HABEAT SYMPOSIUM

MARCH 31ST & APRIL 1ST, 2014
DIJON, FRANCE

Improving infant and child eating habits, encouraging fruit and vegetable intake.

Translating evidence into practical recommendations

Habeat

INRA SCIENCE & IMPACT

INRA Transfert

Bourgogne Conseil régional

VITAGORA

Welcome

Dear Delegates,

On behalf of all partners of the HabEat project 'Determining factors and critical periods in food habit formation and breaking in early childhood: a multidisciplinary approach', it is our pleasure to welcome you to the final symposium of this project.

This project was funded by the European Union under the FP7 programme. It started in January 2010 and will end in April 2014. The different partners involved are very glad to present the main results of these very busy and very exciting years of experiments and data analyses.

Besides the classical dissemination of the results through scientific papers and oral or poster presentations at international conferences, one objective of the project was to disseminate our results to different stakeholders: early childhood professionals, paediatricians, political decision makers in charge of defining nutritional policies, baby food industries, as well as representatives of parent associations. It was also planned to translate our results into recommendations and to discuss these recommendations with these different end-users. To reach these objectives, we have worked hand-in-hand with a board of stakeholder advisors during the whole course of the project, and we have developed a web site with recommendations for parents in the different languages of the partners, i.e. in Danish, Dutch, English, French, Geek and Portuguese. We have also organized different stakeholder workshops in different countries: The United Kingdom, Portugal and Poland and our last event takes place in Dijon, France where is located the CSGA 'Le Centre des Sciences du Goût et de l'Alimentation', a public research unit dedicated to the study of the different signals coming from food and their impact on eating behaviour both in animal models and in humans.

During this symposium, three round-table debates are planned in order to discuss the recommendations based on the results of the project. We thank very much the stakeholders who agreed to participate in these round-table debates to express their views on these recommendations, the best way to disseminate them, the potential barriers for their application, and to suggest the need for further research. All attendees will also have opportunities to make comments.

We are very pleased to welcome for this symposium two invited speakers who are very well-known scientists working on different topics but both are interested in early life, child development and eating behaviour.

We were pleasantly surprised by the number of high quality abstracts that have been submitted for poster presentations. These poster presentations have been organized in two sessions, each dedicated to specific topics. The posters will be available for viewing not only during these sessions but also during the lunches, allowing maximum opportunity for discussions and for sharing experiences between delegates.

Welcome to Dijon on behalf of all HabEat partners, and enjoy the symposium!

Kind regards,

Sylvie Issanchou,

Coordinator

Presentation of the HabEat project

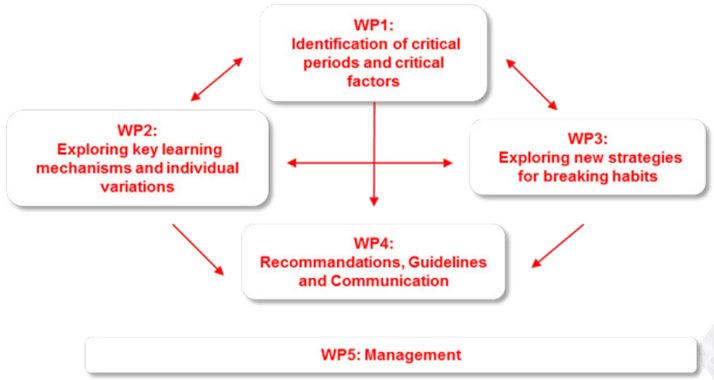
HabEat brought together 11 European partners from 6 European countries with a multidisciplinary approach (psychology, epidemiology, behavioural science, nutrition, sensory science) to enable a key breakthrough in the understanding of how eating habits are formed (and can also be changed) in infants and young children.

The objectives were:

- the critical periods in the formation/breaking of eating habits
- the key learning mechanisms, their relative impact in the short, mid and long term and their importance according to the different critical periods
- the most effective strategies for breaking habits, i.e. for changing from poor to healthy habits
- individual reactions to the learning mechanisms and individual susceptibility to changes.

HabEat combined two complementary approaches:

- An epidemiologic approach based on selected human cohorts from 4 countries (via WP1)
- The experimental approach (via WP2 & WP3) enabled the comparison of the effectiveness of different learning mechanisms at different ages and the comparison of the effectiveness of different strategies for modifying behaviour both in the short term and also in longer term. This approach also enabled us to explore the inter-individual differences concerning the efficiency of these different mechanisms and the origin of these differences in their previous "food history".



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WP1 - Identification of critical periods and critical factors in the development of food habits

WP1 leader: Marie-Aline Charles
Institut National de la Santé et de la Recherche - INSERM- France
E-mail: marie-aline.charles@inserm.fr

Objectives were :

- To review existing assessment tools for both describing parental feeding practices in infancy and for identifying eating habits/preferences through a review of experimental and epidemiologic data in humans.
- To develop new tools for both describing parental feeding practices in infancy and for assessing eating habits and preferences in young children to be used in large scale studies.
- To identify the critical periods in the development of eating habits/ preferences in infancy and early childhood and to produce recommendations for future research aiming at the identification of critical periods of eating habits and preferences in young children

WP2 - Exploring key learning mechanisms and individual variations

WP2 leader: Marion Hetherington
The University of Leeds - ULeeds - United Kingdom
E-mail: M.Hetherington@leeds.ac.uk

Objectives were:

- To apply learning theory to enhance acquisition of preferences and intake for vegetables in young children
- To compare different forms of learning in the acquisition of eating habits in young children (mere exposure, flavour-flavour and flavour-nutrient learning) and identify critical periods for each form of learning
- To examine the duration of eating habits acquired through various forms of learning
- To characterise individual differences in learning and responsiveness to food

WP3 - Exploring new strategies for breaking habits and individual variations in responsiveness to these strategies

WP3 leader: Gertrude Zeinstra
Stichting Dienst Landbouwkundig Onderzoek - DLO-FBR - The Netherlands
E-mail: gertrude.zeinstra@wur.nl

Objectives were:

- To develop and apply new strategies for relearning or breaking eating habits and determine their sustainability.
- To compare the efficacy of the different strategies
- To identify specific situational factors that influence relearning and breaking of eating habits

WP4 - Recommendations, Guidelines and Communication

WP4 leader: Sylvie Issanchou
Institut National de la Recherche Agronomique - INRA - France
E-mail: Sylvie.Issanchou@dijon.inra.fr

Objectives were:

- To set up and maintain the project dissemination and communication tools
- To disseminate scientific results to the wider scientific community
- To elaborate guidelines for stakeholders and communicate them widely
- To elicit feedback and input from all stakeholders on the project results and in particular the guidelines

WP5 - Project management

WP5 leader: Caroline Sautot
INRA Transfert - IT - France
E-mail: caroline.sautot@paris.inra.fr

Objectives were:

- At the strategic level, to steer the project to address all unexpected situations, be these scientific, technological, societal or political.
- At the operational level, to ensure that the project progresses in conformity with the work plan with regard to overall progress, milestones, deliverables, and planned resources.
- At the organisational level, to manage the financial, logistics, information, coordination issues and ensure procedures are put in place to ensure quality and conformity to EC rules and procedures

PROGRAMME

DAY 1: Monday March 31st, 2014

13:00-14:00 REGISTRATION

SESSION 1	INFANT FEEDING & COMPLEMENTARY FEEDING
14:00-14:05	Welcome: Luc Penicaud - CNRS, France - & Sylvie Issanchou - INRA, France
14:05-14:20	Introduction: Sylvie Issanchou - INRA, France
14:20-15:10	How influential is early experience with food-related odours and flavours: a look at paradoxes : Benoist Schaal - CNRS, France
15:10-15:35	Early feeding practices and later food habits: Blandine de Lauzon-Guillain - INSERM, France
15:35-16:00	Early feeding practices and child's growth: Yannis Manios - Harokopio University, Greece
16:00-17:00	Poster session 1 & Coffee break
17:00-17:25	Introduction of vegetables in the diet: Lucy Cooke - University of London, UK
17:25-18:30	Discussions with an introduction by Carla Lopes - University of Porto, Portugal
20:00-22:30	GALA DINER - FREE

DAY 2: Tuesday April 1st, 2014

SESSION 2	EATING BEHAVIOUR IN TODDLERS AND YOUNG CHILDREN
09:00-09:20	Learning to like vegetables: introducing the HabEat experiments: Marion Hetherington – University of Leeds, UK
09:20-09:45	Strategies for learning to eat and like new vegetables: Victoire de Wild - Wageningen University, the Netherlands
09:45-10:10	Interventions to increase vegetable intake in early childhood: Gertrude Zeinstra - Stitching DLO, the Netherlands
10:10-10:35	Modelling the role of individual differences in the effectiveness of interventions to increase vegetable intake in childhood: Pam Blundell – University of Leeds, UK
10:35-11:35	Poster session 2 & Coffee break
11:35-12:00	Control of food intake and impact of parental practices: Sophie Nicklaus - INRA, France
12:00-13:00	Discussions with an introduction by Pauline Emmett - University of Bristol, UK
13:00-14:30	Lunch – FREE
SESSION 3	**TRANSLATING SCIENCE INTO PRACTICE**
14:30-15:20	Promising interventions and research areas in complementary feeding and healthy growth promotion: Kim Fleischer Michaelsen - University of Copenhagen, Denmark
15:20-16:00	General discussion on recommendations and conclusion
16:00	End of symposium

HABEAT SYMPOSIUM

INVITED SPEAKERS

Invited Speaker: Benoist Schaal

He was trained in neuroscience and behavioral biology at the Universities of Strasbourg and Besançon. He was a postdoctoral fellow at University of Montreal (Canada). Since 1988, he is affiliated with the Centre National de la Recherche Scientifique (CNRS), conducting studies on how fetal and infantile sensory experience shape the development of perception, learning and preferences in humans, but also in rabbits, sheep, pigs, cats, and mice. Between 2002 and 2009, he headed the Centre for Smell and Taste Science in Dijon, France. He currently leads there a group focusing on adaptive cognition in infant mammals, specifically on how olfaction contributes to fine-tune their affects, knowledge, and behaviour.
He published over 200 papers and chapters, and edited "Smell Function in Children: Mixing Perspectives" (in French, 1997, PUF, Paris), and co-edited "Olfaction, Taste, and Cognition" (2003, Cambridge University Press, New York), "Infants and Children Facing Food" (in French, 2008, PUF, Paris), and Olfactory Cognition (2012, Benjamin, Amsterdam).

Invited Speaker: Kim Fleischer Michaelsen MD. Dr Med Sci

Professor in paediatric nutrition at the Department of Nutrition, Exercise and Sports, University of Copenhagen and Senior consultant at the Paediatric Nutrition Unit, Rigshospitalet, Copenhagen. Advisor to the National Board of Health on infant and paediatric nutrition. Has been temporary advisor and performed consultancies for WHO on infant and young child feeding, feeding of moderately undernourished children and long term effects of complementary feeding. Head of the research group "Paediatric and International Nutrition" with 25 employees. The group's research projects focus on the effect of infant and young child nutrition on growth, development and later health in industrialised and low-income countries. Topics include breastfeeding, complementary feeding, growth and body composition, early determinants of obesity, prevention and treatment of undernutrition among infants, young children and HIV patients in low income countries. Studies are performed in Denmark, Ethiopia, Kenya, Tanzania, Uganda, Cambodia and Burkina Faso.

Habeat

Invited Speaker

How influential is early experience with food-related odours and flavours: a look at paradoxes

Benoist Schaal

Centre des Sciences du Goût et de l'Alimentation, Dijon, France

The early development of likes and dislikes for foods will be summarized in describing the engagement and retention of chemosensory preferences by the fetal and neonate infant. Then, we will survey the complex perceptual-cognitive situation infants are facing when their diet is being shifted from exclusive milk to more or less unprecedented non-milk foods. Adaptive responses are then mobilized, involving conflicting processes in infant responses between conservative and innovative tendencies. Finally, some data on the long term consequences of early chemosensory experience will be discussed and their validity for our understanding of long-term food preferences in real life situations will be challenged.

References:

- Schaal B. 2005. From amnion to colostrum to milk: Odour bridging in early developmental transitions. In Hopkins B., Johnson S. (Eds.), Prenatal Development of Postnatal Functions. Westport, CT, Praeger, pp. 52-102.
- Schaal B, Soussignan R (Eds.). 2008. L'enfant face aux aliments. Presses Universitaires de France (Enfance), Paris.
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- Lau C, Mizuno K, Geddes D, Schaal B. 2012 (Eds.). The development of oral feeding skills in infants. International Journal of Pediatrics (special issue).
- Schaal B. 2014. Developing human olfaction and its functions in early cognition and behavior In RL Doty (Ed.), Handbook of Olfaction and Gustation, 3rd Edition. Wiley, New York

Invited Speaker

Promising interventions and research areas in complementary feeding and healthy growth promotion

KF Michaelsen

Department of Nutrition, Exercise and Sports, Faculty of Science, University of Copenhagen, Rolighedsvej 30, DK-1958 Frederiksberg C, Denmark

The key outcomes of early nutrition is a healthy growth pattern with improved functional outcomes, such as physical activity, cognitive development and immune status and a reduced risk of non-communicable diseases later in life. To obtain these goals optimal nutrition during the first 1000 days, from conception to age 24 months, provides a window of opportunity. There is agreement about the importance of breastfeeding, but there is still uncertainty about many aspects of optimal complementary feeding, both in low- and high income countries. However, there is increasing evidence that optimal complementary feeding has a large potential to reduce undernutrition, both stunting and wasting, in low-income countries and to reduce the risk of non-communicable diseases, especially obesity which is a problem in high income countries and an increasing problem in many countries in transition.

In a global perspective breastfeeding is the most efficient way to provide optimal nutrition and continued breastfeeding during the complementary feeding is important to optimize health. Breastfed infants plays an active role in regulating breast milk intake, but little is known about which factors influence the volume of breast milk an infant is taking. If the mechanism regulating breast milk intake is better understood, it might also have implications for our understanding of appetite control during complementary feeding.

During the complementary feeding period there is a large increase in protein content in the diet from 5-6 energy percentage (E%) in breast milk to a content in the family diet of about 15 E%; typically 10-15 E% in low income countries and 12-18 E% in high income countries. At the same time there is a dramatic decrease in fat content, from about 50 E% in breast milk to typically 20-30 E% in the family diet. A high protein intake during the complementary feeding period has been associated with an increased risk of later obesity and thereby an increased risk of non-communicable diseases. A low fat content (←20-25 E%) in the complementary feeding diet can be a risk factor for poor growth, a problem seen in both high and low income countries. Interestingly, there is no convincing evidence that a high fat intake during this period is associated with an increased risk of obesity.

Infants who continue to be breastfed during the complementary feeding period has a different growth pattern and grow slower than infants who are not breastfed. Furthermore, there is increasing evidence that breastfed infants have a different body composition, at least during the first years of life, compared to formula fed infants. The growth pattern of the breastfed infants is likely to be associated with less obesity and improved health later in life. The WHO growth standards for children 0-5 years are based on breastfed infants and have recently been recommended for use in a European setting by the European Society for Paediatric Gastroenterology, Hepatology and Nutrition's Committee of Nutrition and are now used in more than 125 countries worldwide, including the UK and USA.

The HabEat project has provided a better understanding of the interaction between acceptability, taste preferences, texture and regulation of satiety during the transition to family food and how it can influence long term feeding habits in a European setting. This knowledge is important when exploring these aspects in low income countries and countries in transition, where availability and affordability of nutritious foods is often a limiting factor. Such information is likely to be valuable in the fight against the double burden in these countries; prevention and treatment of undernutrition and prevention of non-communicable diseases.

HABEAT SYMPOSIUM

ORAL PRESENTATIONS

The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under the Grant Agreement No. FP7-245012-HabEat.

Early feeding practices and later food habits

de Lauzon-Guillain B *., Jones L., Oliveira A., Moschonis G., Betoko A., Lopes C., Moreira P., Manios Y., Papadopoulos N. G., Emmett P. & Charles M.

* Presenting author affiliation: CESP, INSERM, Villejuif, France; UMR-S 1018, Univ Paris 11, Villejuif, France

Several surveys have reported that fruit and vegetable intakes are below the recommended guidelines in adolescents, and younger children, especially for vegetables. Food habits and preferences have been shown to take shape early in life and track through to adulthood and intervention studies shown that it is difficult to modify food behaviours even in children. Therefore, it appears important to understand which factors influence food habit formation early in life in order to prevent the development of unhealthy eating habits and the appearance of related metabolic disorders in later life.

The objective of this task was to analyse relationships between data collected in infancy (up to 2 years) and food habits in preschool children. The analyses were run on data from 4 European cohorts: ALSPAC in the United-Kingdom, EDEN in France, EuroPrevall in Greece and Generation XXI in Portugal. In one cohort (ALSPAC), we were able to extend the follow up to age 13 years to determine if early habits persist. The critical factors or determinants studied were breastfeeding duration, age of introduction of non-milk foods, and, in some on the cohorts, maternal perception of feeding difficulties. In the different cohorts the child's food intake was assessed by food frequency questionnaires, as a common method. Quality of the diet was assessed using the Healthy Plate Variety Score.

In our analyses, longer breastfeeding appeared to be related to higher diet quality in children, as shown by a higher F&V intake and a higher Healthy Plate Variety Score. These associations were still significant when we controlled for the main confounders (i.e. maternal education level and maternal diet). This is consistent with the hypothesis that early sensory exposure through breastfeeding enhances later acceptance of F&V. Moreover, results from ALSPAC indicated that this association could persist through childhood.

The results on complementary feeding were not consistent across the cohorts and highlighted the need to go beyond the timing of complementary feeding. Previous results from ALSPAC and preliminary results from EDEN suggested that other aspects of complementary feeding have to be taken into account, such as food variety during the complementary feeding period and use of homemade vs. ready-prepared baby foods.

Finally, we found that parental perception of feeding difficulties in toddlerhood was related to poorer diet quality in children, with lower fruit and vegetable intake and lower Healthy Plate Variety Score. Further research should investigate in depth children whose parents report child feeding difficulties (prevalence ranging from 15 to 50% in ALSPAC, EDEN and Generation XXI). This research should look more closely at the determinants of these difficulties, the parental response to these difficulties, and the long-term outcomes. It could be that feeding difficulties are a marker of a more general temperament problem in the child. In particular, the question of whether the parents respond to a child's feeding difficulties by lowering the child's exposure to fruit and vegetable in early life and whether this response mediates the association with low child fruit and vegetable intake in later life is worth studying.

HabEat Oral Presentation

Early feeding practices and child's growth

Manios Y.[1], Moschonis G.[1], de Lauzon-Guillain B.[2*], Jones L.[3], Oliveira A. [4,5], Lopes C.[4,5], Moreira P. [5], Papadopoulos N. G.[6], Emmett P.[3], Charles M-A[2].

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[2] *INSERM, Centre for research in Epidemiology and Population Health (CESP), U1018, Epidemiology of diabetes, obesity and chronic kidney disease over the life course Team, F-94807, Villejuif, France.
[3] School of Social and Community Medicine, University of Bristol, UK.
[4] Department of Clinical Epidemiology, Predictive Medicine and Public Health, University of Porto Medical School, Portugal.
[5] Faculty of Food and Nutrition Sciences, University of Porto, Portugal.
[6] Department of Allergy, 2nd Paediatric Clinic, University of Athens, Greece.

Healthy growth but also overweight in children have been consistently reported to have their origins in early life [1-3]. The current work was aiming to examine the association between early feeding practices with growth and adiposity indices in preschool children from four European countries and adolescents in the United Kingdom (UK).

The current work used existing data from four European birth cohorts, i.e. the ALSPAC study (UK), the EDEN study (France), the Europrevall study (Greece) and the Generation XXI study (Portugal). Comparable data available in the four cohorts on family sociodemographic, dietary, perinatal, anthropometric and body composition indices collected from 4-5 year old children were used in the parallel analyses conducted in the current work. Furthermore, body fat mass data (measured with Dual x-ray absorptiometry: DXA) on 9 and 13 year-old children and adolescents were available and used only in the ALSPAC study. Associations of early feeding practices (i.e. breastfeeding and timing of complementary feeding) with growth and adiposity indices were tested using multiple linear or logistic regressions separately in each cohort, after adjustments for potential family sociodemographic, dietary and perinatal confounders.

When stature was tested as an outcome, 4 year-old children in ALSPAC that were never breastfed and those been breastfed between 1 and 3 months of age were found to have higher height z-scores compared to children breastfed for more than 6 months of age (P=0.006). On the contrary, 5 year-old children in EDEN that were never breastfed and those been breastfed from 1 to 6 months of age (P=0.0004) were found to have lower height z-scores compared to children breastfed for more than 6 months. Furthermore, 4 year-old children in Generation XXI to whom complementary foods were introduced after 6 months of age had lower height z-scores than children to whom complementary foods were introduced between 5 and 6 months of age (P=0.049). The aforementioned findings combined with the non-significant ones also observed in the other studies show that early feeding practices do not appear to be consistently associated with height z-score in preschool children in the four cohorts thus not allowing safe conclusions.

When testing BMI as an outcome, 4 and 13 year-old children in ASPAC breastfed between 3 and 6 months of age had lower BMI z-scores (P=0.019 at 4 y and P=0.007 at 13 y) and were also less likely to be overweight or obese at 4 years (P=0.008) than those breastfed for longer than 6 months of age. Furthermore, 4 year-old children in Generation XXI to whom complementary foods were introduced before 4 months of age had higher BMI z-scores than children to whom complementary foods were introduced between 5 and 6 months of age (P=0.048). However, the relevant associations for preschool children observed in the other studies were not statistically significant, thus making it difficult to conclude on a significant influence of early feeding practices in BMI z-score and overweight/obesity in this specific age group.

When body fat mass was examined as an outcome, 13 year-old children in ALSPAC breastfed for less than one month had higher body fat mass levels (measured with BIA) compared to children breastfed for more than 6 months (P=0.030). On the contrary, 13 year-old children in ALSPAC that were breastfed from 3 to 6 months of age were found to have lower body fat mass levels (measured with DXA) compared to their peers that were breastfed for more than 6 months of age (P=0.025). Lastly, 5 year-old children in EDEN to whom complementary feeding was introduced before 4 months of age were found to have higher fat mass levels compared to their counterparts to whom solid food was introduced between 5 and 6 months of age (P=0.046). Summarizing these results and also considering the non-significant findings observed in the other studies, early feeding practices did not appear to be consistently related to body fat mass (assessed either by BIA or DXA) in preschool children and/or adolescents.

All aforementioned findings remained even after adjusting for a wide range of possible confounders.

In conclusion, the findings of the current work showed that early feeding practices, i.e. any breastfeeding duration and age of introduction of complementary foods, do not appear to be consistently associated with height and BMI z-scores, overweight/obesity and body fat mass in preschool children from four European countries and in UK adolescents.

References:

1. Moschonis, G., E. Grammatikaki, and Y. Manios, Perinatal predictors of overweight at infancy and preschool childhood: the GENESIS study. Int J Obes (Lond), 2008. 32(1): p. 39-47.
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3. Budge, H., et al., Session on 'Obesity'. Adipose tissue development, nutrition in early life and its impact on later obesity. Proc Nutr Soc, 2009. 68(3): p. 321-6.

HabEat Oral Presentation

Introducing vegetables into the infant diet

Cooke L.*, Fildes A., Moschonis G., Lopes C., Moreira P., Oliveira A., Mavrogianni C.

* Presenting author affiliation: Health Behaviour Research Centre, UCL, Gower Street, London WC1E 6BT

An important predictor of children's fruit and vegetable consumption is their liking for these foods. Innate preferences for sweet tastes and dislike of bitter tastes mean that fruit is readily accepted, but that liking for vegetables may be harder to achieve.

Evidence suggests that infants of around 4-7 months are highly receptive to new flavours and will accept unfamiliar flavours more rapidly than older children (1). Exposing children to the taste of more commonly rejected foods, such as stronger-tasting vegetables, may be most effective in early infancy before the onset of food neophobia or pickiness (during the second year of life)(2). Since food preferences develop early and track through later childhood and into adulthood early intervention is likely to reap the greatest benefit.

Recommendations concerning first complementary foods vary slightly from country to country, but most advise starting with fruits, vegetables and cereals. The practices of mothers also vary widely. In the TASTE study, carried out as part of the HabEat project, we found that British and Greek babies are usually offered some form of baby rice whereas in Portugal, vegetable soups are the most common first foods. It may not be a coincidence that the Portuguese are Europe's biggest consumers of fruit and vegetables!

While repeated exposure to a single vegetable flavour increases infants' acceptance (3), a lack of variety may result in monotony and the infant becoming bored with the taste. Daily changes in the vegetables offered to infants during the transition to solid foods have been shown to lead to immediate increases in preference and intake and greater acceptance of novel tastes (4,5). In addition, a more varied diet during the weaning period has been linked to greater dietary diversity in later childhood.

The aim of the TASTE study was to investigate the impact of providing guidance to parents on early exposure to a variety of vegetables on infants' liking and intake assessed in taste tests using novel fruits and vegetables. Almost 300 mother-child dyads from the UK, Greece and Portugal took part in this randomized control trial to compare an intervention with a control group receiving usual care with follow-ups immediately post-intervention and 6 and 9 months later. Findings were that the TASTE intervention increased vegetable acceptance in the short-term in countries where vegetables are not typically provided as first foods, but the longer term impact remains unclear. Interpretation and implications of the findings will be discussed.

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HabEat Oral Presentation

Learning to like vegetables: introducing the HabEat experiments

M. Hetherington

Background: Infants are born as univores and must make the transition to omnivore. They are assisted in this task by innate preferences directing their acceptance of milk, by early exposure to flavours and by exposure to a range of solid foods during and after complementary feeding. The early experience to flavour occurs in utero and is then enhanced by breastfeeding and expanded during weaning. It is clear from studies of infants that they prefer human milk even if formula fed (Marlier & Schaal, 2005) and that they prefer sweet tastes over all others. By 6m of age infants appear to prefer salty, umami and sweet tastes to water (Schwartz et al., 2013) but show no liking for sour and bitter tastes. It has been suggested that exposure to breastmilk facilitates acceptance of a variety of flavours given the complex flavour components of breastmilk. This demonstrates the critical role of learning in the development of flavour and food preferences. In practice, parents use a range of strategies to encourage acceptance of novel foods during and long after complementary feeding to encourage the transition to the family diet. Effectively parents are teaching their infants about the range of acceptable foods within their family and society as well as culturally appropriate patterns of eating.

Current research: Findings from the cohort research within HabEat confirm the importance of early experience and demonstrate that breastfeeding duration was associated with acceptance of fruit and vegetable intake in children. Thus, the longer the exposure to complex flavours during milk feeding the greater the probability of accepting fruits and vegetables in childhood. This raises an important research question about the role of other forms of learning which may facilitate healthy eating in children. Therefore, a series of experimental studies conducted within the HabEat project extended these findings by comparing the effectiveness of different forms of learning on liking and intake of a variety of vegetables (both unfamiliar and familiar). These experiments tested in a systematic way the efficacy of different learning strategies from early, varied exposure during weaning to observational learning in pre-schoolers. The experiments set out to test the hypothesis that repeated exposure to a vegetable could facilitate learning through familiarisation by comparing this strategy against others such as adding a familiar flavour to a novel vegetable (flavour-flavour learning) or adding energy (flavour-nutrient learning); and by testing the efficacy of manipulating the sensory experience of the vegetable (adding seasoning, changing the shape, offering dips) could enhance vegetable liking and intake.

Conclusions: Early and repeated exposure to vegetables is the most effective means by which to encourage acceptance of vegetables. The strategies tested within the HabEat experiments could be used by mothers to encourage vegetable intake since overall the best form of learning is through familiarisation and repeated exposure. In future research the durability of this learning form of learning could be tested and applied to other healthy foods to improve the diets of young children.

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HabEat Oral Presentation

Strategies for learning to eat and like new vegetables

de Wild, V. [1]; Ahern S. [2]; Bouhlal S. [3, 4]; de Graaf C. [1]; Hetherington M. [2] ; Issanchou S. [3]; Jager G. [1]; Möller P. [5] ; Nicklaus S. [3]; Olsen A. [5]; Remy E. [2]; Zeinstra G.G. [6].

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Children's consumption of vegetables is still below recommendations. Despite different interventions, promoting children's vegetable intake is challenging, compared to encouraging fruit intake. One explanation is that many children do not like vegetables, which may be due to their bitter taste, their texture, appearance and/or low energy content. A series of studies involving children from weaning to 6 years were executed in Denmark, France, the Netherlands, and United Kingdom. These studies investigated the effects of different learning strategies, including repeated exposure, flavour-flavour learning and flavour-nutrient learning, on increasing intake of vegetables. The majority of studies used novel vegetable products especially prepared for these studies to test the relative success of different strategies: such as artichoke puree, green vegetable soups, Chinese radish and freeze dried vegetable crisps. Two studies used different kinds of serving styles and sensory variations together with repeated exposure to test our hypotheses. Most studies were performed in day-care settings and of the early years of primary schools.

Results across all eight studies showed that repeated exposure is a powerful learning strategy to accept novel vegetable tastes and to increase vegetable intake in young children. The four studies conducted with the artichoke puree and the Chinese radish, demonstrated that around five exposures were sufficient to achieve a significant effect. Most studies showed that flavour-flavour learning and flavour-nutrient learning were not more effective than repeated exposure in increasing the acceptance of an unfamiliar vegetable. The studies focusing on sensory variations showed that serving style influenced vegetable liking and intake. In the Danish study, the highest level of intake was observed in the experimental groups receiving sticks, and in the Dutch study slices were slightly preferred over sticks.

In all the studies, the aim was also to establish whether potential effects on vegetable acceptance and intake were long lasting. The increase in vegetable intake was maintained during the long-term measures, which varied from one month to six months after the intervention took place. Thus, overall, repeated exposure appears to be a relatively simple technique to apply at home, school or day care-centres to increase vegetable intake in the short term and even in the long term in children from weaning to six years.

HabEat Oral Presentation

Interventions to increase vegetable intake in early childhood

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Despite various health benefits, children's vegetable consumption is below the recommended intake across Europe (Fagt et al, 2007; Ocké et al, 2008; Yngve et al, 2005). Previous research has shown that it is not easy to increase children's vegetable intake. Neophobia peaks between the ages of two to six years (Cashdan, 1998; Pliner, 2006), which makes it especially challenging to increase vegetable consumption in this age range. A series of studies were conducted among two- to six-year-old children in real-life settings, with the aim to investigate whether different strategies based on social learning can be applied to increase vegetable consumption. The studies described in this abstract examined the strategies imitation and choice-offering.

Four imitation studies were executed in The Netherlands and Greece among children aged 3 to 6 years. A popular (TV) character or the teacher acted as role model and raw carrots were used as target vegetable. In contrast to what was expected, the children did not increase their vegetable intake during the intervention period. The children that were exposed to the role modelling strategies consumed on average between 20 and 35 grams in The Netherlands and 20 to 50 grams in Greece. Interestingly, when the children could choose one out of four vegetables during the choice tests, their vegetable intake was about two to three times higher (The Netherlands: 65-80 grams; Greece: 45-85 grams). Contrasting effects were found between classes in the same condition, suggesting that other factors, such as peer pressure or the class atmosphere, also played a role. These factors may have undermined the effect of the applied imitation strategies. Overall, it seems that imitation strategies with a relatively familiar vegetable applied in a complex classroom setting do not result in an increase in vegetable intake among children aged 3 to 6 years.

Three studies investigated the effect of choice offering on children's vegetable consumption. Two studies were executed in a nursery and used a within-subject design (Denmark & Greece). The third study was executed at home and used a between-subject design (The Netherlands). Taking the results together, the studies indicated that choice offering has the potential to positively contribute to children's vegetable intake. The results also suggested that specific groups may benefit more from choice offering than others since the Dutch study showed that age and vegetable liking prior the intervention may be moderators of the effect of choice offering.

In all studies, large variations in children's individual eating patterns were observed. Analyses of the questionnaire data showed that food fussiness, neophobia and vegetable liking were significantly correlated with children's vegetable intake. Children who score unfavourably on these characteristics may need more specific attention and other strategies might be needed to encourage their vegetable intake. Future research should extend our findings by focusing on how intake of relatively familiar vegetables can be encouraged. In addition, subgroups of children should be defined on the basis of children's individual characteristics, and tailored interventions should be developed for each subgroup.

HabEat Oral Presentation

Modelling the role of individual differences in the effectiveness of interventions to increase vegetable intake in childhood

Blundell, P.[1]; Nekitsing, C.[1]; Caton, S. J.[1,2] ; Ahern, S. M.[1]; Olsen, A.[3]; Møller, P.[3]; Hausner, H.[3]; Bouhlal, S. [4,5,6]; Remy, E.[4,5,6]; Nicklaus, S. [4,5,6]; Chabanet, C.[4,5,6]; Issanchou, S. [4,5,6]; de Wild, V.[7]; de Graaf, C.[7]; Jager, G.[7]; Hetherington, M. M.[1]

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Despite the known health benefits of eating vegetables, most children do not consume the recommended daily amounts of vegetables. Many children dislike vegetables and in some families, vegetables are rarely offered. Thus, for some children eating traits such as food fussiness preclude acceptance or even tasting these foods; whilst for others the family diet is low in vegetable content, therefore exposure is low.

It is clear that eating habits are formed early in life and are shaped as a function of experience, exposure and the interaction between child eating traits and caregiver environment. Therefore, the current study examined how variations in attributes of the child, the caregiver (predominantly mothers) and their feeding practices (measured by questionnaires in relation to food habit formation) predicted consumption of novel and familiar vegetables in controlled conditions. Questionnaire and intake data were collected across 4 countries and 5 experiments (518 children aged between 4 – 46 months) from the UK, Denmark, France and the Netherlands. The data were collated and analysed using structural equation modelling (SEM). Three models were tested, examining the contribution of maternal factors, child factors, and a combination of child and maternal facts to both initial vegetable intake, and rate of change in intake with exposures. The most significant predictor of initial vegetable intake was food avoidance (a composite of food fussiness and satiety responsiveness traits), followed by the age of the child. Food avoidance predicted lower intake of familiar and unfamiliar vegetables; however, food avoidant children demonstrated a greater rate of change in consumption of a novel vegetable. Younger children consumed more vegetables and had a steeper rate of change than older children; however food avoidance may mediate the association between age and intake. The regression weights indicate that food avoidance predicted intake of an unfamiliar vegetable better than a familiar vegetable. Other factors which were indirect predictors included maternal education, maternal neophobia and age of complementary feeding, with more educated mothers reporting lower maternal neophobia and later complementary feeding. Unexpectedly, breastfeeding and maternal vegetable intake predicted neither vegetable intake, nor learning. In agreement with previous research child age and eating traits predict acceptance of vegetables and despite food avoidance tendencies, learning can occur indicating that repeated exposure is successful even in children who are fussy eaters.

Caloric compensation and eating in the absence of hunger in preschool children: evolution over 1 year and impact of an intervention focusing children on internal cues

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Between the ages of 3 and 6 years, children may become less responsive to internal cues of hunger and satiation and less responsive to external food cues, which may induce overeating and conduct to weight gain. The aims of this series of studies were:

1. to measure caloric compensation (CC) and eating in the absence of hunger (EAH) in 3 to 6 year-old French children in their usual eating context,
2. to link these measurements with individual characteristics (age, sex, adiposity) and maternal feeding practices,
3. to develop an intervention targeted to children to help them focus on their internal cues of hunger and satiation to avoid overeating, and to evaluate its impact on children's CC and EAH,
4. to evaluate the evolution of CC and EAH over one year in children who had not received the intervention.

At baseline, three identical lunches were offered to 3-to-6-year-old children in school canteens. Food intake was measured at individual level. The first lunch was a control session. For the CC situation, thirty minutes before the second lunch children were offered a preload (137 kcal). For the EAH situation, ten minutes after the third lunch children were exposed to palatable foods (430 kcal). Six types of parental feeding practices were measured by questionnaires. The same measurements were conducted 3 and 15 months later (FU3M and FU15M, respectively). Between baseline and FU3M, some of the children above 4 years received an 8-session intervention aimed at focusing them on their hunger and satiation feelings.

At baseline (n=236), on average children compensated half of the calories from the preload and ate in the absence of hunger about a quarter of the energy that they had consumed during their lunch. CC and EAH scores were not correlated with each other. EAH and CC did not vary with age or adiposity. EAH was higher in boys than in girls. Mothers who used feeding practices such as food as reward more often had children who ate more in absence of hunger, but who showed surprisingly better CC.

The intervention was conducted with a subgroup of 32 children, compared to children matched on CC and EAH scores at baseline. The evaluation at FU3M showed that the intervention impacted neither CC, nor EAH.

A subgroup of 98 children who had not received the intervention participated in the 1-year follow-up. CC scores decreased from FU3M to FU15M ($P = 0.009$). EAH scores did not change from FU3M to FU15M.

This study provides evidence that CC and EAH are two distinct eating behaviors. CC may be mostly driven by internal factors while EAH may be influenced by external factors such as parental feeding practices. Results may be used to develop interventions to educate parents to provide an eating environment likely to prevent development of overweight.

HABEAT SYMPOSIUM

POSTERS

Session 1 - Monday 31st March, 16:00-17:00

P1 **Oliveira A, Lauzon-Guillain B, Jones L, Emmett P, Moreira P, Ramos E, Charles MA, Lopes C.**
Could birth weight predict feeding behaviours in early life? Cross-cultural comparisons within three European population-based cohorts.

P2 **Oliveira A, Jones L, Lauzon-Guillain B, Emmett P, Moreira P, Charles MA, Lopes C.**
Early eating behaviours in relation to fruit and vegetable intake and a healthy diet variety score at 4-5 years of age – a prospective analysis in three European birth cohorts.

P3 **Yuan WL, Rigal N, Monnery-Patris S, Chabanet C, Charles MA, de Lauzon-Guillain B.**
Early determinants of fruit and vegetables liking among children from the EDEN mother-child cohort.

P4 **Rekosz A, Matuszczyk M, Winnicka-Makulec E, Socha P, Rybak A.**
Clinical characteristic of patients with feeding disorders.

P5 **Matuszczyk M, Rybak A, Wiernicka A, Winnicka-Makulec E, Zych K, Socha P.**
Multidisciplinary care of children with feeding disorders - why dietitian is essential in the team?: a case report.

P6 **Feron G, Brignot H, Ducoroy P, Gaillard S, Jeannin A, Le Deaut AL, Lucchi G, Morzel M, Neyraud E, Nicklaus S, Nicod F, Schlich P, Truntzer C, Visalli M, Peretti N.**
Understanding food behaviour in child through salivary composition: a prospective study on children expressing oral disorders.

P7 **Le Révérend BJD, Edelson LR, Alder M, Loret C.**
Physiological aspects of the development of mastication in early childhood.

P8 **Tournier C, Nicklaus S, Salles C.**
Studying food oral processing in young infants: Methods development.

P9 **Pean J, Alles M, Warren JM, Delaere F, Lluch A.**
Simulation of the theoretical nutritional impact of replacing cows'milk with growing-up milk in the diet of UK children.

P10 **Amarger V, Migraine A, Moyon T, Vaiman D, Darmaun D, Flamant C, Rozé JC, Parnet P.**
A common genetic variant in the Insulin Receptor gene is associated with eating difficulties at 2 years of age in a cohort of preterm infants.

P11 **De Decker A, Sioen I, Verbeken S, Michels N, De Henauw S.**
Reward sensitivity and consumption frequency of fatty and sugar rich foods.

P12 **Godefroy V, Rigal N.**
Children's appetitive traits associated with BMI: validation of a new questionnaire and a new model, inspired from temperament literature.

P13 **Rannou C, Texier F, Courcoux P, Cariou V, Nicklaus S, Prost C.**
A comparison of salt perception and acceptance of salt reduced food among children and adults.

P14 **Lange C, Schoumacker R, Yuan WL, Chabanet C, Nicklaus S.**
Development of a questionnaire to measure attraction to sweet, salty and fatty foods in children.

P15 **Ferdenzi C, Poncelet J, Rouby C, Bensafi M.**
Olfactomotor correlates of olfactory perception in children.

P16 **Morzel M, Chabanet C, Schwartz C, Nicklaus S.**
Salivary protein profiles are linked to bitter taste acceptance in infants.

P17 **Pouyfaucon M, Gaignaire A, Biguzzi C, Lange C, Schlich P.**
EveilSens: an early-learning sensory education in 5 to 6 years-old children.

Session 2 - Tuesday 1st April, 10:35-11:35

P18 **Olsen A, Møller P, Ritz C, Bär R, Hausner H.**
Optimizing mere exposure: How are vegetables most efficiently served to children?

P19 **Hausner H, Olsen A, Møller P.**
Mere exposure and flavour–flavour learning increase 2–3 year-old children's acceptance of a novel vegetable

P20 **Nehring I, Kostka T, von Kries R, Rehfuess EA.**
Early infant flavor experiences and taste preferences: a systematic review using harvest plots.

P21 **Hetherington M, Schwartz C, Madrelle J, Croden F, Vereijken C, Weenen H.**
Gradual introduction of vegetables in milk and rice during weaning: early, varied and repeated exposure enhances liking and intake.

P22 **Divert C, Remy E, Rousselot J, Brondel L, Issanchou S, Nicklaus S.**
Effect of energy density on liking and on caloric adjustment conditioning after sweet beverage exposure in children aged 8-11 y.

P23 **Moens E, Verbeken S, Vandeweghe L, Vervoort L, Goossens L, Braet C.**
How can classical conditioning learning procedures support the taste development in toddlers (REWARD): rationale, design and methods.

P24 **Lafraire J, Labeye E, Giboreau A, Picard D.**
Encouraging fruit and vegetable intake through social facilitation: From research to practice.

P25 **Vandeweghe L, Verbeken S, Moens E, Vervoort L, Braet C.**
Strategies to improve the willingness to taste: the moderating role of reward sensitivity.

P26 **Vervoort L, Vandeweghe L, Moens E, Verbeken S, Braet C.**
(In)effective strategies and cues to promote healthy eating in toddlers.

P27 **Edelson LR, Kuenzel J, Martin N.**
Parent techniques for encouraging toddler consumption of fruits and vegetables.

P28 **Francis-Granderson I, Dowrich M, Copeland C.**
Improving fruit and vegetable intake among primary school aged children in North East Trinidad.

P29 **Dimitrieva S, Simonenko S, Mosov A, Portnov N.**
Observations of the Moscow parents' society on kindergarten menu design.

P30 **Monnery-Patris S, Peteuil A, Chabanet C, Rigal N, Issanchou S.**
Parental practices associated with child's self-regulation abilities: Validation of a French questionnaire.

P31 **Monnery-Patris S, Thiebaut D, Lopes C, Oliveira A, Manios Y, Mavrogianni C, Moschonis G, Chabanet C, Issanchou S.**
New questionnaire to assess parental feeding practices in large scale studies: cross validation in three countries (France, Portugal and Greece).

P32 **Wolnicka K, Jaczewska-Schuetz J, Taraszewska A.**
Analysis of factors affecting the consumption of fruits and vegetables by children.

P33 **Shloim N, Rudolf M, Feltbower RG, Mohebati L, Hetherington M.**
Breast is best – positive mealtime interactions in breastfeeding mothers from Israel and the UK.

P34 **Brown A, Lee M.**
Introduction of complementary foods and later weight and eating behavior: The role of a baby-led weaning approach.

P35 **Ahern SM, Caton SJ, Blundell P, Hetherington MM.**
Comparing flavour-flavour learning with repeated exposure as a strategy for promoting vegetable intake in pre-school children.

P36 **Harton A, Myszkowska-Rycia J.**
Nutritional education of preschool children.

P37 **Coulthard H, Sealy A.**
Sensory fruit & vegetable play increases acceptance in preschool children.

Poster P1

Could birth weight predict feeding behaviours in early life? Cross-cultural comparisons within three European population-based cohorts.

Oliveira A [1,2], Lauzon-Guillain B [3], Jones L [4], Emmett P [4], Moreira P [2,5], Ramos E [1,2], Charles MA [3], Lopes C [1,2]

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Introduction and objective: Biological plausibility supports that birth weight, as a surrogate of intrauterine environment, could influence child's feeding behaviours, but there is a lack of population-based evidence. We aim to prospectively relate birth weight (standardized for gestational age) with feeding behaviours at different ages in three European population-based cohorts: Generation XXI (Portugal), ALSPAC (UK) and EDEN (France).

Material and methods: Analyses were based on three European population-based birth cohorts: the Portuguese Generation XXI Birth Cohort (G21), the British Avon Longitudinal Study of Parents and Children (ALSPAC), and the French EDEN mother-child cohort. Caregiver's perceptions on feeding behaviours, measured as eating difficulties, poor eating (corresponding to eats small quantities each time, does not eat enough or needs to be stimulated to eat), food refusal/neophobia and difficulties in establishing a daily routine were assessed at 4-6, 12-15, 24 and 48-54 months. Based on sex-specific Kramer standards, children were defined as small (SGA), appropriate (AGA) or large (LGA) for gestational age. Associations were estimated by odds ratio and 95% confidence intervals (OR, 95%CI), obtained from logistic regressions (adjustments for maternal age, education, pre-pregnancy body mass index (BMI), smoking, breastfeeding duration, number of older siblings and type of birth, and in a second step for child's z-score BMI).

Results: Children born SGA presented higher odds of eating small quantities at each meal at 4-6 months in the Portuguese (OR=1.97, 95%CI=1.35-2.86) and UK cohorts (OR=1.26, 95%CI=1.05-1.51) compared to AGA children. These associations did not remain at older ages. A model without adjustment for child's current BMI, showed these associations in all three cohorts at 4-6 months, and in at least one cohort associations were found at older ages as well. Conversely, children born LGA were less likely to refuse foods after 12 and 48-54 months in the UK cohort (OR=0.81, 95%CI=0.63-1.05, OR=0.80, 95%CI=0.61-1.06, respectively). Conclusions: The results suggest that children born SGA present more eating difficulties than AGA children. On the other hand, children born LGA seem less likely to present these eating difficulties, but seem more neophobic. The effects were weakened after adjustment for child's BMI, suggesting that caregiver's perception of child's poor eating could be influenced by child's weight. As feeding problems are persistent throughout childhood and increase the risk of other behavioural and psychosocial problems, their early identification, followed by parents' advice and support may reduce feeding difficulties, and potentially improve childhood growth and future health.

The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/ 2007-2013) under the grant agreement n.FP7-245012-HabEat.

Poster P2

Early eating behaviours in relation to fruit and vegetable intake and a healthy diet variety score at 4-5 years of age – a prospective analysis in three European birth cohorts

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Introduction: Eating behaviours during early childhood could be mediators to a worse health profile. Fruit and vegetables (F&V) intake and overall diet variety are surrogates for healthful diets. This study aims to prospectively relate feeding behaviours at different ages with F&V consumption and a healthy diet variety score of children with 4-5 years of age.

Material and methods: Eating behaviours were assessed in three European cohorts (Generation XXI from Portugal, EDEN from France and ALSAPAC from the UK) at 4-6, 12-15, 24 and 48-54 months, based on caregiver's perception of child's eating difficulties, poor eating (defined based on eating small quantities at each meal), food refusal, and establishment of daily food routines. F&V intake and the healthy plate variety score (HPVS) was calculated in each cohort using food frequency questionnaires. HPVS assesses variety of healthy foods within and across the main food groups based on the number of servings recommended for each group in healthy eating guidelines, the maximum score is 5. Associations were tested by logistic regressions (odds ratio and 95% confidence intervals (OR, 95%CI) adjusted for maternal age, education, smoking during pregnancy, any breastfeeding and child's z-score body mass index.

Results: Children with more eating difficulties, poor eating, food refusal/neophobia, and difficulties in establishing a daily routine at 12-15, 24 and 48-54 months, as reported by parents, had in general lower fruit and vegetable intake at 4-5 years. The association with vegetables was slightly stronger than with fruits. Early eating difficulties were also inversely associated with the variety score at 4-5 years of age. The association with food refusal/ neophobia and difficulties in establishing a daily routine were in the same direction, but only significant when eating behaviours were reported after 12-15 months of age.

Conclusions: Children with eating difficulties, food refusal/neophobia and difficulties in establishing a daily routine, as reported by their parents, presented a lower fruit and vegetable intake and less dietary variety at 4-5 years of age. These associations were consistent across cohorts, slightly stronger for vegetables than fruits, and more evident when eating behaviours were reported after 12-15 months of age.

The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/ 2007-2013) under the grant agreement n.FP7-245012-HabEat.

Poster P3

Early determinants of fruit and vegetables liking among children from the EDEN mother-child cohort

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Introduction and objective: Identifying early determinants of food liking is of great importance to improve children's diet (in terms of quality and frequency). Many determinants have been examined but usually separately. Our goal is to examine together early determinants of fruit and vegetables liking including maternal determinants and those related to the child.

Material and methods: EA hedonic test, based on 36 foods photographs, has involved 1142 children aged of five years during a clinical examination lead by trained midwifes. Associations between children fruit and vegetables liking, early feeding exposures and child's eating behavior were analyzed using structural equation modelling. The variables considered were maternal fruit and vegetables intake before pregnancy, infant feeding patterns (three quantitative variables (1/ Later introduction of dairy product and use of ready-prepared baby foods; 2/Long breastfeeding, late introduction of meal main components and use of home-made foods; 3/ Use of ready-prepared adult foods), parental feeding practices assessed at 2 years (restriction for weight and child control), child's fruit and vegetables intake reported at 3 years, intensity of child's food neophobia assessed each year from 1 to 5 years.

Results: Fruit and vegetables liking was associated moderately but positively with fruit and vegetables intake at 3 years (r =.15). Besides, it was negatively linked to the intensity of food neophobia from 1 to 5 years (r =-.41). On the other hand, children fruit and vegetables intake was associated positively with maternal intake (r =.30), as well as some early feeding practices during the first year (r pattern 2 = .17, r pattern 3 = -.11). Parental feeding practices at 2 years were neither associated with fruit and vegetables liking at 5 years nor with children' intake at 3 years.

Conclusions: Our results suggest that the main determinants of fruit and vegetables liking at 5 years in the EDEN cohort study were food neophobia and to a lesser extent fruit and vegetables intake at 3 years . Furthermore, maternal fruit and vegetables intake during pregnancy and early feeding practices were related to fruit and vegetables intake at 3 years but not directly to their liking at 5 years. This study brings new highlights on food liking development and the crucial role of neophobia.

The research leading to these results has received funding from the European Community's Seventh Framework Program (FP7/ 2007-2013) under the grant agreement n°FP7-245012-HabEat and from the "Fond Français pour l'Alimentation et la Santé".

Poster P4

Clinical characteristic of patients with feeding disorders

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Introduction and objective: Feeding disorders described as food refusal, picky eating or inability to eat, are one of the most common problems in pediatric population, affecting up to 40% of normally developing children and 80% of neurological patients. Some of them require hospitalization and a multidisciplinary care provided by a specially qualified team consisting of pediatrician, nutritionist, psychologist and speech therapist. Only such holistic approach can improve patient's outcome. The aim of the study was to describe the clinical characteristic of patients with severe feeding disorders with respect to the underlying disease based on multidisciplinary team's experience in our hospital, which is a referral center in Poland. Detailed results are presented for patients with behavioral issues, as it is the most common cause of feeding disorders.

Material and methods: Children (age: 1-209 months, median 19 months) with feeding disorders (n=356) who were hospitalised between September 2009 and May 2013 were enrolled into the study. Based on the underlying disease, patients were classified into 7 groups: behavioral, neurological, anatomical, gastrological, metabolic, cardio-pulmonary and mixed. The retrospective analysis was made based on age, nutritional status (at admission to the hospital), birth history, presence of gastroeosophagal reflux disease, feeding practices and used therapy.

Results: Complete data were obtained for a total of 284 patients. The count of patients in each of the 7 groups was as follows: 42% behavioral (n=119), 32% neurological (n=91), 8% gastrological (n=24), 5% metabolic (n=15), 3% cardiopulmonary (n=8), 7% anatomical (n=19), 3% mixed (n=8). Groups did not differ with respect to malnutrition. Among children with behavioral issues, 13% had a history of prematurity and 29% were born through caesarian section; 10% were diagnosed with gastroeosophagal reflux disease; 78% of the children were 3 years old or younger (mean age= 36 months); 40% of patients were undernourished (BMI <3pc) at the day of admission, 54% of the patients had their BMI between 3-85pc, whereas 56% of them (n=37) had BMI between 3-15pc; 97% of the patients were fed orally, 3% (n=4) were fed both orally and through the nasogastric tube.

Conclusions: Our results show that the most common cause of feeding disorders are behavioral problems, which are manifested mostly as picky or fussy eating. The age of patients corresponds with the theory for a neophobic period to start at the age of 1-2 years. The rate of undernourished children is very alarming: 40% were undernourshied and 31% were at risk of undernutrition. This indicates that feeding disorders are not diagnosed on time and patients are admitted to hospital too late. This also shows the need for improving the diagnostic and therapeutic approach by creating feeding teams in pediatric units.

Poster P5

Multidisciplinary care of children with feeding disorders - why dietitian is essential in the team: a case report

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Introduction and objective: Multidisciplinary approach is the best way of treating children with feeding disorders. Quite often after analysis made by all feeding specialists one of them becomes more important in the therapeutic process.

Material and methods: A 7 months old girl fed exclusively by nasogastric tube was admitted to our department for the oral feeding training. After common consultation of feeding's team it was decided to start with the tube weaning. All specialists gave recommendations for parents - dietitian was responsible for planning the exact schedule of meals and regular assess of caloric intake and nutritional status.

Results: During therapy the girl lost 400 g weight but from day 6 she was fed only orally. After 16 days the hospitalization was finished - at this point she covered 70% of her energy needs (504 kcal per day) and 100% of her fluid needs. Dietitian gave exact recommendations for feeding at home and the girl was included into the special program with 3 videoconsultations (each 2 weeks) with all feeding specialists. After 2 months she had the control visit in the hospital - she increased her body weight with 1,1 kg and her daily diet covered 90% of her current energy needs (705 kcal per day).

Conclusions: In this case the most essential link of feeding team was dietitian, however without advices given by other specialists the therapy would be probably longer and no so effective. This analysis confirms the importance of feeding team in treating of paediatric feeding disorders.

Poster P6

Understanding food behaviour in child through salivary composition: a prospective study on children expressing oral disorders

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Introduction and objective: In Human, the oral sphere is the first and main place where sensory stimuli are released and perceived. The phenomena occurring during food breakdown and sensory perception are complex and in this system saliva plays a major role. Over the last ten years, the increasing research on human saliva revealed the extreme complexity of this biological fluid, in terms of protein and small molecules composition. As such, saliva may carry the biological signature of an individual. Related to food, a fundamental question is to understand whether this biological signature is established during early oral exposition to food and whether it reflects the future oral sensitivity of an individual to food. A mean to prove this concept is to follow children who had an oral by-pass during critical phases of early food behavior development that results in the development of so-called oral disorders. Oral disorders are expressed for example by an exacerbated gag reflex, difficulties in chewing and swallowing and high food selectivity and may persist for years after oral by-pass ending.

Material and methods: In this context a population of 21 children who suffered from oral disorders (OD) was compared to a healthy control population (NOD, n=23). The two populations were followed during one year (three samplings over the year) and compared regarding their sensitivity to food (feeding difficulties, food preferences and food habits measured through questionnaires) on one side and their salivary composition (measured with targeted and non-targeted approaches) on the other side.

Results: On feeding difficulty aspects, OD children were separated significantly on 6 dimensions reflecting eating difficulties, oral tactile sensitivity, appetite and interest for food, sensitivity to food texture, sensitivity to tastes, sensitivity to temperature. Moreover, liking, consumption frequency and number of consumed foods were lower for the OD compared to the NOD children for some specific food groups. On saliva, some components identified by biochemical, proteomic, peptidomic and metabolomic analyses were associated specifically to oral disorder.

Conclusions: Despite a large heterogeneity within the groups, this study permitted to discriminate clearly between the two populations on both their food sensitivity and their salivary composition. Further analyses of the data are ongoing in order to identify the relationships between salivary markers and food sensitivity.

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Poster P7

Physiological aspects of the development of mastication in early childhood

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Introduction and objective: The development of feeding skills is a complex process influenced by four main factors: (i) Anatomy, (ii) Neurophysiology, (iii) Environment, (iv) Society and culture. Feeding skills are therefore investigated by two fields of science: (i) the behavioral science of feeding and (ii) the biomechanics of feeding (e.g. chewing and swallowing), with a particular emphasis on the first approach. Food intended to be fed to infants and toddlers are currently recommended based on motor and eating skills described by Speech Language Pathologists (SLPs) and feeding expert specialists. The biomechanical characterization of the mastication and its development has been less addressed whereas it could bring a new insight in the design of developmentally appropriated food.

Materials and methods: In this work, we focus on the evolution of mastication of infants and toddlers. We aim to describe the changes in the oral physiology (e.g. bone and muscle structure, teeth and soft tissues) of infants and toddlers (i), and its links to mastication abilities (ii). Finally, we reviewed previous works on the effect of the food consistency on children's mastication abilities and on their level of texture acceptance (iii).

Results and conclusions: Recommending products well adapted to children's mastication during weaning could facilitate their acceptance of new textures and support the development of healthy eating habits.

Poster P8

Studying food oral processing in young infants: Methods development

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Introduction and objective: The development of food preferences and eating habits is strongly influenced by early experiences and several studies revealed the impact of early odor and taste exposure on food acceptability. In the case of texture, preferences depend on oral chewing skills, which also evolve with experience. Experiences with food texture will only start around 4-6 months when infants are presented with semi-solid food products. At this stage, the development of munching followed by chewing will progressively start due to several anatomical and physiological changes and the progressive introduction of various solid foods. Food experience during the first year of life seems to be critical for the development of chewing and preferences. Infants with more experience with different textures were reported to be more confident in handling more complex textures and to have higher preference for these textures (1,2). The age of introduction of chewable foods seems to be important, as a late introduction of lumpy food was reported to increase difficulty to feed at 15 months and decrease fruit and vegetable consumption at 7 years old (3,4).

Materials and methods: Thus, knowledge on the chewing development seems essential to understand eating behaviour and food preferences. In literature, informations on the anatomical and physiological development of the masticatory function (jaw, tongue and lips movements and chewing muscles activity) during the first year of life has been described (5,6) but experimental studies available reported very different ages for the emergence of mastication maturity. Moreover, link between chewing behaviour and food structural properties has barely been addressed. From adult studies it is well known that saliva also plays a key role in food bolus formation and texture perception (7), but the interaction salivation-food has never been studied in children, although the association between saliva composition and taste acceptance in infants was recently unravelled (8). The lack of information on food oral processing in infants can be partly attributed to the difficulty to work with this specific population and the lack of methods available for young infants. In our preliminary work, we tested the applicability of video, jaw movements and chewing muscle activity recordings to study chewing behaviour in an infant (9). In the present study, we compare results obtained at different age and present new methods based on sensors and food bolus characterisation to better characterise chewing skills and food oral processing in infants.

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Poster P9

Simulation of the theoretical nutritional impact of replacing cows' milk with growing-up milk in the diet of UK children

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Introduction and objective: Young childhood is a period of rapid growth and development resulting in specific nutritional needs. Nutrient inadequacies (e.g. iron, vitamin D) and excesses (e.g. protein, saturated fat) are often observed (1). Growing-up milks (GUM) are fortified milks with an adapted nutrient composition, aimed at meeting the nutritional requirements of young children. This simulation study aimed to assess the theoretical impact of replacing cows' milk (CM) with GUM in the diet of UK children.

Materials and methods: Analyses were based on individual dietary data from National Diet and Nutritional Survey (NDNS), 2008-2011. Children consuming cows' milk only (no GUM) and aged 18-36 months (n=159) were divided into 2 age subgroups, 18-23 months (n= 41) and 24-36 months (n=118). Simulations were conducted using Creme Food® software. Cow's milk was replaced with GUM in individual diets, either at matching volume (scenario 1) or with an intake of 300mL/d (scenario 2). Nutritional intakes from the observed data and after simulations were compared using paired Wilcoxon tests and evaluated against different nutrient recommendations (UK [2], EFSA [3,4] and Nordic [5]).

Results: In both scenarios and age subgroups, replacing cows' milk with GUM led to a significant reduction in protein (-14 to -20%) and saturated fat (-20 to -30%), and a significant increase in iron (+56 to +79%) and vitamin D (+277 to +356%) intakes. Slight increases in non-milk extrinsic sugars (+2 to +4%) and decreases in calcium (-13 to –23%) were observed. Overall, both scenarios led to intakes closer to recommendations.

Conclusions: The results of this simulation suggest that the theoretical replacement of habitual cows' milk intake by a matching volume or 300 mL of growing-up-milk may lead to more balanced nutritional intakes in UK young children.

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Poster P10

A common genetic variant in the Insulin Receptor gene is associated with eating difficulties at 2 years of age in a cohort of preterm infants

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Introduction and objective: Children born preterm are more likely than full term infants to develop early feeding difficulties that can impair their growth in early childhood. Although some determinants of this behaviour originate from the fetal and postnatal history of these children, efficient interventions are still restrained by a large individual variability and a complex interaction between genetic and environmental factors. The objective of this study was to identify common genetic variants associated with eating difficulties at 2 years of age in a cohort of 234 preterm infants.

Materials and methods: Eating behaviour was assessed using a parental questionnaire, and expressed as a quantitative score. A non-targeted high throughput approach using DNA pools was combined with a candidate gene strategy in order to select 96 common SNPs candidates.

Results and conclusions: A strong heritability of the trait was evidenced by a high level of correlation of the phenotype between monozygotic twins (n=9, R2=0.85, P=4x10-4) which was not significant between dizygotic twins (n=29, R2=0.04, P=0.34). Two SNPs showed a significant association with the phenotype on a dominant model, one (rs11671975:A→G) situated in an intron of the Insulin Receptor (INSR) gene and one (rs12147093:G→C) mapping in a gene free genomic region on chr14q21.1. Carrying the minor allele for rs11671975 lowered the risk to have eating difficulties (RR = 0.5[0.34-0.53]) whereas the minor allele for rs12147093 increased this risk (RR = 1.9[1.3-2.8]). For both SNPs, the effect was enhanced after adjustment on birth-weight Z-score and maternal education level, two factors that are associated with eating difficulties at 2 years of age.

Poster P11

Reward sensitivity and consumption frequency of fatty and sugar rich foods

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Introduction and objective: Individual differences in brain reward circuitry are associated with overweight in children [1,2]. High reward sensitivity predicts fast-food consumption in the presence of fast food restaurants in the environment in adults [3]. The current study examines the link between individual differences in reward sensitivity and consumption frequency of highly palatable fatty and sugar rich foods in primary school children.

Materials and methods: Parents of 419 Flemish children aged 5.5 to 11.5 years completed a 43 item food frequency questionnaire and BIS/BAS scale for their children in 2011. Correlations and multiple linear regression analyses were conducted with food consumption indices as outcome variables and reward sensitivity as predictor variable controlled for age and gender.

Results: Analyses revealed no significant associations between reward sensitivity and food indices for high fat nor sugar rich food and drinks. However, reward sensitivity had low but significant positive associations with single food items like fruit juice, ketchup, white bread, pizza.

Conclusions: The current study shows no associations between reward sensitivity and the consumption frequency of high fat or sugar rich foods in primary school children. Results are not as expected. A first explanation is that parents missed some of the foods that were consumed by the children (at school, with friends, ...). A second explanation is that primary school children's food consumption is highly controlled by the parents and not by a child characteristic. However, the current study shows positive associations between reward sensitivity and single food items that can be classified as 'comfortable food'. They are appealing to eat or drink and easy to chew, peal, cut etc. Further research is needed to replicate the findings.

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Poster P12

Children's appetitive traits associated with BMI: validation of a new questionnaire and a new model, inspired from temperament literature

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Introduction and objective: A review of explicit and implicit methods to assess BMI-linked appetitive traits allowed to identify two major groups: 1/ those assessing the reactivity of desire to eat facing different kinds of stimuli such as external food cues or internal emotions; 2/ those revealing the ability to self-regulate to stop eating when reaching satiety. Moreover, appetitive and temperamental traits have been shown to present some similarities (Farrow & Blissett, 2012). That's why Mary K. Rothbart's definition of temperament, as interindividual differences in reactivity and self-regulation, was found to be very suitable to be applied to appetitive traits. This study aims at 1/ constructing a new theoretical model of children's appetitive traits, directly inspired from Rothbart's definition of temperament; 2/ constructing and validating a new questionnaire, based on this unique theoretical model; 3/ exploring its links with children's BMI, temperament, dietary restraint and perceived parental restriction.

Materials and methods: *Construction and validation of a new questionnaire based on the new model* : Two broad dimensions of food reactivity and self-regulation have been theoretically defined, with two sub-dimensions for each, inspired from temperamental definitions. A 27-item questionnaire has been developed, with DEBQ- and CEBQ-inspired items, to assess the 4 created dimensions: "appetite arousability", "appetite intensity", "satiety focus" and "satiety-respecting control". A Confirmatory Factorial Analysis, involving 475 10 to 12 year-old children, should allow to validate the internal structure of the dimensions of the questionnaire. *Exploring the links between the new model of appetitive traits and children's BMI, temperament, dietary restraint and perceived parental restriction :* Children's temperament (self-regulation), dietary restraint and perceived parental restriction have been measured (using validated questionnaires), as well as their BMI. Structural Equation Modeling will be used to test causal relations between appetitive traits and these dimensions.

Results and conclusions: This study should help researchers to better understand BMI-associated appetitive traits, providing a new tool to evaluate them in children. Investigating the potential links with temperament, dietary restraint and perceived parental restriction could lead to an improvement of childhood overweight prevention.

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Poster P13

A comparison of salt perception and acceptance of salt reduced food among children and adults

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Introduction and objective: Salt reduction in food is becoming a major concern for public authorities and industries, because an excessive intake of sodium in the diet is considered having detrimental effects on health. However, the reduction of salt involves many modifications of the product properties such as texture, shelf life, food safety and obviously taste and aroma[1]. The consequences of salt reduction on the organoleptic properties are of main interest because they directly impact the acceptance and consumption of a food product. As adults and children are known to have different ability to detect taste stimuli[2], it is interesting to compare their perception and acceptance of a salt reduced food in order to predict their related consumption. This study presents some of the results of the KIDYSALT project (regional project, 5 partners, 2013-2015) which aims to formulate salt reduced food for children without altering their organoleptic qualities.

Materials and methods: Two products were studied: pasta recipe (pasta with chicken and cheese sauce) and meat recipe (beef balls with tomato sauce). Each one of these products was formulated with four levels of salt content (from a classical salt content to a maximum reduction of 40%). Products are presented to a panel of 60 adults and 100 children (7-12 years old). The experiments took place in a sensory analysis room (AFNOR). The test consisted in (i) a notation of the products on a hedonic scale (5-point for children, 7-point for adults), and (ii) a ranking of the products according to the 'salty' intensity. Products were presented according to Mutually Orthogonal Latin Squares. Analysis of variance was performed to compare the results obtained.

Results: The ranking of the four pasta recipe formulations was correctly assessed by adults and children according to salt content. They clearly perceive differences between the formulations. The appreciation of the four recipes by adults significantly decreases with the salt quantity, whereas children do not prefer a product to another. Concerning meat recipes, the four formulations were correctly ranked by adults according to the salty taste whereas children only distinguished the less salty formulation. The hedonic note of the three salt reduced products was higher for adults than that of the reference product. These results are explained by the modification of the texture of beef balls which become smoother as the salt content decreases. Children similarly liked the four formulations.

Conclusions: A reduction of salt content is possible in some products without declining their organoleptic qualities whereas others need salt compensation to be accepted by adults. Children seem to easily accept salt reduced foods, which confirm the importance of accustoming themselves to eat such products as infancy and early childhood is of great importance in the formation of preferences and later food choice behavior[3].

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Poster P14

Development of a questionnaire to measure attraction to sweet, salty and fatty foods in children

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Introduction and objective: Childhood obesity may be responsible for a major alteration of life quality in children and in future adults. The causes of obesity are multiple and obesity results from a chronic imbalance between food intake and energy expenditure. The challenge is to understand the cause of this imbalance. In this context, this study aimed at evaluating the contribution of the attraction toward salty, sweet and fatty foods. Thus, the first aim of this study was to establish a tool to assess children's attraction toward sweet, salty and fatty foods that could be used later in large-scale cohorts. The second objective was to compare this questionnaire to sensory tests measuring the overall liking for sweet, salt and fat applied to the same subjects. Both tools have been initially developed in adults and were then adapted to the child population (age 7-10 y). The third objective was to compare results between children and adults.

Materials and methods: The initial questionnaire was revised by replacing some foods not adapted for children by others, and by adding pictures of foods and detailed instructions. The questionnaire included 83 items (sweet, 21; salt, 11; fat-sweet, 20; fat-salt, 31) scattered into: liking towards foods, preferred level of seasoning, preferred drinks in a menu and behavior-related questions. The sensory test included 14 sets of food models (sweet, 4; salt, 4; fat, 6), each with each featuring 5 grading levels of sweetness, saltiness or fattiness. Within each set, the samples were tasted in a random order and rated on a hedonic scale. The study included 123 children. The sensory test was divided in 3 sessions. Then, children filled in the questionnaire at home. For the questionnaire, scores of attraction toward sweet, salty or fatty foods were computed. For the sensory tests, an optimum level of sweetness, saltiness or fattiness was calculated for each food model and then average for each sensation.

Results: Children's optima of liking (sensory) for sweet and salt were higher than for adults. Attraction (questionnaire) for fat and to a lesser extent for sweet was also higher for children than for adults. Scores from the questionnaire and from the sensory tests were correlated for salt (r=0.33, P=0.001) and fat (r=0.34, P=0.0005). For sweet, these two scores were only moderately correlated (r=0.21, P=0.05) compared to the scores obtained with adults.

Conclusions: In conclusion, the questionnaire and the sensory tests help to highlight some common variance but also refer to different aspects of liking.

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Poster P15

Olfactomotor correlates of olfactory perception in children

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Introduction and objective: Sniffing responses to odors constitute non-verbal measures of odor hedonics. Research in animals and humans has shown that sniffing behavior, i.e. the motor component of olfaction, is of considerable importance in odor perception. Sniffing is driven by stimulus attributes such as odor concentration, and is also modulated by subjective pleasantness of an odor: sniff duration and volume increase when pleasant odors are sampled compared to unpleasant ones (Bensafi et al., 2003). The role of sniffing in olfactory perception has been investigated in adults only. The aim of the present study was to investigate how sniffing behavior is modulated as a function of odor hedonic value in two different conditions.

Materials and methods: In a first study, we compared sniff parameters for two odors contrasted in hedonicity. In a second study, we examined sniffing correlates of more subtle variations in hedonicity, namely between a condition without and with label, a manipulation that has proven to increase pleasantness of neutral odors in a rating study involving children and adults (Bensafi et al., 2007). Two studies were conducted involving respectively 10 and 12 children aged 6-12 years, and 10 and 13 adults aged 18-30 years. In each study, participants were exposed to two odors presented randomly through an olfactometer, for twenty presentations each (stimulus duration: 3 sec, inter-stimulus interval: 30 sec). Odorous stimuli were banana (pleasant) and heptanal (unpleasant) in the first study, and mint and banana in the second one. On each trial, participants were to smell and judge intensity and pleasantness of the odor. In addition to the nasal cannula that directed the odorized air from the olfactometer to the subject's nose, sniffing was recorded simultaneously using an airflow sensor. Inspired volume, maximum flow rate, time to reach maximum flow rate, and sniff duration were computed for each odor trial and each participant, and averaged across the twenty odor presentations.

Results and conclusions: Results showed that, in the first study, duration of the sniff was shorter in presence of the unpleasant smell in children and adults, compared to the pleasant smell. In the second study, labelling the odors increased hedonic and intensity ratings in children and adults, replicating previous findings. There was no clear effect of the label on sniff parameters: labelling increased time to reach maximum flow rate for banana only and was not associated with any change in other sniff parameters. Altogether, these results suggest that variations of sniffing patterns as a function of odor hedonicity are similar in children and adults. Sniffing appears less vulnerable than verbal ratings to modulation by explicit or voluntary strategies, which makes it a more objective measure of hedonic responses (Frank et al 2004). This measure could be particularly useful in children, who are susceptible to response modulation as a function of experimenter's expectations (social desirability: Soussignan & Schaal, 1996).

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Poster P16

Salivary protein profiles are linked to bitter taste acceptance in infants

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Introduction and objective: Salivary proteins may modulate taste perception through several mechanisms. For example, carbonic anhydrase 6 participates to taste bud development and function (Henkin et al., 1999). Levels of histatin 5 and sensitivity to quinine are linked, possibly through binding mechanisms (Wada et al., 2010). Here, we tested the hypothesis that saliva protein composition, a dynamic fluid subject to changes with age, may predict taste acceptance. The study was performed longitudinally on infants, in whom the contribution of food experience to taste acceptance is rather low.

Materials and methods: Saliva sampled from 73 infants aged 3 and 6 months old was analysed by SDS-PAGE and mass spectrometry. Acceptance of the five basic tastes was assessed by measuring intake of taste solutions relatively to water (Schwartz et al., 2009). Data allowed first to describe changes of salivary protein profiles in infants, second to investigate the statistical link between biochemical and sensory data using Partial Least Square regression.

Results and conclusions: Salivary protein profiles were modified substantially between the two ages. For example, S-type cystatins increased in abundance, and exposure to solid foods exacerbated this trend. Protein profiles were not predictive of taste acceptance, with the notable exception of bitterness in 3 month-old infants. Infants who preferred the bitter solution over water (presumably less sensitive to bitterness) had lower proportions of carbonic anhydrase 6. More intriguingly, they also had higher proportions of S-type cystatins and PRP-3. In conclusion, acceptance of bitterness is conditioned in part by the saliva protein composition of 3 month-old infants.

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Poster P17

EveilSens: an early-learning sensory education in 5 to 6 years-old children

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Introduction and objective: The EveilSens project aimed to assess the effects of a sensory education, also called «taste education», in 5 to 6 years-old children on aspects of cognitive, psychosocial and psycho-affective development related to attitudes and eating behaviors. This program was provided to 75 children in last year of kindergarten classes in 2012-2013, during school time thanks to a partnership with the Dijon Education Authority.

Materials and results: This poster presents the early-learning sensory education program which was designed for kindergarten children, thanks to the expertise of sensory education organisms which have been carrying out actions dedicated to young children for fifteen years. The educational progression of this program is detailed. Moreover, the structure of the sessions and the method of teaching are explained. The implication of the teacher and the link with families are also described. Finally, the strengths and limitations of this program are discussed.

This project was funded by the Regional Council of Burgundy France (PARI Agral 1) and the Nestlé Foundation.

Poster P18

Optimizing mere exposure: How are vegetables most efficiently served to children?

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Introduction: Mere exposure is known to be an effective strategy to change children's liking and intake of vegetables, and serving styles of vegetables have recently been shown to influence children's liking. However, whether certain serving styles of vegetables are more effective than others in exposure-based interventions is not known. As exposures are time-consuming, getting the most out of them is highly desirable.

Aim: To compare three different serving styles of a raw snack vegetable; a "classic" serving style (sticks), an interesting figure (triangles), and a very modified form (grated).

Material and methods: 172 children aged 2-5 years participated. Chinese radish was used as a novel target food, and the intervention consisted of 7 exposures. Exact intake by each child was determined at each session. Children were divided into four experimental groups based on the serving style they received: Grated, sticks, triangles, and a control group, which did not receive any exposures. All stimuli were evaluated by a sensory panel. At baseline and post intervention, liking and intake of the target stimulus were measured (in a "neutral" shape; round). Three and six month follow-ups will also be conducted.

Results: Preliminary analyses show that intake increased during exposures in all groups. After the intervention, all groups also had higher intake compared to baseline levels, but the changes were only significant in the groups receiving triangles and sticks. All groups increased their liking for the Chinese radish, and the highest increase was observed in the group receiving sticks.

Conclusion: These preliminary results show that the serving style by which a vegetable is presented during exposures influences both liking and intake. Among the styles investigated here, sticks seem to be the most efficient.

The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under the Grant Agreement No. FP7-245012-HabEat.

Poster P19

Mere exposure and flavour–flavour learning increase 2–3 year-old children's acceptance of a novel vegetable

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Introduction and objective: Vegetable consumption is low among many children. This study compared the efficacy of the exposure learning strategies mere exposure, flavour–flavour and flavour–nutrient learning in changing children's intake of a novel vegetable.

Material and methods: An unmodified artichoke purée was served at pre-testing. Hereafter children were exposed 10 times to unmodified purée (mere exposure, n = 32), a sweetened purée (flavour–flavor learning, n = 33) or an energy dense purée with added fat (flavour–nutrient learning, n = 39). Unmodified and sweet purée contained approximately 200 kJ/100 g; the energy dense purée 580 kJ/100 g. The unmodified purée was served again at post-testing, 3 and 6 months after last exposure to monitor long-term effects of learning.

Results: Intake of purée increased in the mere exposure and flavour–flavour condition, and was unchanged in the flavour–nutrient condition. Mere exposure changed children's intake by the 5th exposure, flavour–flavour learning by the 10th. Mere exposure led to the largest increase in intake of unmodified purée at post-test and over 6 months. Children following flavour–flavour learning consumed more of the sweet purée than of unmodified purée. About 30–40% of the children were resistant to acceptance changes.

Conclusion: The results of this study imply that mere exposure and flavour–flavour learning are powerful strategies for changing children's acceptance of a novel vegetable, even though a substantial number of children are resistant to these types of exposure learning.

The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under the Grant Agreement No. FP7-245012-HabEat.

Poster P20

Early infant flavor experiences and taste preferences: a systematic review using harvest plots

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Introduction and objective: Growing childhood overweight and obesity is associated with several health problems and may be a consequence of children's specific food preferences. We hypothesized that foetus and infants exposed to a specific flavor show greater acceptance of that flavor later in life. We also hypothesized that infants experiencing specific feeding patterns show differential acceptance of novel flavors later in life.

Material and methods: We hypothesized that foetus and infants exposed to a specific flavor show greater acceptance of that flavor later in life. We also hypothesized that infants experiencing specific feeding patterns show differential acceptance of novel flavors later in life.

Results: 19 studies comprising 74 subgroups which differed by taste, age, medium and duration of exposure were included. Repeated exposure to sweet, bitter and specific flavors appeared to increase the acceptance of these flavors. Studies on salty and sour flavors were sparse. Infants exposed to a variety of fruit and vegetables showed greater acceptance of new flavors compared to unexposed infants.

Conclusions: This review suggests that subjecting foetus and young infants to a variety of flavors both increases their acceptance of these flavors later in life and decreases their fear of experiencing novel flavors. However, in the light of many limitations in the current evidence base it is not advisable to make recommendations for practice.

Poster P21

Gradual introduction of vegetables in milk and rice during weaning: early, varied and repeated exposure enhances liking and intake

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Introduction and objective: Developing healthy eating habits in early life begins with experience of various healthy foods including fruits and vegetables. Early exposure is essential for food preferences to develop. Early food preferences appear to track into later life (Nicklaus and Remy 2013) thus exposing infants to a variety of fruits and vegetables will facilitate food preferences and intake shaping future food habits. The health benefits of fruits and vegetables are generally accepted. Specific fruits and vegetables confer protection against cardiovascular disease (CVD) and quantity of vegetables consumed is more important than variety (Bhupathiraju et al, 2013). For example high intakes of citrus fruit, green leafy vegetables, and those fruits and vegetables which are high in β-carotene- and vitamin C lower the risk of developing CVD. However, intake of vegetables is much lower than recommended both in adults and in children, particularly for green, leafy vegetables which are generally disliked. Therefore, early experience of health promoting vegetables is an essential strategy to ensure the development of liking and intake.

Breastfed infants are more willing to try new foods (Maier et al. 2008), due to varied flavour exposure via breast milk (Menella 1995). However, exposure to a novel flavour will promote intake even after the milk feeding period (Hausner et al. 2010). Therefore, one strategy which can facilitate intake and liking of vegetables, is to provide this flavour systematically with milk and solid foods at the time of weaning. The present study investigated the effect of a step-by-step introduction of pure vegetables added first to milk and then to rice at the start of weaning on liking and intake of vegetables.

Material and methods: Just before weaning, enrolled mothers were randomised to either the intervention (IG, n=18 of which 6 were breastfed) or control (CG, n=18 of which 6 were breastfed) group. IG infants received 12 daily exposures to vegetable puree added to milk, then 12 daily exposures to vegetable puree, added to baby rice at home. Plain milk and cereal were given to the control group. Then both groups received 11 daily exposures to vegetable puree; intake and liking were recorded; eating behaviour in response to vegetables was filmed on days 25-26 and 33-35 in the laboratory. Vegetables were provided in rotation (carrots, green beans, spinach and broccoli) and a new vegetable (parsnip) given on the final day (day 36).

Results: IG infants liked and ate the exposed vegetable purees more than CG infants. Carrots were liked and consumed more than green beans. New vegetable intake was marginally greater in IG infants. Furthermore, mothers reported that the approach was acceptable and they appreciated the structure and guidance the step-by-step approach provided.

Conclusions: The weaning period is an ideal time to provide vegetables since acceptance is generally high. Early exposure to vegetables in a step-by-step process enhanced liking and intake of vegetables during weaning. This approach was appreciated by mothers and could provide infants with a foundation on which to build healthy eating habits by improving vegetable acceptance.

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Poster P22

Effect of energy density on liking and on caloric adjustment conditioning after sweet beverage exposure in children aged 8-11 y

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Introduction and objective: The contribution of sweet beverages to weight gain in children and adolescents is controversial. The present study was conducted to study, in 8-11 year-old children, the influence of energy conditioning on liking and on caloric adjustment after sweet beverages exposure. We also studied the stability of the conditioning effects after a period without exposure and an extinction period.

Materials and methods: Children (n = 44) were exposed to 2 flavored sweetened beverages: a high energy version (HE: 150kcal) and a no energy version (NE: 0kcal). During a 4-wk conditioning period, children were exposed either 2 or 7 times to each beverage. During a 3-wk stability period children were not exposed to any beverage. During a 4-wk extinction period, children were exposed 3 times to both beverages in which the association between the flavor and the energy density had been switched.

Results: Flavor liking and food intake during the meals following the consumption of each beverage were assessed before and after each period. After the conditioning period, the liking for both beverages increased significantly ($P \leftarrow 0.001$). After the stability period, the liking for the HE flavor was significantly higher than that for the NE flavor ($P = 0.025$). After the extinction period, the liking for the flavor initially associated with the HE beverage remained higher than that for the flavor initially associated with the NE beverage ($P = 0.040$). Initially, energy intakes at the meal following beverage ingestion did not differ. After the conditioning period up until the end of the extinction period, children's energy intake was lower after the consumption of the HE than the NE beverage regardless of the beverage flavor but caloric adjustment remained partial.

Conclusions: The number of exposures influenced neither liking nor caloric adjustment. In conclusion, once the association between flavor and energy density is learned, liking is induced by the beverage flavor whereas caloric adjustment is induced by the beverage energy density.

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Poster P23

How can classical conditioning learning procedures support the taste development in toddlers (REWARD): rationale, design and methods.

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Introduction and objective: The strongest barrier for vegetable consumption in children is their preference for these foods. Surveys show that vegetables are children's least liked food category. Also, food neophobia is common during childhood, affecting 8% to 50% of children. The development of food preferences can be seen as a learning process, as such it is assumable that classical conditioning via associative learning can enhance or impede this process. We want to study the applicability of this theoretical framework in the acquisition of food preferences. Moreover, we will study differential effects of associative learning taking into account individual differences in children's reward sensitivity (RS). In this poster, we describe the design of a study that aims to examine how positive stimuli influence children's willingness to taste and the liking of an unliked food item and how this is interrelated with RS.

Materials and methods: This study is designed as a prospective observational study of 45 children in day care (aged 24-30 months) and their parents and caregivers. The children will be randomly allocated to three conditions (a neutral condition, a positive condition or a control group) and will be exposed to an unliked food item from the category of (cooked) vegetables. The neutral condition consists of 'mere exposure'. The positive condition is operationalized based on focus groups with parents and caregivers determining cues and techniques facilitating children's eating development. Children's liking and usual intake of the vegetable will be assessed before (pre test). The manipulation includes a three week exposure(+stimuli) intervention consisting of 9 tasting trials (3/week). During each trial, children's willingness to taste will be observed. Their liking will be measured using a 3-point visual 'faces' scale: 'yummy' (smiling), 'just okay' (neutral face) and 'yucky' (frowning) on trial 3, 6 and 9. After the intervention phase, the child's usual vegetable liking and intake will be assessed, 5 weeks from baseline (post test) and 3 months from baseline (follow-up 1). This replicates the procedure described by Anzman-Frasca et al. (2011). The child's RS will be assessed by the BIS/BAS Questionnaire (Carver & White, 1994). Both parents and caregivers will be asked to fill out this questionnaire.

Results and conclusions: This study can provide knowledge of how (1) RS may predict change in willingness to taste and liking behavior of vegetables; and (2) the tasting and liking process can develop faster when the child is exposed to positive stimuli via the process of associative learning (compared to mere exposure and the control group). This could lead to more successful interventions tailored to individual characteristics of children.

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Poster P24

Encouraging fruit and vegetable intake through social facilitation: From research to practice

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Introduction and objective: Many children are not consuming enough fruits and vegetables during childhood and thereby do not meet recommended daily intake. It has been put forward that the two main factors responsible for food and vegetable rejection, food neophobia and picky/fussy eating (Dovey et al., 2008), can be overcome through social facilitation. Clayton (1978) initially defined social facilitation as "an increase in the frequency of a familiar behavior pattern in the presence of others displaying the same behavior pattern at the same time." More precisely, evidence from research studies suggests that a young child learns to accept foods through observing significant others (e.g., Hendy, 2002). The aim of this poster is to provide a comprehensive review of a selected range of studies on social facilitation effects on children's food behavior.

Materials and methods: We will consider the specificity of social influences in children compared to other species (e.g., Addessi et al., 2005). We will then show that one positive effect of social facilitation is to decrease the duration of expression of food neophobia, but that the strength of this effect is a function of the number of, and familiarity with, people acting as a model in the immediate environment of the child (e.g., Birch, 1980). Moreover, we will highlight that the positive influence of social facilitation on child's food choices is complicated by several other factors that may result in adverse effects, such as normative beliefs and expectations from parents and peers, and facial expression of models' emotions.

Results and conclusions: Building on these data, we will propose to investigate practical ways to set up social facilitation situations in ecological environments such as school canteens in order to promote fruit and vegetable intake in children.

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Poster P25

Strategies to improve the willingness to taste: the moderating role of reward sensitivity

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Introduction and objective: We investigated the effectiveness of different behavioral change techniques (i.e. reward strategies) in willingness to taste (WtT) an unliked vegetable. Moreover, we examined whether children with a high reward sensitivity (RS) were more willing to taste compared to children with a low RS. The innovative part of this research lies in the focus on the differential effects of behavioral change techniques depending on individual differences (i.e. RS), and in the focus on WtT instead of change in liking. We consider WtT to be a crucial first step in the process of liking healthy food.

Materials and methods: Preschool children (n=132, 53% boys, age: M=4.51, SD=1.07) participated in a single-tasting experiment with unliked vegetables. They were randomly allocated to one of five different reward strategies: encouragement, modeling (adult), modeling (puppet), token, and modeling+token. Using logistic regression, we tested the effect of reward strategies on WtT (did not taste, hesitated to taste, and tasted immediately) and the moderating role of RS, indexed via the Behavioral Inhibition System and Behavioral Approach System Scales.

Results: We found no main effect of reward strategies ($p < .1$) or RS ($p > .1$) indicating that WtT was not dependent on reward strategy or RS. However, we found an interaction effect between reward strategy and RS ($p < .05$): children with a higher RS were more likely to taste in the token strategy.

Conclusions: Rewarding is known as an effective technique to increase the consumption of healthy food. The present study suggests a differential effect of reward strategies depending on individual differences (i.e. RS). Focusing on both individual differences and behavioural techniques (i.e. reward strategies) might be a promising strategy for health promotion.

Poster P26

(In)effective strategies and cues to promote healthy eating in toddlers

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Introduction and objective: Healthy eating in children is important since it contributes to a normal growth and development. Therefore, it is important that people who are responsible for the daily care of children (such as parents, nannies and daycare assistants) apply appropriate strategies and accommodations to facilitate healthy eating. This study explores which strategies and environmental facilities are perceived by those people to promote healthy eating and will translate the findings in a theoretical framework .

Materials and methods: Three focus groups were conducted, respectively with parents (n = 7), nannies (n = 9) and daycare assistants (n = 10). The discussion started with general questions and narrowed to more specific and important questions, tailored toward the research questions. The discussions were audio-recorded and transcribed. In order to identify the answers on our questions, we applied a thematic analysis using NVivo software (qualitative analysis).

Results: The participants perceived encouragement, repeated exposure, modeling and offering a variety of healthy options as effective strategies, whereas offering alternatives and forcing were considered ineffective. The participants further stressed the importance of a quiet, cozy atmosphere in which one has patience with the children. Involvement in cooking activities and an attractive presentation of the food was also seen as facilitating healthy eating.

Conclusions: The discussions revealed different strategies and environmental cues to promote healthy eating. We can translate this according to Learning Theory that says that (a) approach behavior will increase when a rewarding consequence follows the approach behaviour (b) modeling the new behavior by a role model is very effective to initiate new behavior (c) positive auditive and visual cues can facilitate new behavior and (d) a positive relaxing atmosphere is an anti-fear agent as it reduces stressful arousal and neo-phobia. If further research investigates which aspects have the most impact in interaction with individual differences, important data are provided for future intervention programs.

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Poster P27

Parent techniques for encouraging toddler consumption of fruits and vegetables

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Introduction and objective: Toddlers often do not meet the recommended intake of healthy foods such as fruits and vegetables. This study explores which practices mothers use to encourage their children to eat fruits and vegetables, and which techniques were most successful.

Materials and methods: 60 American families with toddlers (12-36 mo.) participated in an in-home observational study of parent-child mealtime interactions. Parents video-recorded their children's meals and these videos were later coded by a team of trained observers for both parent and child behaviors. Two conditions are compared: typical family meals and meals at which parents were asked to introduce a fruit or vegetable that their child had never eaten before. Parents also completed questionnaires about their feeding style and feeding practices.

Results: Authoritarian parents made the most total encouragements and encouragements/minute of video; this was especially evident in the new fruit/vegetable task. Indulgent parents made the fewest encouragements with authoritative parents falling in between. Parents use encouragements approximately twice as often when introducing a new food than when serving familiar foods.

Neutral-tone encouragements were the most common for all types of parents and across meal types. When introducing new foods, parents also often use modeling, reasoning, and creative techniques at a higher rate than during meals with familiar foods. The relative success rates of these different techniques for different parents will also be presented.

Conclusions: Parents with different feeding styles employ different techniques to encourage their children to eat. These findings are consistent with the feeding style literature. Parents of all feeding styles use a wider range of encouragement practices when offering a novel food than familiar ones.

Poster P28

Improving fruit and vegetable intake among primary school aged children in North East Trinidad

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Introduction and objective: The 2003 World Health Report deemed low fruit and vegetable consumption as a global risk factor for mortality. Numerous children do not satisfy World Health Organization's recommendation of consuming 400 grams of fruit and vegetables per day (Krølner et al 2011). Fruits and vegetables are important as they provide numerous health benefits which help to combat the risk of obesity and heart disease. The aim of the study is to determine if improved meals with or without nutrition education has an impact on fruit and vegetable (F&V) consumption among primary school aged children between the ages of 5-9.

Materials and methods: Four primary schools (two interventions and two controls) were randomly selected from the North East region of Trinidad. After receiving written parental consent, 261 children between the ages of 5 to 9 were eligible to participate in the study. All children received modified school lunches which included recommended daily servings of (F&V). 116 children received the modified meal only, while 145 children received both nutrition education and modified meals. The children were observed for two consecutive school terms corresponding approximately to 138 days. Daily, a 10% sample of children by class, from each school receiving modified meals was selected and interviewed. Analysis of the F&V consumption data gathered included a one-way ANOVA test and independent sample t-test using SPSS version 20.

Results: In term one, the mean vegetable consumption for the (5-6 year olds) group was significantly higher ($F=8.18$; $p<0.001$) than those of the older year groups (ages 8-9). Children who received nutrition education lessons had a significantly higher vegetable consumption than children who received modified meals only ($t=-2.377$; $p=0.018$). Younger children (5-6 year olds) had the highest fruit consumption and were significantly different when compared to other year groups (7-8 & 8-9 year olds) $F=2.490$; $p=0.042$). Schools located in rural areas (regardless of control or intervention) had significantly more fruit ($t=6.818$; $p<0.001$) and vegetable consumption ($t=2.327$; $p=0.02$) than those located in urban areas. In term 2, younger children continued eating more vegetables than the older children. The mean for the youngest group of children was significantly higher than those of the other year groups ($F=13.461$; $p<0.001$). Children who received nutrition education lessons had a significantly higher vegetable consumption than those who received modified meals only ($t=-4.220$; $p<0.001$). Fruit consumption showed a significant difference between the intervention and control schools ($t=-2.163$; $p=0.031$). Children in schools located in rural areas ate significantly more fruit ($t=7.631$; $p<0.001$) and vegetables ($t=3.077$; $p=0.002$) than those in urban areas. Schools that were introduced to the nutrition education lessons alongside modified meals showed a better (F&V) consumption pattern over the two school terms.

Conclusions: Multi-component interventions thus proved to work well in the improvement of (F&V) consumption. Enhanced understanding of interventions and their impact on both access to and consumption of (F&V) can provide guidance to public health decision makers (Ganann et al, 2012).

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Poster P29

Observations of the Moscow parents' society on kindergarten menu design

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Introduction and objective: Eating habits in Russian Federation have changed considerably over the past two decades. We can observe that traditional ingredients have been widely replaced by newer and more exotic substitutes as attitudes towards diet have changed as a consequence of urbanization and globalization. The previous catering scheme in kindergartens has been criticized and is considered out of date, and the development of the new version is a serious process demanding a huge amount of statistical and clinical data. It is obvious that there should be a harmonious balance between food consumption in the home and at school, so our objective must be a universal policy. The first step is to get a clear impression of parents' and society's expectations for the menu design.

Material and methods: An internet based study of parent opinions in Moscow was conducted to determine ways to optimise catering in kindergartens. People with children attending kindergarten in Moscow were asked to evaluate a range of dishes currently used in school canteens. Dishes were selected from official recipe catalogues that are in accordance with current rules and norms. Dishes were grouped according to courses (starters, salads, main courses, side dishes etc.). Ready-to-consume dishes were included as separate courses (for example dishes based on cottage cheese, confectionary, fermented milk drinks etc.). Parents graded each dish from 2 to 5: like (5 points); do not have objections (4 points); do not like (3 points); totally against (2 points). Parents were also asked to give their opinion on obligatory vitamin fortification; they were given two options: 'Agree with vitamin-fortified food in kindergarten' or 'Do not agree with obligatory vitamin fortification of food in educative organizations and prefer to supplement vitamins personally'). The survey included 845 food items. In total 81 585 forms were completed, not including discarded sheets that were blank or where all or majority of products got negative marks (67 533 forms).

Results: One of the practical results discovered was the low level of trust towards government policy of vitamin fortification: 69% of the interviewees were against free vitamin fortification in food in the kindergarten. We hypothesize that the main reason for this fact is the low level of awareness about vitamin and mineral deficiency and corresponding health disorders. The highest score (average 4.99) was given for 4 products: apples; steamed minced meat cutlets; stewed meat; and compote of fresh apples. Most dishes got an intermediate score. Low level of approval (lower than 4.0 points) was observed for dishes with names consisting of the words "from the industrial semi-products" and assorted canned foods. The label "for children" means that the recipe and composition of the product satisfies Russian Food Regulations. But even with this definition parents do not tend to trust dishes that have an unsatisfactory reputation (e.g. salads with mayonnaise sauce for children or pancake rolls (less than 4.0 points), or which they may be prejudiced against (e.g. vegetarian salad with sea cabbage; dishes containing squid). Instant vitamin-mineral complex for children got the lowest score (2.61 points in average). Surprisingly, the sandwich with canned meat for preschools and schoolchildren took the penultimate place in the list (2.77 points).

Conclusions: The study shows that the level of reliance of parents on simple dishes that are produced traditionally from familiar raw materials in kindergarten kitchens is high. These are highly preferred to composite industrial products even if specifically designed for children to balance nutritional intake and to ensure high sanitary safety. It is particularly noticeable that parents have a negative reaction to children's consumption of sweet pepper, squids, sorrel, spinach, meat bouillon, chicken dishes, soybean oil, turnip, honey and nuts. The main origin of current parent opinion could derive from the onslaught of questionable information in mass media which causes difficulty for parents in selecting the reliable information.

Poster P30

Parental practices associated with child's self-regulation abilities: Validation of a French questionnaire

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Introduction and objective: The ability to respect physiologic cues (ie, hunger and satiation) during feeding events has been identified as important to obesity prevention. Infants and young children are able to regulate food intake thank to these cues, but this ability decreases with age. The Caloric Compensation (CC), described as the ability to adjust food intake following different density preloads, seems to decrease while parental control triggering eating increase (Wardle, Guthrie, Sanderson & al., 2001). Eating in the Absence of Hunger (EAH) may contribute to excess body weight in children and in adolescents (Shunk & Birch, 2004). The objective of the present study was to validate a new questionnaire, usable in large-scale studies, to assess EAH and CC in 1-5 year-old children, and the parental practices hypothesized to be linked to these regulation mechanisms.

Materials and methods: A 66-item questionnaire has been developed or adapted and validated using a Structural Equation Modeling approach involving 793 parents of 1-5 y children. This questionnaire includes items on Parental attention to child's cues, parental practices in feeding events, child's sensitivity to these internal cues and self-regulation abilities (EAH and CC).

Results: Firstly, a Confirmatory Factor Analysis was used to validate the internal structure of the dimensions of the questionnaire. The results showed satisfying fit indexes for a 8-dimension model, with 29 items. Secondly, a SEM approach was used to explore the links between the different dimensions. The results indicated that Eating in the Absence of Hunger and the Caloric Compensation were two independent behaviors, impacted by different parental factors. More specifically, affective practices, such as "food as rewards" was significantly linked to EAH; whereas social practices/habits, such as "feeding on schedule", or allowing "Snacking" were associated to CC. The results also indicated that the impact of CC on child's BMI was higher than the impact of EAH on BMI.

Conclusions: This new questionnaire fills in a gap in the literature (de Lauzon-Guillain, B., A. Oliveira, et al., 2012), and could in turn help epidemiologists/clinical researchers in studies focusing on children's eating regulation and parental feeding practices.

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Poster P31

New questionnaire to assess parental feeding practices in large scale studies: cross validation in three countries (France, Portugal and Greece)

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Introduction and objective: Food habits developed in early childhood persist in adulthood, thus playing a long-lasting role on our eating behaviours. Investigating food habits development during the first years of life permits the identification of key periods in their formation and the development of interventions to improve food habits. Many tools have been developed to understand eating behaviour formation, but a review of literature (de Lauzon et al, 2012) highlighted a gap in the methods to measure parental feeding practices and child's self-regulation of food intake. Our objective was to design and validate a new questionnaire which assesses parental feeding practices and child's self-regulation of food intake in order to establish potential relationships between these dimensions. The originality of the present research was to develop and validate this tool in three countries: France, Portugal and Greece.

Materials and methods: Parents of 1 to 5-year-old children were recruited in schools and nurseries in the 3 countries to complete a questionnaire about their feeding practices, the child's capacity to regulate his/her food consumption, and the child's height and weight. A subsample of parents was asked to complete the questionnaire twice with a 3-week delay to assess test-retest repeatability.

Results: Using Structural Equation Modelling models, the results validated the consistency of most of the dimensions of the questionnaire. Test-retest analysis confirmed the repeatability of the questionnaire.

Conclusions: These results highlight the reliability of the questionnaire developed in the present study. This questionnaire appears to be a sound tool to assess different dimensions of parental feeding practices and of child's eating behaviours linked to self-regulation of food intake. This quite short questionnaire could be used in large scale studies as in epidemiological researches. The internal consistency of the dimensions and their reproducibility have been checked and validated for parents of children aged from one to five, in three different countries: France, Greece and Portugal.

Reference

de Lauzon-Guillain, B., A. Oliveira, et al. (2012). 'A review of methods to assess parental feeding practices and preschool child's eating behavior: the need for further development of tools'. Journal of the American Dietetic Association 112(10): 1578-1602.

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Poster P32

Analysis of factors affecting the consumption of fruits and vegetables by children

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Introduction and objective: Food habits of children are an important part of a healthy lifestyle. Determination of the factors affecting the consumption of fruits and vegetables by children can help to increase the effectiveness of health promotion activities conducted both at school and in the family home. The aim of the study was to analyze the factors affecting the consumption of fruits and vegetables by children.

Material and methods: The study was conducted in the school year 2010/2011 in 38 primary schools in urban and rural areas of the five selected provinces representing the northern region, southern, eastern and central in Poland. The study was performed among students aged 9 years on the basis of anonymous questionnaires and 3-day food record method.

Results: Average daily intake of vegetables in boys was 164 g, in girls 155 g. Average consumption of fruit in boys was 194 g , in girls 185 g. The availability of various fruits and vegetables at home every day or most days, giving fruit and vegetables to school, encouraging consumption by parents significantly, positively affected average consumption of fruit and vegetables by children. Significantly higher intake of vegetables was recorded in the urban area, the lowest fruit and vegetable intake was recorded among children of parents with primary education.

Conclusions: Higher consumption of fruit and vegetables by children is determined primarily by the availability of fruits and vegetables at home, getting children fruits and vegetables for school and nutrition habits of parents. Education of parents is integral to the development of healthy eating habits in children.

Poster P33

Breast is best – positive mealtime interactions in breastfeeding mothers from Israel and the UK

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Introduction and objective: It is estimated that 9.5% of infants worldwide are above the 95th percentile in weight and rapid infant weight gain is associated with obesity in later life. Decisions about feeding early in life, such as whether to breastfeed and for how long are important determinants of growth and are more likely to be associated with parental feeding styles and behaviours during mealtimes. Thus, research exploring mealtime interactions should aim to identify potentially problematic feeding behaviours, such as overfeeding or lack of maternal responsiveness to infant hunger/satiety cues.

Materials and methods: The present study investigated the quality of filmed mealtime interactions in mothers from Israel and the UK through the use of the Simple Feeding Element Scale. The study was designed to 1) explore whether mode of feeding (breastfeeding vs. mixed feeding) influenced mealtime interactions; and 2) to determine if feeding interactions varied by maternal BMI and country. Forty one women (N=41) were filmed during a feed during the first months of life (mean age: 21.5±9.4 weeks). Most mothers were married and multiparous. Maternal BMI was similar in both countries with most mothers being within the healthy weight range compared to overweight/obese. Babies' weight, length and age at measurement were obtained. Mothers reported their own weight and height and maternal BMI was calculated. Three independent researchers scored each film according to the Simple Feeding Element Scale.

Results: The findings suggested that higher scores for most elements were obtained across the sample indicating generally responsive feeding. Significantly more UK mothers breastfed during the filmed meal (P=0.001) compared to Israeli mothers. Breastfeeding was significantly associated with more ideal scores for setting (no distractions during the meal), and mother's awareness of infants' disengagement cues. Mothers who did not breastfeed and positioned their infants face to face were more likely to restrain infants' participation in the meal and not encourage self-feeding. Maternal BMI was not significantly associated with meal interaction; however, trends indicated that healthy weight mothers were more likely to breastfeed or feed infants healthier food (such as fruit and vegetables).

Conclusions: The findings from this study suggested that mothers showed high levels of responsive feeding 2-6m following birth with breastfeeding being associated with more positive mealtime interactions. Mealtime interactions offer an insight into the quality of the early feeding experience and future research should continue to explore this within larger and more diverse populations.

Poster P34

Introduction of complementary foods and later weight and eating behavior: the role of a baby-led weaning approach

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Introduction and objective: Nutrition during infancy may have a long-term impact upon weight gain and eating style. Breastfeeding and a later introduction of solid foods have both been shown to be protective against obesity. How infants are introduced to solid foods may also be important. Traditionally, infants are introduced to solid foods via spoon-feeding of purees. However, an alternate approach known as baby-led weaning advocates allowing infants to self-feed foods in their whole form. Given recommendations to introduce solid foods at six months, infants are developmentally able to self feed at this stage and advocates of baby-led weaning suggest that pureed food is unnecessary.

Proponents of the baby-led weaning method suggest this may promote healthy eating styles, but evidence surrounding the method and its impact is sparse. The aim of the current study was to thus to compare child eating behaviour at 18–24 months between infants weaned using a traditional weaning approach and those weaned using a baby-led weaning style.

Materials and methods: To explore this, two hundred ninety-eight mothers with an infant aged 18–24 months completed a longitudinal, self-report questionnaire. In Phase One, mothers with an infant aged 6–12 months reported breastfeeding duration, timing of solid foods, weaning style (baby-led or standard) and maternal control, measured using the Child Feeding Questionnaire. At 18–24 months, post-partum mothers completed a follow-up questionnaire examining child eating style (satiety-responsiveness, food-responsiveness, fussiness, enjoyment of food) and reported child weight.

Results and conclusions: The findings showed that infants weaned using a baby-led approach were significantly more satiety-responsive and less likely to be overweight compared with those weaned using a standard approach. This was independent of breastfeeding duration, timing of introduction to complementary foods, infant birth weight, maternal demographic background and maternal control. Baby-led infants were also less likely to be rated as fussy eaters but lower levels of maternal control explained this. A baby-led weaning approach may therefore encourage greater satiety-responsiveness, lower fussy eating and healthy weight-gain trajectories in infants. Potentially, allowing the infant to self-feed enables the infant to be in greater control of their intake and may also lead to longer meal durations, both of which may promote positive appetite control. Additional explanations might include post ingestive learning, a wider variety of flavours and participation in family meal times, which encourage a healthier relationship with food. However, the limitations of a self-report, correlational study with self-selecting participants are noted. Data also needs to explore whether these differences remain into later childhood. Further research using a more rigorous design is needed given the increasing numbers of parents choosing to follow this approach in the UK.

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Poster P35

Comparing flavour-flavour learning with repeated exposure as a strategy for promoting vegetable intake in pre-school children

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Introduction and objective: Health benefits of consuming vegetables are widely accepted (Bhupathiraju et al 2013), yet children do not consume the recommended amount of vegetables in their habitual diet. Food preferences and eating habits established in early life tend to track into adulthood (Nicklaus & Remy 2013). If children do not establish healthy eating habits early in life they are less likely to eat well later on and will not accrue the associated health benefits. A variety of strategies have been developed to investigate the optimal means of encouraging vegetable intake. For example repeated exposure is known to increase intake of a novel vegetable (artichoke) in pre-school children (Caton et al 2012). Flavour-flavour learning involves pairing a novel food with an already liked flavour and could facilitate intake and liking of vegetables more effectively than mere exposure. Therefore the present experiment was designed to compare the effectiveness of flavour-flavour learning against repeated exposure in promoting vegetable intake in pre-school children.

Materials and methods: The experiment had a within-subjects design with three conditions. Children (N=29) aged 15 to 56 months were recruited through participating nurseries (mean = 34m). Each received a minimum of 6 and maximium 8 exposures to a root vegetable puree (celeriac, swede and turnip). Vegetables were randomised to one of the three conditions: for flavour-flavour learning (FFL) apple puree was added to the vegetable; for repeated exposure the puree was served plain and for the control condition the third vegetable puree was served only at pre and post intervention. Intake was weighed from pre-weighed cups at baseline and and post-intervention, then again at follow up; 1 month (n=28) and 6 months (n=10) after the intervention.

Results and conclusions: Intake increased significantly from pre to post intervention for all purees (+36g), with no effect of condition. Magnitude of change was smaller in the control condition. Analysis of follow up data showed that intake remained significantly higher than baseline at 1 month ($p \leftarrow 0.001$) and 6 months ($p \leftarrow 0.001$) post-intervention for all conditions. Age effects were also observed with younger pre-school children (←24m) consuming more across conditions compared to older pre-school children (↗25 m) with no effect of condition observed. The current investigation demonstrates that in this context there was no advantage of adding a familiar and liked taste (apple puree) to vegetables compared to repeated exposure for the promotion of vegetable intake in pre-school children. Repeated exposure to vegetables at an early age enhanced intake, younger children consistently ate more of the new vegetables compared to the older children, therefore early and repeated exposure are crucial. This supports previous research within the HabEat project (Hausner et al 2012; Remy et al 2013) and reassures parents that adding sweetness will not be beneficial to improve acceptance of vegetables.

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Poster P36

Nutritional education of preschool children

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Introduction and objective: Developing healthy eating habits in preschool children as a part of early prevention of diet related diseases

Materials and methods: Nutritional education was conducted in selected preschools in Warsaw in years 2010-2013 among children (aged 4-5 years), parents and preschool teachers. Project was conducted by nutritionists/dieticians from the Department of Human Nutrition and Consumer Sciences of Warsaw University of Life Sciences and trained preschools' teachers. Education was provided in a form of 2-4 workshops with methods adequate for the age of children (e.g. game, puzzle). Parents and preschool teachers were educated directly during meetings organized in the nursery and in an indirect way (brochures with the nutritional guidelines). In total 820 children and 200 parents and teachers were involved in the project. The first edition untitled «Preschooler Nutrition Pyramid» was conducted from October 2010 to February 2011 and included 300 children and 200 parents and preschool teachers. The main aim of this edition was to familiarized participants with the nutrition pyramid for children and the general nutritional guidelines. The second edition untitled «Start a healthy diet» (December 2012- January 2013) involved 400 children. It was intended to educate parents in identifying «healthy» and «unhealthy» food products that should be included/avoided in the kids menu. The third edition «I have a plan for breakfast» performed between October and November 2013 included 120 children. In this action the special emphasis was given on the role of breakfast and its balanced, adequate composition.

Results and conclusions: All actions attracted wide interest among children, parents and teachers. Early education of children, parents and preschool teachers may have an impact on children healthy eating habits and should be an obligatory element of the early prevention of diet related diseases.

Poster P37

Sensory fruit & vegetable play increases acceptance in preschool children

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Introduction and objective: Exposure studies in children have tended to focus on visual (de Droog, Buijzen & Valkenberg, 2014; Houston-Price, Butler & Shiba, 2009) and taste exposure (Sullivan & Birch, 1994), and ignore the contribution of tactile sensory exposure. There is some evidence that tactile sensitivity is associated with fruit & vegetable (FV) acceptance in young children (Coulthard & Blissett, 2009; Coulthard & Thakker, 2013). The aim of the present study was to ascertain whether combining visual and tactile exposure would encourage trying fruits and vegetables.

Materials and methods: Forty-one children (20 boys and 21 girls) aged 3-5 years were recruited through a nursery school in the East Midlands, UK. Baseline measurements of tactile processing, FV consumption (daily portions & variety) and child food neophobia were taken. Children were randomly assigned to one of two experimental conditions; a FV sensory play condition and a non-food sensory play condition. After the play session children's acceptance of eight fruits & vegetables was measured.

Results and conclusions: Children tried significantly more fruits & vegetables if they had been in the FV sensory play condition ($p<0.005$). A hierarchical regression found that FV sensory play predicted FV acceptance after controlling for food neophobia and tactile sensitivity. This study is the first to suggest that inclusion of tactile sensory exposure may be an important factor in designing interventions that target the range of FV accepted by young children.

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