study,

children that were older and those who liked vegetables more prior to the intervention, ate more vegetables during the intervention. Future research should confirm and extend these findings to find out which conditions favour or undermine a positive effect of choice. It is also important to find out where choice should be placed (e.g. prior to food preparation, right before consumption etc.) and which age groups are most responsive to choice effects. Since the studies showed some mixed results and differences were found between countries despite a similar design in Denmark and Greece, we recommend further research in this area.

Participating in one interactive vegetable preparation session did not increase children's vegetable intake during the evening meal, but it may maintain children's interest in the prepared vegetable and their involvement in meal preparation in general. The fact that we did not find an increase in vegetable intake, may have to do with the large within-subject variability that was observed, the age group that was studied, or the fact that parent-child conversations after the meal were partly controlled in the study. It is hypothesized that perhaps it is not the participation in vegetable preparation itself that affects intake, but possibly the positive comments and interaction with parents during and after vegetable preparation that might lead to a positive effect on vegetable intake. This is a recommended area for future studies.

So, these studies confirm that it is difficult to increase intake of relatively familiar vegetables among 2-6-year-old children, as the evidence for the effectiveness of these social techniques for increasing vegetable intake is not convincing from the studies executed in this task. However, all the three social techniques point to a potential positive contribution to vegetable eating, but the results were not completely consistent and some outcomes were not in line with the literature. These inconsistencies in the results prevent more robust conclusions at present, but at the same time, the studies point to several moderating factors (setting, vegetable type, frequency of intervention activities and child characteristics such as age and vegetable liking) that may help shaping further research.

*Note: An overview of the research shown in this Deliverable has been presented during the 20th IUNS International Congress of Nutrition, Granada, Spain: 15-20th September 2013. Title of oral presentation: Strategies to increase vegetable consumption in 3- to 6-year-olds: theory and practice. The abstract has been published in Annals of Nutrition and Metabolism 2013; Volume 63 (supplement 1): page 40.*