



HabEat

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

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Effective combinations of sensory properties in changing food habits by mere exposure

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An interim report has been submitted in M38.

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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 in children is generally lower than the daily recommended amount. Strategies that improve vegetable preferences might help in increasing vegetable intake in young children. One of the strategies studied in the literature is repeated exposure to foods to increase food preferences (also referred to as mere exposure). It has been shown that at least five to ten exposures are required to increase liking of a food product. Whether this strategy also helps to improve actual intake of the food products (in particular vegetables) and how sensory variation influences this process, is less clear. In Task T3.2 of Work Package 3 of the HabEat project, we aim to increase intake of vegetables by combining repeated exposure to originally not well-liked foods with sensory variation. This report describes the results of the intake data and the liking/preference data including the results of the long-term follow-up measures.

The studies were performed among kindergarten children in Denmark (period 2012-2013; UCPH) and among primary school children in The Netherlands (period 2011-2012; DLO-FBR). Because the vegetable was offered as a snack during school time, both studies used raw vegetables as target vegetable, with a portion size of 100 grams during the exposures. At DLO-FBR, sensory variation was included by offering the children a plate with two shapes (slices and sticks) of raw carrots and measuring intake of both variations. At UCPH, different shapes and textures of Chinese radish were used during the exposure period: sticks, triangles and grated. There were three experimental groups in the Danish study, with each group being exposed to another serving style of the Chinese radish. A control group was included in both studies.

In the executed studies, we used a *real life* class room approach in which all children received the same vegetable and intake was measured. The real life approach has some limitations, as can be seen from the DLO-FBR results on differences between class rooms and individuals, but also gives insight in the feasibility of such an approach in schools and kindergartens.

The main study in Denmark shows very clearly that it is possible to increase intake of an initially unfamiliar and not well-liked vegetable among 3-5-year-old children. During the seven exposures, children's intake of Chinese radish increased from about 40 grams to 55 grams in all three groups (sticks, triangles and grated). From pre-test to post-test, children's liking of sliced Chinese radish increased significantly in all three groups, from about 1.9 to 2.6 on a 3-point-scale. Liking remained stable during the follow-up measurements at 3 and 6 months. Nevertheless, children's intake of Chinese radish kept increasing during the post-test and

follow-up tests at 3 and 6 months. It is interesting to see that the control group that did not have the seven exposure sessions of the intervention period, followed a similar pattern concerning liking and intake of Chinese radish slices during the post-test and follow-up measurements, suggesting that a longer time between exposures can be effective as well.

The Denmark study also showed that texture is an important property for children's vegetable intake. Children who have been exposed to a certain texture will accept/eat more of another shape of the vegetable with a similar texture than they will if the texture of the vegetable is changed by, in this study, grating it. Furthermore, the Danish study showed that intake can increase even though liking does not change. This has important implications for understanding the determinants of food acceptance and should be pursued in future studies. Another noteworthy result of the Danish study is the suggestion that repeated exposure interventions can also be effective with a lower number of exposures (5 times) than what is usually practised.

The Dutch study at DLO-FBR shows that the approach of repeated exposure did not lead to increased intake of the vegetable in a Dutch school situation, among 4-6-year-old children. Children's raw carrot consumption during the repeated exposure period was 32 grams in the mere exposure group and 47 grams in the control group, and remained stable over time. There was a large variation in eating patterns among the children, which suggests that individual characteristics do play a role. The Dutch children ate more slices compared to sticks in six out of ten sessions, indicating that a slight preference was present for slices over sticks. Children's intake increased during the follow-up measures at two months and nine months in both groups, but the increase was significant only for the control group between the first session (48 grams) and the 9-month follow-up measure (58 grams).

A remarkable result of the Dutch study was that the two intervention classes showed opposite effects on intake during the repeated exposure period, despite the fact that the classes were in the same area of Arnhem, The Netherlands, and the children were similar in gender and age. This finding confirms that situational aspects and individual characteristics are important factors in children's vegetable consumption. In addition, the Dutch study found a surprisingly large number of children that ate very little or nothing at every session, the so-called non-eaters. Both these topics should be addressed in further research to expand our understanding of the determinants of vegetable intake. Analyses of the parental questionnaire data may also provide some indications, and will be reported in D18.

To conclude, the work of this task indicates that serving style of vegetables influences children's liking and intake of vegetables and this is an important area for further research. In The Netherlands, no repeated exposure effect was found among 4- to 6-year-old children for a relatively familiar vegetable when this vegetable was offered ten times as a morning snack. Data from the Danish study demonstrate that it is possible to increase intake of a vegetable that is relatively unknown to 3-5-year-old children and that is not very well-liked at the start of the intervention. This difference in familiarity of the vegetable as well as cultural and situational differences may explain that a repeated exposure effect was found for all three versions of Chinese radish in the Danish study and not for raw carrots in the Dutch study. Still, the vegetable consumption of the children during the exposure period (~40-55 grams) could be a valuable addition to children's current vegetable intake, because vegetables are usually consumed only during the evening meal in The Netherlands and in Denmark. Therefore, we recommend offering vegetables to children during the school day, especially in countries where vegetables are mainly eaten during the evening meal. In addition, we recommend that parents and caretakers should offer children unfamiliar vegetables repeatedly for tasting, in order to encourage children to learn to like these new vegetables.