Nutrition Education: Strategies for Improving Nutrition and Healthy Eating in Individuals and Communities

Lausanne | Switzerland | September 17–20, 2018

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There has been a tremendous shift in the quantity and quality of the human diet over the last decades. On the one hand, nutritious food is more readily available, resulting in improved nutrition and the opportunity for better health. However, on the other hand, there is a higher consumption of saturated fats, salt, and sugar. Despite increased overall wealth, there remains a health disparity, particularly in low-income populations in developing countries, giving rise to the double burden of obesity and malnutrition. Indeed, data from the latest WHO/UNICEF/World Bank Joint Child Malnutrition Estimates indicate that around 155 million children under the age of 5 years are stunted, 41 million are overweight, and 52 million are wasted. Furthermore, developed countries are also witnessing a dramatic rise in diet-related disorders, such as cardiovascular disease and type 2 diabetes.

Despite the explosion of information on diet, health, and nutrition, changing an individual’s eating habits is a difficult task. We now have a better knowledge of the forces that shape a person’s eating behavior, and it is high time to leverage nutrition education to drive healthy food choices for a better quality of life.

The importance of nutrition education as an integral part of day-to-day life was in the centerpiece of the 92nd Nestlé Nutrition Institute Workshop “Nutrition Education: Strategies for Improving Nutrition and Healthy Eating in Individuals and Communities,” which took place in Lausanne in September 2018.

Nutrition education may be defined as a combination of educational tactics accompanied by physical or environmental supports, whose purpose is to encourage the voluntary adoption of foods and other lifestyle behaviors that are beneficial for health. The first session on Nutrition education to optimize healthy growth and development during the first 1,000 days, led by Prof. Maureen M. Black, took an in-depth look at what nutrition education really is and how it can be used to influence different target populations, including women, girls, and young children. The second session on the importance of nutrition education in childcare, schools, and communities settings, chaired by Prof. Mary T. Story explored the complexities of eating behavior, underscoring the importance of early childhood as a critical time for intervention. Here, nutrition education efforts in childcare, schools, and community settings play an important role. The
final session with Dr. Helen K. Delichatsios shifted the focus to nutrition education in medical schools. Paradoxically, nutrition education is sorely lacking in many medical schools around the world. This session highlighted the latest educational technologies that are being used in medical school curricula, as well as methods for bringing nutrition to the clinic. Altogether, the 3 sessions in the workshop cover the basis of how nutrition interventions can be designed and delivered to improve food choices and ultimately, an individual’s health.

On behalf of the Nestle Nutrition Institute, I would like to thank the 3 Chairpersons Mary T. Story, Maureen M. Black, and Helen K. Delichatsios for putting the scientific program together.

I would also like to thank all speakers and scientific experts in the audience, who have contributed to the workshop content and scientific discussions.

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Early Development of Taste and Flavor Preferences and Consequences on Eating Behavior

Sophie Nicklaus, Camille Schwartz, Sandrine Monnery-Patris, and Sylvie Issanchou

Early childhood is an important period for the development of health. Recent researches using different approaches (experimental and epidemiological) have shown the importance of this early period for metabolic programming. This general concept of “Developmental Origin of Health and Disease” (DOHAD) has been refined in humans to highlight the importance of the first 1,000 days for the development of the health status. Eating behavior also develops during this period, in particular because from conception until the age of 2 years, the mode of feeding drastically evolves, which involves that the child has to learn “how” to eat, but also what to eat, how much food to eat, and in which context. After birth, when foods are orally exposed, infants discover the intrinsic properties of foods, with a variety of tastes, flavors, textures, as well as energy densities. Here, we focus on deciphering the involvement of taste and olfaction in the early establishment of eating behavior. In the frame of the OPALINE French birth cohort (Observatory of Food Preferences in Infants and Children), taste and flavor preferences were studied in children in relation with food acceptance over the first 2 years of life.

At birth, previous works revealed evidence of differential preferences across tastes, with a preference for the sweet taste and a rejection of the bitter taste, and very few evidence of inborn flavor preference, except when infants had been previously exposed to flavors from the maternal diet. The later evolution of taste and flavor preferences has received little attention. Within the OPALINE cohort, we studied longitudinally in a group of 285 infants the evolution of taste preferences from 3 to 20 months [1] and the evolution of flavor preferences from 8 to 22 months [2]. Taste acceptance trajectories for all primary tastes and for a fat emulsion were modeled. For saltiness, acceptance increased sharply between the ages of
3 and 12 months. The trajectories of acceptance were parallel for sweetness, sourness, and the umami taste between 3 and 20 months, with sweetness being preferred. Between 12 and 20 months, the acceptance of all tastes, except bitterness, decreased, and at 20 months, only sweetness was not rejected. The acceptance of bitterness remained stable. For the fat emulsion, acceptance evolved from indifference to rejection. Between 8 and 22 months, unpleasant food odors (trimethylamine, dimethyl disulfide, and butyric acid) lead to avoidance behavior in infants, but pleasant food odors did not elicit specific behavior. Developmental changes were dependent on taste and flavor; thus, a general change in taste or flavor perception is unlikely.

Taste exposure (i.e., dietary exposure to a variety of foods) might partly explain the taste acceptance trajectories. We showed that a longer breastfeeding duration (likely associated to a longer exposure to the umami tasting glutamate found in breast milk) was associated to a higher preference for the umami taste at 6 months [3]. Moreover, simultaneous to the introduction to complementary foods, taste differential reactivity (within-subject variability across tastes) clearly increased. At the beginning of the complementary feeding period, we showed that a higher preference for sweet, sour, and umami tastes was associated to a higher acceptance of sweet-, sour-, and umami-tasting foods, respectively [4], and, similarly, that rejection of the odor of trimethylamine and of dimethyl disulfide were related to the rejection of fish and sulfurous cheeses, respectively [5]. Further in development, at 20 months, food neophobia was associated to flavor differential reactivity (within-subject variability across flavors) but not to taste differential reactivity (within-subject variability across tastes) [6], underlining the importance of olfaction in the development of neophobic reactions. Further studies are necessary to establish a more complete understanding of the programming effect of early dietary taste and flavor exposure on later food choices.

References


Early development of taste and food pleasure plays an important role for children and has long-lasting influences on subsequent food preferences and choices. Eating a variety of foods is essential to achieve adequate coverage of macro- and micronutrients. However, children’s vegetable consumption often falls below current recommendations, highlighting the need to identify strategies that promote better acceptance of vegetables.

Apart from our innate liking for sweet foods and disliking for very bitter foods, sensory pleasure for foods is mostly acquired through our early eating experiences. Infants have a fine palate and more taste buds than adults when they are born. They have about 10,000 taste buds all around their tongue including the roof and the back and sides of their mouth. The flavors of what a mother eats while pregnant can reach the fetus and help set up flavor preferences later on. From birth, infants can taste and smell foods, an experience that can take place through human milk as the food eaten by the mother influences the flavor of her milk and, thereby, the child’s preference.

Thus, preferences for specific flavors develop early through milk-related flavor exposure or even during pregnancy, allowing an easier acceptance of new flavors and textures. Breastfeeding favors the acquisition of a taste for a variety of foods. At weaning, food preferences develop due to repeated exposure to a variety of foods, especially vegetables and fruits. The persistence of these early influences seems to be long-lasting. Factors favoring the development of food acceptance at the beginning of complementary feeding include, in particular, the role of early variety, repeated exposure, timing of food introduction, and sensory properties (texture, taste, and flavors) (Fig. 1).

During the third year of life, most children enter a neophobic phase during which the introduction of new foods becomes difficult. However,
habits of eating a variety of vegetables and foods acquired early in weaning appear to attenuate this neophobia.

Recently, experimental studies have reported promising interventions that increase acceptance of vegetables and new foods. The first, offering infants a high variety of vegetables during weaning, increases acceptance of new foods, including vegetables. Frequent (daily) changes in vegetables offered appears to be more effective than changing every few days. In addition, breastfeeding (as opposed to formula feeding) followed by a wide variety of foods at weaning produces the greatest acceptance of new foods (Fig. 2). The second, offering an initially disliked vegetable at 8 subsequent meals, markedly increased acceptance for that vegetable.

![Figure 1](image)

**Fig 1.** Early food-related variety experience is associated with higher intake of new vegetables. Intake (mean ± SE) at follow-up 3, i.e., when children were on average 6 years old. **a** Breastfed and formula-fed infants. **b** Three experimental groups (no, low, and high variety).
These effects have been shown to persist into childhood. This underlines the importance of promoting access to a variety of healthy foods (such as vegetables and fruits) in early childhood.

In conclusion, early experiences with vegetable variety during weaning can influence food choice and preference into childhood, and parents should actively encourage their children to try new vegetables and foods. If a new food is initially disliked, it is worth offering at 7–8 subsequent meals since this will usually lead to its long-lasting acceptance. These strategies provide the basis for science-based recommendations to help parents promote healthy eating habits in their children.

**Suggested Reading**


Healthy eating habits formed in childhood track into later life [1]. Whilst some eating behaviors appear to have a genetic basis[2], the early feeding environment is considered critical to the development of healthy eating behaviors that will ensure children to effectively self-regulate energy intake through the ability to recognize and respond appropriately to internal cues of satiety and hunger, and ultimately achieve and maintain a healthy weight status [1, 3].

Parental feeding practices have been of interest to researchers and clinicians alike because they constitute modifiable risk factors for problematic child diet-related outcomes and appear to be amenable to intervention [3]. The purpose of this review is to examine current evidence for a causal relationship between feeding practices and child eating behaviors related to obesity risk.

Feeding practices are defined as content-specific, goal-directed strategies or behaviors used by parents in an attempt to control or modify their child’s diet and eating behaviors. DiSantis et al. [4] proposed that non-responsive feeding practices that are controlling, coercive, or encourage children to eat for reasons other than hunger may interfere with a child’s ability to self-regulate their energy intake, i.e., to adjust their eating in response to internal feelings of fullness or satiety. It is proposed that when parents fail to recognize or respond appropriately to children’s internal cues of hunger or fullness, the child’s ability to self-regulate may be disrupted [4]. Therefore, the way in which feeding is responsive is an important element of the caregiver-child interaction.

Responsive feeding is defined as developmentally appropriate (not intrusive or controlling), prompt, and contingent responses to infant and child hunger and satiety. Also integral to responsive feeding are: establishing routines around mealtimes (eating at the same place and times), modeling appropriate behavior (making healthy choices), and ensuring children are seated [5].
Research in this field has predominantly focused on nonresponsive feeding practices including pressure to eat, instrumental, and emotional feeding (i.e., using food as a reward or to soothe the child), and restriction. In summary, current evidence generally suggests that nonresponsive feeding practices may be detrimental to the development of healthy eating behaviors in children. Pressure to eat appears to be associated with higher consumption of discretionary/snack foods but may be a practice that is used in response to child (low) weight concerns or food-avoidant eating behaviors such as food fussiness. Instrumental and emotional feeding have consistently been associated with emotional eating, food responsiveness, and higher snack food intake. Restricting children's access to unhealthy snack foods appears to lead to greater interest in the restricted food and higher intake if the child is granted access in experimental settings. Finally, although a relatively new construct in the feeding literature, structure-related feeding practices appear to have protective effects on children's eating behaviors.

Future research in this field that utilizes a longitudinal design assesses feeding practices and child eating concurrently, and attempts to ensure the validity of such measures is needed. Observational data that can complement self-report measures of both feeding practices and child eating behavior are one option for ensuring the validity of study findings. It is anticipated that greater understanding of the complex associations between these eating and feeding constructs can assist in improving our knowledge of the modifiable factors that contribute to the development of childhood obesity. These findings may be used in the design of future obesity prevention interventions targeting parental feeding practices.

References

Many parents report that their children are picky eaters, with this behavior peaking at the age of 2–5 years. Some of the most common behaviors of picky eaters include limited dietary variety, neophobia, food refusals, less enjoyment of eating, and sensory sensitivities [Fries et al., unpubl. data], and this can be a source of stress for families during mealtimes.

Parents can influence their children’s mealtime behavior through the feeding practices they use when offering foods. This feeding relationship is a 2-way interaction, with children’s behaviors also affecting the parents’ feeding practices [1]. It is important to evaluate how parents can effectively intervene when encountering difficult eating behaviors in their children and to give them useful alternatives to parenting practices that have been shown to be counterproductive in establishing healthy eating habits.

Parents often give up after a food is refused a few times, but they should be encouraged to keep trying, as children may need to be exposed to a food several times before it is accepted. Different preparation methods change the taste, texture, and appearance of foods, and certain variants may be better accepted by children. Children can also become more familiar with food by cooking together with the caregiver [2] or even playing with food products.

Coercive feeding practices such as the use of pressure to eat should be avoided, as this can create negative associations with the food or meals, and could lead to more food refusals [3, 4]. Instead, one of the most successful ways to convince a child to try a food is for another person to model eating and enjoying it [5]. When families eat meals together and consume the same foods, this provides an excellent opportunity for modeling. Parents who give a reason why the child should taste something, such as by talking about the good taste of the food or its nutritional value,
rather than simply telling them to eat it, may also help children be willing to taste a new food. This practice can also create intrinsic motivation for the child to eat the food in the future, as they will appreciate the food for its own properties (e.g., taste and health benefits), rather than only eating it when they expect an external reward.

Another practice to avoid is using one food as a reward for eating another food, as this can have negative short- [5] and long-term [6] consequences, such as food refusals and decreased liking of the target food. In contrast, non-food rewards, such as praise or stickers, can be used to encourage children to taste a food without creating these negative outcomes [7]. It should be noted that such rewards should be reserved for encouraging children to taste a food, but the child should not be required to finish the food. Using any kind of extrinsic rewards for plate cleaning can override children's internal satiety cues and lead to eventual overeating.

It may be tempting for parents to prepare separate meals for picky eaters, but providing an alternative meal for a child who refuses the food initially offered reinforces the food refusal behavior. Further, if children are regularly provided with a limited range of “accepted” foods, this reduces opportunities for the child to experience new tastes or to have additional exposures to foods that they have not previously accepted. Thus, this behavior can perpetuate the child's limited diet. As some children refuse foods as a way of expressing independence, parents may be able to avoid rejections by providing choices between 2 healthy options, as this allows children to express a preference without saying “no” altogether.

References

What Children Eat in Developing Countries: Diet in the Etiology of Undernutrition?

Christian Jeyakumar Henry

It has been reported that nearly 50% of all deaths in children under 5 years may be attributed to undernutrition [1]. An understanding of what children eat is at the heart of our ability to prescribe an optimal diet for growth, development, and well-being. Undernutrition during the first 1,000 days of life has far-reaching consequences. It is a time when body tissues and brain development are forged, with long-term metabolic consequences. Stunting (short height for a child’s age), underweight (low body weight for age), and wasting (low weight for height) are the 3 commonly measured parameters of undernutrition. Around 25% of all children in low-/middle-income countries are permanently stunted in both their height and cognitive development. Stunting rates are up to 35% in Asia [2]. In fact, of the 34 countries where 90% of all the stunted children live, a significant number are in Asia. This statistic prompts us to reexamine the “the Asian enigma” to describe the lack of clarity on why the prevalence of childhood undernutrition and poor growth is much higher in this region than the rest of the world. An obvious starting point to explore this question is to examine critically what children eat in this region. There are surprisingly little reliable quantitative data on the energy intake in children living in many emerging economies. With increasing number of observational studies from around the world, some generalization can be made. The primary staples given to young children (in Asia and Africa) are largely composed of gruels made from rice, maize, cassava, yam, millet, and sago. These gruels are usually prepared by cooking these starches with water. During the process of cooking, the starch granules swell, gelatinize, and form thick, viscous pastes that are very low in energy density. Fed on such viscous foods, children are unable to consume sufficient feed to meet their energy and nutrient needs [3]. In an attempt to make such feeds acceptable to the infants, mothers may further tend to increase the water content of these porridges. This enables the porridge
to be fed using a drinking cup. However, the further dilution of the porridge with water, although reducing the viscosity, drastically reduces the energy density of the feed. The first challenge in preparing foods with adequate nutrients for growth and maintenance in children is to construct and formulate foods with sufficient energy density, optimal viscosity, and mouthfeel. The opportunities and technical solutions that will enable us to develop foods of high nutrient value and energy for infant feeding will form the first part of this paper.

It is now well recognized that linear growth (height) is significantly influenced by the quality and quantity of protein intake along with the bioavailability of certain micronutrients, notably zinc and other trace elements. A major challenge facing infant feeding in Asia, Africa, and Latin America is the poor quality of protein consumed and the bioavailability of micronutrients. Novel strategies to improve protein quality and enhance bioavailability will be the focus of the final part of the paper. Despite nearly 8 decades of nutrition research on improving child nutrition, many children around the world have poor access to energy and nutrient-rich foods. Modern advances in agriculture, technology, and nutrition will enable us to develop a range of foods that will optimize growth, development, and human well-being.

References

Children’s Eating Behaviors and Energy Intake: Overlapping Influences and Opportunities for Intervention

Ciarán G. Forde, Anna Fogel, and Keri McCrickerd

Early-life factors combine to influence the development of childhood overweight/obesity [1], yet the eating behaviors that support a sustained positive energy balance and unhealthy growth outcomes are less clear. The transition from “risk” to childhood obesity operates largely through the emergence of maladaptive eating behaviors that consolidate during childhood, remain stable, and predict sustained higher energy intakes and adiposity [2]. We examined associations between eating behaviors, energy intake, and body composition among children from the GUSTO cohort (Growing Up in Singapore towards Healthy Outcomes). Measures were collected at 2 time points (4.5 and 6 years) and included premeal portion selection, within-meal coding of oral processing behaviors, and postmeal measures of food responsiveness, which were examined alongside measured parental feeding practices and parent reports of their child’s appetite traits.

Before lunch, children completed portion tasks on a computer, where they rated their appetite and then navigated through a series of food portion images to select their ideal portions of 8 familiar foods. Portions selected in the computer task significantly predicted the portions selected and consumed during a lunchtime meal. Children tended to pick more of foods they reported liking, but also smaller portions of foods they expected to be more filling, independently of whether they were liked. Importantly, the children who selected the largest portions tended to serve and consume a larger portion during the lunchtime meal.

At the 4.5- and 6-year time points, behavioral coding was used to capture each bite, chew, and swallow during the lunch, to subsequently derive a series of oral processing behaviors associated with energy intake (Fig. 1). Children who ate at a faster rate (g/min) took larger bites, chewed less per bite, and consumed more energy at each meal (Fig. 2) [3, 4]. Faster
eating rates at 4.5 years predicted faster eating and higher energy intakes at 6 years, with the same oral processing behaviors driving eating rates at both time points. Children who ate faster at 4.5 years also had higher adiposity at 6 years, emphasizing a role for these behaviors in prospective weight gain. Portion selection and eating rate independently predicted higher energy intakes, but children who chose the largest portions, had the longest meals, and ate at the fastest rates consumed the most energy, highlighting an important overlap in behaviors that contribute to higher energy intakes.

Postmeal child responsivity to palatable food cues was assessed using the EAH paradigm (eating in the absence of hunger), where children were given free access to snacks after they had eaten to fullness. Children who demonstrated EAH consumed more energy cumulatively from lunch and the snack test [5]. This EAH behavior was consistent over time and linked to faster eating rates, highlighting an overlap between behaviors that contribute to higher energy intakes both within and outside the main meals.

Importantly, parents appear to be aware of their child’s appetitive traits, with faster eating and greater intake significantly correlated with higher “food responsiveness” and “enjoyment of food” reported by the
parents in the CEBQ (Child Eating Behavior Questionnaire) [6]. Some parents responded to their child’s behaviors during the meal by using feeding practices more frequently during the meal, particularly among girls. Despite this, children who were prompted more continued to eat quickly and consume more energy [7]. Our findings suggest a bidirectional relationship between parental feeding practices, child eating behaviors, and subsequent weight status.

Fig. 2. Association between eating rate and energy intake during lunch ($r^2 = 0.38; p < 0.001; n = 386,$ adapted from Fogel et al. [3]).

Taken together, these findings highlight that higher energy intakes were consistently associated with a series of overlapping eating behaviors and parental feeding practices that were stable over time and most commonly found in children with highest BMI$_z$ scores. Our findings emphasize the need to go beyond targeting individual eating behaviors to consider the cumulative impact differences in energy selection, consumption, and associated parental feeding practices have on energy intake when developing interventions targeting children at risk of overweight or obesity.
References


FITS and KNHS Overview: Methodological Challenges in Dietary Intake Data Collection among Infants, Toddlers, and Children in Selected Countries

Alison L. Eldridge

FITS (the Feeding Infants and Toddlers Study) began in 2002 as a large-scale national telephone survey to study the eating patterns and nutrient intakes of infants and young children in the USA and was followed in 2008 by a second FITS. Both studies helped to fill a gap in knowledge and confirmed Nestlé’s commitment to understanding dietary patterns among children in these vulnerable age groups.

Building on the FITS model, Nestlé expanded their research program to include older children and launched the KNHS (Kids Nutrition and Health Study) in 2014. Together, FITS and KNHS investigate nutrient intakes, food groups consumed, food sources of nutrients, meal patterns, feeding practices, household demographic factors, and key behaviors related to energy intake and expenditure in infants and children in different countries around the world [1–5].

In each FITS and KNHS country, dietary intake was assessed using trained interviewers and multiple-pass 24-h recalls on 1 or more days (Table 1). The FITS and KNHS used data from national nutrition and health surveys when available. This was the case for KNHS in Australia, China, and the USA, and for FITS and KNHS in Mexico, the Philippines, and Russia. In China and the USA, the national surveys did not include infants or toddlers, so we collected data using similar methods (MING in China and FITS in the USA).

Although many countries with comprehensive national nutrition surveys use dietary recalls for individual-level intake estimations, other aspects of the survey methodology differed considerably. National surveys used in FITS and KNHS have collected data on intake at 1 day (Mexico), 2 nonconsecutive days (Australia, the Philippines, and the USA), or
3 consecutive days of intake (China). In Russia, 2 days of intake data were collected, 1 in spring and 1 in autumn. Food composition tables varied by country, both in number of nutrients and completeness of the databases. Different countries used different age classifications and different food grouping schemes. Not all surveys recorded details about the meals or times when foods were consumed.

To address these issues, a common analysis approach has been applied across all FITS and KNHS countries. The standard analysis evaluates
nutrient intakes by looking at means and distributions of intakes, and compares them with established dietary reference intakes. We evaluate meal patterns, including the percent consuming and skipping different meals and snacks and timing of consumption. Food groups are applied to all foods and beverages reported, and these are used to look at eating patterns, including the complementary feeding transition, and to understand the top sources of energy and nutrients in the diet.

As much as possible, the FITS and KNHS have standardized reporting of age categories (typically 0–5.9, 6–11.9, 12–23.9, and 24–47.9 months, and 4–8 and 9–13 years of age) and food grouping systems so comparisons could be made. Aligning food groups is challenging as the specificity needed for some food groups differs depending on the country. We have supported work to impute nutrient values to complete datasets for nutrients of interest when needed (e.g., total sugar in Mexico and China; fiber, sodium, and total sugar in the Philippines).

In summary, the FITS and KNHS are part of a global Nestlé research initiative to study dietary intakes and related behaviors in infants, toddlers, and children. We have evaluated national survey data where they exist, and when not available, we have conducted our own studies to fill the gaps in knowledge. To address methodological issues, we implemented a common analysis approach, supported work to impute nutrient values to complete food composition databases, and harmonized food grouping systems so comparisons could be made across countries. This overview is accompanied by case studies sharing results from countries that comprise the current FITS and KNHS.

References

**Kids Nutrition and Health Study in China**

Dantong Wang

KNHS (the Kids Nutrition and Health Study) is a global research project focusing on the assessment of children’s dietary intakes and eating behaviors, including nutrient intakes, food patterns, and physical activities. China is one of the countries involved in the study. KNHS China is a collaboration between the China National Institute of Nutrition and Health (NINH; Beijing, China), the University of North Carolina (UNC; Chapel Hill, NC, USA), and the Nestlé Research Center (NRC; Lausanne, Switzerland). Data used in this study were from the 2011 China Health and Nutrition Survey (CHNS).

In the 2011 CHNS, a multistage randomized cluster sampling method was used to recruit participants from 9 provinces and 3 mega cities (Beijing, Shanghai, and Chongqing) representing different geographies and economic development stages, with communities from both urban and rural areas. The KNHS China project focused on children 4–13 years old. In total, dietary intake data from 1,481 children in the age range were analyzed. In some publications, the age range was extended from 4–13 to 4–17 years (1,905 subjects) to provide information on a broader age spectrum. Individual dietary data were collected using 24-h recalls on 3 consecutive days (2 weekdays and 1 weekend day). For children younger than 12 years, the mother or a caregiver who handled food preparation and feeding in the household was interviewed. The interviews were conducted by trained field interviewers with the assistance of food models and pictures. Household edible oils, sugar, and salt consumption were determined on a daily basis by calculating the changes in the home food inventory by weighing [1]. Food recalls were coded and analyzed to calculate nutrient intakes using the Chinese Food Composition Tables published in 2009 [2].

We found that, compared to dietary intake recommendations, Chinese children had low intakes of micronutrients such as calcium and vitamin D. The intake of dietary fiber was low in 97% of children, whereas the intakes of saturated fat and sodium were excessive in 57 and 85% of
children, respectively (Fig. 1). Geographic location and socioeconomic status have an impact on food quality and nutrient intakes. Children from urban areas and from higher-income households were more likely to have higher micronutrient intakes and consume more animal source foods, especially dairy products, than those from rural areas and from lower-income households [3]. We observed the double burden of malnutrition in Chinese children: the prevalence of overweight or obesity in children was higher in urban areas and higher-income families than in rural settings and those from lower-income households [4]. The disparity found in this study suggests that specific strategies are needed to improve diet quality and address nutrient shortfalls in different community types.

We also reported that almost all children had 3 main meals, breakfast, lunch, and dinner, and over 70% of them reported having snacks, which contributed 10% of total daily energy. Children 9–13 years old consumed more salty snacks and less fruits and dairy products than children 4–8 years old did, which deserves attention [5]. Promoting healthy food choices in snacking could contribute to the improvement in nutritional quality of the total diet.

In conclusion, the KNHS China results suggest that a comprehensive approach that includes nutrition education, nutrition intervention
programs targeting vulnerable populations, and promotion of physical activity inside and outside of school is needed to improve the nutrition and health status of Chinese children.

References

Feeding Patterns of Infants and Toddlers: The Mexico Case Study

Salvador Villalpando-Carrión and Alison L. Eldridge

Understanding the feeding patterns of Mexican infants and toddlers has required a large amount of effort due to the lack of recent reliable data. The double burden of obesity and micronutrient deficiency has caused alarm, identifying the need to discover when and how inadequate consumption of nutrients take place in such a diverse country. The types of foods and beverages that children consume have drastically changed in recent years, although there is poor factual knowledge around this matter. Another issue is that many physicians and health care professionals are bystanders in the practice of complementary feeding. There is a national recommendation for the introduction of complementary feeding that serves as a nationwide reference. Breastfeeding is strongly recommended. The national policy is for exclusive breastfeeding for at least 6 months, and introduction of complementary foods should not start before this age.

FITS Mexico (the Feeding Infants and Toddlers Study) was initiated to address the lack of knowledge of the actual feeding patterns of Mexican children. Secondary data analyses from a nationally representative sample of over 5,000 children from ENSANUT 2012 (Encuesta Nacional de Salud y Nutrición – the Mexican National Health and Nutrition Survey) were used to review the feeding and drinking patterns of Mexican children in depth [1–4]. Micronutrient and food sources of nutrients were analyzed. Appropriate and inappropriate foods and beverages were considered at the end point analyses of the feeding patterns. Also, a broad country panel of experts were involved in developing new feeding recommendations according to the FITS findings for healthy infants [5].

Low rates of exclusive breastfeeding were found in infants less than 6 months old [1]. We also reported that 31 and 35% of 6- to 11.9-month-old infants consumed cow’s milk or sugar-sweetened beverages, respectively [2]. Few infants received iron-rich food sources, such as fortified infant cereal or meats. One half of 6- to 47.9-month-old children consumed fruit, but 85% did not consumed vegetables as a distinct serving on the day of the recall. After 12 months of age, over 80% of toddlers...
consumed some type of sweet or sugar-sweetened beverages on any given day. Between 18 and 36% of toddlers did not meet the estimated average requirement for iron, and about 40% did not meet that for zinc. In contrast, more than 30% of toddlers exceeded the tolerable upper intake level of sodium daily [3].

Feeding patterns in Mexican children seem to be established early in life. Food groups consumed with poor micronutrient intakes and high energy consumption might explain the nutritional condition for the Mexican population through all age groups. Regional experts have used this information to set new and more strict recommendations for child feeding [5]. Public policy must change accordingly. Continuous study of feeding patterns in a population, especially in children, will be a powerful tool to monitor health and nutrition status for the whole country.

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The 2016 Feeding Infants and Toddlers Study: Dietary Intakes and Practices of Children in the United States from Birth to 48 Months

Regan Bailey, Shinyoung Jun, and Alison L. Eldridge

The Feeding Infants and Toddlers Study (FITS) is a periodic national cross-sectional survey to examine the diets and feeding practices of US infants and children, with ages categorized to represent important transition times in the diet: younger infants (birth to 5.9 months), older infants (6–11.9 months), toddlers (12–23.9 months), younger preschoolers (24–36.9 months), and older preschoolers (36–47.9 months). FITS 2016 collected dietary data using a 24-h dietary recall \((n = 3,235)\), with a replicate in a representative subsample \((n = 799)\) [1, 2]. Energy, nutrient intakes, and compliance with dietary reference intakes were estimated using the National Cancer Institute method. Infant feeding practices and food group consumption were also assessed by participation in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) that provides food packages to US children <5 years.

**Infant Feeding Practices (Birth to 12 Months).** Initiation and duration of breastfeeding were higher in 2016 compared to previous FITS surveys but remained below public health recommendations. Exclusive breastfeeding varied by race/ethnicity with non-Hispanic White (40%) and Hispanic (36%) (birth to 3.9 months) having significantly higher rates than non-Hispanic Black infants (20%). Transition to complementary foods tended to occur earlier in formula-fed than breastfed infants.

**Energy and Nutrients.** Energy intakes and dietary diversity increased with age; however, vitamins D and E were low in all age groups. Nutrient intakes of the younger infants were largely adequate except for iron among older infants, with 18% of those 6–11.9 months below the estimated average requirement. After 12 months, few exceed the adequate intake for fiber and potassium: 3 and 3% among toddlers; 9 and 6% among younger preschoolers; and 8 and 4% among older preschoolers, respectively. Concerns exist about excessive intakes of retinol and zinc with estimates ranging from
32 to 49% for retinol and from 41 to 69% for zinc above the upper intake level. Among preschoolers, more than 70% exceeded the upper intake level for sodium and >60% exceeded the saturated fat recommendations.

**Foods and Beverages.** These nutrient imbalances noted in FITS 2016 are likely the result from lower-than-recommended intakes of vegetables and whole grain foods and higher-than-recommended intakes of sugar-sweetened beverages and savory snacks. Iron-rich infant cereal was consumed by about one-half of those 4–12 months old. Close to 20% of toddlers and preschoolers did not consume cow’s milk, an excellent source of vitamin D and calcium, while all in this age group consumed grains; 40% did not consume whole grains. Fruit consumption was adequate across all groups, but vegetable intakes were lower and comprised primarily fried potatoes. After 12 months, all children exceeded energy recommendations from added sugars, primarily coming from sweet bakery foods, sugar-sweetened beverages, and candy. High sodium intakes were associated with processed meats and savory snacks.

**Women, Infants, and Children.** WIC reaches 51% of US infants and about 30% of children 1–5 years. WIC eligibility is based on income; foods provided are tailored to meet age-specific nutrient needs. WIC infants were less likely to be breastfed than higher-income children; however, mean micronutrient intakes were higher for WIC infants possibly due to consumption of fortified infant formula. WIC preschoolers had a lower risk of inadequate vitamin D than income-eligible nonparticipants. High intakes of sodium, added sugars, and sweetened beverages were especially of concern among WIC participants [3].

**Conclusion.** The dietary intakes of US infants (<12 months) were nutritionally adequate, with exceptions noted for iron (6–11.9 months). However, starting at 12 months, we observed higher-than-recommended intakes of sodium, added sugars, saturated fat, retinol, and zinc combined with low intakes of potassium, fiber, vitamin D, and vitamin E. Shifting dietary patterns to enhance whole grains, fruit, vegetables, and low-fat dairy while limiting processed meats, sources of added sugars, and savory snacks would help align nutrient intakes with guidelines.

**References**

Usual Energy and Nutrient Intakes and Food Sources of Filipino Children Aged 6–12 Years from the 2013 National Nutrition Survey

Imelda Angeles-Agdeppa, Liya Dinney, and Mario V. Capanzana

It is important to assess the food intake of children aged 6–12 years in order to possibly link this with other nutrition-specific interventions to address malnutrition [1]. This study evaluated usual energy and nutrient intakes and food sources of school-age children in the Philippines. Data were from the 2013 National Nutrition Survey. A total of 6,565 children 6–12 years old from all sampled 8,592 households were interviewed for first-day 24-h dietary recall. A second-day recall was obtained from a random subsample (50% of the children). Usual energy and nutrient intakes were estimated using the PC-SIDE program [2]. Energy inadequacy was compared with estimated energy requirements considering active physical activity. Macronutrients were evaluated using the acceptable macronutrient distribution ranges. Micronutrient inadequacy was computed using the estimated average requirements (EAR) cutoff point method [3].

Results showed that mean energy intake (1,358 kcal) of all children was 24.6% below the estimated energy requirements. Forty-two percent had total fat intake as percentage of total energy below the lower range of acceptable macronutrient distribution ranges (AMDR), and hence most of the energy was provided by carbohydrates (Table 1). About 16% of children had protein intake below the EAR [4]. The mean intakes of total sugar and dietary fiber were 26.8 and 6.9 g/day, respectively (Table 1).

The prevalence of inadequate total fat intake as percent energy intake was especially high in rural areas (60%). In children from the poorest quintile, a higher proportion did not meet the AMDR for total fat (80%), while 14% of the children from the richest quintile exceeded the AMDR. Furthermore, 36% of children from the poorest quintile exceeded the AMDR for carbohydrates (Table 1).

The vitamin with the highest prevalence of inadequacy was vitamin C (81%). Nutrient inadequacy for other vitamins was: folate (70%),
riboflavin (67%), and vitamin A (63%), vitamin B₆ (30%), niacin (13%), and vitamin B₁₂ (9%). The average intakes of vitamins D and E were 2.2 µg/day and 2.6 mg/day, respectively, and these were very low compared with the recommendations [4]. A high prevalence of inadequacy was also observed for calcium (93%), iron (87%), phosphorus (48%), and zinc.
Table 2. Percentage contributions of the top 10 food groups to selected macro- and micronutrient intakes among Filipino school-age children

<table>
<thead>
<tr>
<th>Food groups</th>
<th>Percent contribution to total daily intake</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>macronutrients</td>
</tr>
<tr>
<td></td>
<td>energy</td>
</tr>
<tr>
<td>Rice</td>
<td>52.7</td>
</tr>
<tr>
<td>Bread</td>
<td>4.4</td>
</tr>
<tr>
<td>Pork</td>
<td>4.1</td>
</tr>
<tr>
<td>Noodles</td>
<td>3.2</td>
</tr>
<tr>
<td>Fish and shellfish</td>
<td>3.0</td>
</tr>
<tr>
<td>Sausages/luncheon meats</td>
<td>3.0</td>
</tr>
<tr>
<td>Fats and oils</td>
<td>–</td>
</tr>
<tr>
<td>Poultry</td>
<td>1.7</td>
</tr>
<tr>
<td>Cakes</td>
<td>1.5</td>
</tr>
<tr>
<td>Cookies</td>
<td>1.5</td>
</tr>
<tr>
<td>Banana snacks (with sugar and fried)</td>
<td>–</td>
</tr>
<tr>
<td>Beans</td>
<td>–</td>
</tr>
<tr>
<td>Chocolate/-flavored beverages</td>
<td>–</td>
</tr>
<tr>
<td>Crackers</td>
<td>–</td>
</tr>
<tr>
<td>Dark green leafy vegetables</td>
<td>–</td>
</tr>
<tr>
<td>Deep yellow vegetables</td>
<td>–</td>
</tr>
<tr>
<td>Eggs and egg dishes</td>
<td>–</td>
</tr>
<tr>
<td>Fruit-based beverages (powdered)</td>
<td>–</td>
</tr>
<tr>
<td>Fruits</td>
<td>–</td>
</tr>
<tr>
<td>Milk</td>
<td>–</td>
</tr>
<tr>
<td>Other sweetened beverages (tea)</td>
<td>–</td>
</tr>
<tr>
<td>Other vegetables</td>
<td>–</td>
</tr>
<tr>
<td>Potato chips</td>
<td>–</td>
</tr>
<tr>
<td>Soft drink</td>
<td>–</td>
</tr>
<tr>
<td>Starchy vegetables</td>
<td>–</td>
</tr>
<tr>
<td>Sugar</td>
<td>–</td>
</tr>
</tbody>
</table>
(38%). Usual intake of sodium, magnesium, and potassium were 848, 130, and 853 mg/day, respectively. The mean intake of sodium exceeded the requirement, while the intake of potassium and magnesium were below the requirement (Table 1).

Refined rice is the major source of energy, carbohydrates, and protein providing 53, 67, and 35% of total intake, respectively (Table 2). Rice also contributed a large amount of phosphorous (48%), iron (28%), calcium (20%), thiamine (32%), and riboflavin (17%). Another major contributor of calcium intake was fish and shellfish (21%). The major sources of fats are pork, sausages, and oils. The major source of vitamin C is fortified fruit-based drinks. Dark green leafy vegetables were the major source of vitamin A (34%). Bread was a major source of folate, contributing 17% (Table 2).

Applying usual intake analysis in Filipino children, this study demonstrated that the intakes of fat and many micronutrients were markedly inadequate as evidenced by a high prevalence of inadequate intakes of fat and most vitamins and minerals. The shortfalls in nutrients can be largely explained by the high intake of refined rice, which is the major source of many key nutrients, while nutrient-dense foods such as milk, fruits, and vegetables played little role in the diet. The results are informative to nutrition policy and education both for parents and health care professionals, and could be used for the development of various public health strategies to improve diet quality and address nutrient shortfalls in the diets of this population.

References

Rapid socioeconomic growth has led to nutrition and health transition in Malaysia. Childhood obesity has become a major concern. The findings from 2 nationwide studies, namely, SEANUTS Malaysia (the South East Asian Nutrition Survey of Malaysian Children) [1] and the MyBreakfast study [2] showed that between 13 and 17% of school children aged between 6 and 12 years were either overweight or obese, with similar prevalence in both urban and rural areas. These studies showed that overweight and obesity problems among Malaysian children should be of concern, as 3 in 10 children are either overweight or obese, irrespective of the areas where they reside.

Table 1 shows the prevalence of children not achieving the recommended nutrient intake (RNI) for selected macro- and micronutrients. The mean energy intake of the children ranged from 1,800 to 1,900 kcal/day. The majority of the children in both studies (SEANUTS Malaysia [1] and MyBreakfast study [2]) achieved the Malaysian RNI for energy and protein; however, at least two-thirds of the children did not achieve the RNI for calcium. About 9 in 10 children did meet the RNI for vitamin D in the MyBreakfast study [2]. These findings are worrying as both calcium and vitamin D are important nutrients for bone health.

In the MyBreakfast study, breakfast was defined as the first eating occasion after an overnight sleep until 10 a.m. on weekdays and 11 a.m. on weekend days [2]. In the MyBreakfast study, the prevalence of breakfast skippers (ate breakfast 0–2 days/week) and irregular breakfast eaters (ate breakfast 3–4 days/week) was 9.3 and 10.8%, respectively, while 79.9% were found to be regular breakfast eaters (ate breakfast 5–7 days/week) [2]. In the SEANUTS Malaysia, breakfast was defined as the first eating occasion consumed by the children before 10 a.m., and irregular breakfast eaters were defined as children who skipped breakfast on a daily basis [3]. Table 2 shows the distribution of breakfast consumption among primary school children in the SEANUTS Malaysia and the MyBreakfast study.
Table 1. Prevalence of Malaysian primary school children (6–7 to 12 years) not achieving the RNI of selected macronutrients and micronutrients

<table>
<thead>
<tr>
<th>Area</th>
<th>Nutritional status</th>
<th>Boys</th>
<th>Girls</th>
<th>All</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>SEANUTS Malaysia [4]</strong></td>
<td></td>
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<tr>
<td>Urban</td>
<td>n</td>
<td>558</td>
<td>615</td>
<td>1,173</td>
</tr>
<tr>
<td></td>
<td>Energy, %</td>
<td>39.7</td>
<td>31.7</td>
<td>35.7</td>
</tr>
<tr>
<td></td>
<td>Protein, %</td>
<td>0.6</td>
<td>1.2</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>Calcium, %</td>
<td>63.4</td>
<td>66.6</td>
<td>65.0</td>
</tr>
<tr>
<td></td>
<td>Iron, %</td>
<td>12.8</td>
<td>10.1</td>
<td>11.5</td>
</tr>
<tr>
<td></td>
<td>Vitamin C, %</td>
<td>13.4</td>
<td>8.9</td>
<td>11.2</td>
</tr>
<tr>
<td></td>
<td>Vitamin A, %</td>
<td>4.3</td>
<td>3.1</td>
<td>3.7</td>
</tr>
<tr>
<td></td>
<td>Vitamin D, %</td>
<td>52.0</td>
<td>52.6</td>
<td>52.3</td>
</tr>
<tr>
<td>Rural</td>
<td>n</td>
<td>388</td>
<td>408</td>
<td>796</td>
</tr>
<tr>
<td></td>
<td>Energy, %</td>
<td>40.8</td>
<td>36.8</td>
<td>38.9</td>
</tr>
<tr>
<td></td>
<td>Protein, %</td>
<td>1.2</td>
<td>1.7</td>
<td>1.4</td>
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<td>Calcium, %</td>
<td>66.2</td>
<td>74.8</td>
<td>70.3</td>
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<td></td>
<td>Vitamin A, %</td>
<td>10.2</td>
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<td>9.9</td>
</tr>
<tr>
<td></td>
<td>Vitamin D, %</td>
<td>59.9</td>
<td>66.7</td>
<td>63.2</td>
</tr>
<tr>
<td>All</td>
<td>n</td>
<td>946</td>
<td>1,023</td>
<td>1,969</td>
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<tr>
<td></td>
<td>Energy, %</td>
<td>40.2</td>
<td>33.7</td>
<td>36.9</td>
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<tr>
<td></td>
<td>Protein, %</td>
<td>0.8</td>
<td>1.4</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>Calcium, %</td>
<td>64.6</td>
<td>69.8</td>
<td>67.1</td>
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<td></td>
<td>Vitamin C, %</td>
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<td>11.8</td>
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<td>Vitamin A, %</td>
<td>6.7</td>
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<td>6.1</td>
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<tr>
<td></td>
<td>Vitamin D, %</td>
<td>55.2</td>
<td>58.2</td>
<td>56.7</td>
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<tr>
<td><strong>MyBreakfast Study [5]</strong></td>
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</tr>
<tr>
<td>Urban</td>
<td>n</td>
<td>638</td>
<td>797</td>
<td>1,435</td>
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<tr>
<td></td>
<td>Energy, %</td>
<td>13.6</td>
<td>12.2</td>
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</tr>
<tr>
<td></td>
<td>Protein, %</td>
<td>0.2</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Calcium, %</td>
<td>55.0</td>
<td>62.1</td>
<td>59.0</td>
</tr>
<tr>
<td></td>
<td>Iron, %</td>
<td>1.4</td>
<td>0.6</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Vitamin C, %</td>
<td>34.3</td>
<td>33.9</td>
<td>34.1</td>
</tr>
<tr>
<td></td>
<td>Vitamin A, %</td>
<td>8.5</td>
<td>8.9</td>
<td>8.7</td>
</tr>
<tr>
<td></td>
<td>Vitamin D, %</td>
<td>94.4</td>
<td>93.0</td>
<td>93.6</td>
</tr>
<tr>
<td>Rural</td>
<td>n</td>
<td>242</td>
<td>428</td>
<td>670</td>
</tr>
<tr>
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<td>Energy, %</td>
<td>12.4</td>
<td>13.6</td>
<td>13.1</td>
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<td></td>
<td>Protein, %</td>
<td>0.0</td>
<td>0.2</td>
<td>0.1</td>
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<tr>
<td></td>
<td>Calcium, %</td>
<td>58.3</td>
<td>67.1</td>
<td>63.9</td>
</tr>
<tr>
<td></td>
<td>Iron, %</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>Vitamin C, %</td>
<td>42.6</td>
<td>46.7</td>
<td>45.2</td>
</tr>
<tr>
<td></td>
<td>Vitamin A, %</td>
<td>7.0</td>
<td>8.9</td>
<td>8.2</td>
</tr>
<tr>
<td></td>
<td>Vitamin D, %</td>
<td>94.6</td>
<td>95.3</td>
<td>95.1</td>
</tr>
<tr>
<td>All</td>
<td>n</td>
<td>880</td>
<td>1,225</td>
<td>2,105</td>
</tr>
<tr>
<td></td>
<td>Energy, %</td>
<td>13.3</td>
<td>12.7</td>
<td>12.9</td>
</tr>
<tr>
<td></td>
<td>Protein, %</td>
<td>0.1</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Calcium, %</td>
<td>55.9</td>
<td>63.8</td>
<td>60.5</td>
</tr>
<tr>
<td></td>
<td>Iron, %</td>
<td>1.0</td>
<td>0.4</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td>Vitamin C, %</td>
<td>36.6</td>
<td>38.4</td>
<td>37.6</td>
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<tr>
<td></td>
<td>Vitamin A, %</td>
<td>8.1</td>
<td>8.9</td>
<td>8.6</td>
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<tr>
<td></td>
<td>Vitamin D, %</td>
<td>94.4</td>
<td>93.8</td>
<td>94.1</td>
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</tbody>
</table>
A total of 65.2% of children in the SEANUTS Malaysia consumed breakfast daily. Regular breakfast eaters were found to have higher intake of calcium and vitamins A, C, and D than irregular breakfast eaters [3]. Analysis of 2-day dietary recalls from the MyBreakfast study showed that 17.7% of the children consumed ready-to-eat cereal (RTEC) at breakfast, while among non-RTEC consumers, bread (44.2%), eggs (31.8%) and nasi lemak (23.9%) were the most common foods consumed at breakfast [4]. RTEC was found to be the major contributor of whole grain (68.6%), followed by hot cereal (18.6%), biscuits (8.7%), and bread (1.8%) [5]. It was also shown that only 1.0% of Malaysian children achieved the 43 g/day of whole grain intake recommendation in the Malaysian Dietary Guideline (MDG) for children and adolescents.

In the SEANUTS Malaysia, among children aged 7–9 years (n=890), only 13.4 and 9.5% met the MDG for fruits and vegetables per day, respectively. The pattern was similar among the older children aged 10–12 years (n=883), although slightly higher, whereby only 19.6 and 16.1%, respectively, met the MDG for fruits and vegetables. For the milk group, only very low percentages (5.5%) of children aged 7–9 years and among those aged 10–12 years (3.7%) met the MDG for milk/dairy products [4]. Despite the low milk drinking habits, the MyBreakfast study showed that UHT (ultra-heat-treated) milk was commonly consumed at breakfast among RTEC consumers [5]. Thus, the consumption of RTEC at breakfast can promote milk consumption among the children and, subsequently, may increase the prevalence of children meeting the MDG for milk/dairy products.

<table>
<thead>
<tr>
<th>Table 2. Breakfast consumption among primary school children in Malaysia: the SEANUTS Malaysia [10] and MyBreakfast Study [9]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Breakfast consumption</strong></td>
</tr>
<tr>
<td><strong>SEANUTS Malaysia [10]</strong></td>
</tr>
<tr>
<td>Children (2–12 years old), n</td>
</tr>
<tr>
<td>Regular breakfast eaters, % (ate breakfast daily)</td>
</tr>
<tr>
<td>Irregular breakfast eaters, % (non-daily breakfast)</td>
</tr>
<tr>
<td><strong>MyBreakfast Study [9]</strong></td>
</tr>
<tr>
<td>Children (6–12 years old), n</td>
</tr>
<tr>
<td>Breakfast skippers, % (ate breakfast 0–2 days/week)</td>
</tr>
<tr>
<td>Irregular breakfast eaters, % (ate breakfast 3–4 days/week)</td>
</tr>
<tr>
<td>Regular breakfast eaters, % (ate breakfast 5–7 days/week)</td>
</tr>
</tbody>
</table>
References

The value of regular breakfast intake for nutrition, health, and well-being is widely recognized. Data exist, with varying degrees of confirmation, that a regular breakfast intake may help in body weight management, in cognitive function, and in cardiometabolic health. Regular breakfast consumers also enjoy a more optimal total daily intake of nutrients compared to breakfast skippers. A critically important question that must be addressed by policy makers is the approach to defining an optimal breakfast. Such a definition would involve the enumeration of quantitative nutrient guidelines which should transcend geographic patterns and ensuing food-based dietary guidelines that would reflect local foods and gastronomic customs.

Most governments that have issued standards for optimal breakfasts have done so in the context of food groups such as cereals, breads, fruits, and fruit juices, dairy produce, and pulses. None have based their recommendations on any underlying objective evidence derived from any analysis of existing breakfast patterns. Two countries, the USA and Mexico, have issued statutory guidelines on nutrient and food choices for optimal breakfasts in schools. In both cases, the nutrient recommendations are simply energy-adjusted targets based on prevailing dietary guidelines for adults. Moreover, neither enumerates specific targets for micronutrients and neither do they elaborate on the evidence base for the targets set for food intakes to achieve these nutritional guidelines. In the UK, a voluntary nutrient standard for school meals recommends a universal figure of 20% of daily intake based on the frequently observed finding that breakfast supplies about 20% of daily energy intake. The reality is that the intakes of many desirable nutrients, the minerals and vitamins in particular, contribute far more than 20% to total daily intake.

Cluster and principal component analyses have been used to identify patterns of breakfast food intake. These studies have frequently allowed the intakes of nutrients of different breakfast food clusters to be described in terms of their contribution to both breakfast nutrients and to overall
daily nutrients. What is clear from an analysis of some of these data is that intake of nutrients across clusters of breakfast foods is very large compared to the variation that exists for the same clusters as regards total daily intake. In simple terms, good breakfast patterns do not automatically lead to optimal daily nutritional patterns. Equally, poor quality of breakfast nutrients does not determine a poor overall daily nutritional pattern.

One approach which is currently being examined by the International Breakfast Research Initiative is to assign each individual in a national survey with a value for their nutrient-rich food (NRF) index. The NRF index measures dietary quality for both macro- and micronutrients and has been extensively used across the globe to provide a quantitative score of overall dietary quality. For each of 6 national surveys (Canada, Denmark, France, Spain, UK, and USA), tertiles of NRF scores are created, indicating increasing overall energy-adjusted dietary quality. The intake of foods and nutrients for each individual at breakfast is computed for each of the 3 NRF tertiles. This approach is to be explored to establish if optimal breakfast nutrient targets can be defined. As regards food-based dietary guidelines, these will alter across different gastronomic traditions, but some critically important points need to be noted before food advice for breakfasts is issued. The average population intake of a food is a function of 2 elements: the percentage of the population consuming the food and the mean intake of the food among consumers of that food. The average intake of yogurt across NRF tertiles is constant for yogurt consumers. However, as NRF scores improve, more people eat yogurt. This approach is essential for public health nutrition in improving breakfast food choice toward achieving an optimal nutrient intake.
The Importance of Dietary Protein at Breakfast in Childhood

Leonidas Karagounis

Proteins (derived from the Greek word πρώτος [protos] meaning “first one” or “most important one”) are the major functional and structural components of all the cells of the body and participate in virtually all biological processes occurring in the body. Protein provides amino acids to the body that are used to build and maintain bones, muscles, and skin, and to produce molecules with important physiological roles, such as enzymes, hormones, neurotransmitters, and antibodies. To this end, dietary protein intake is imperative in child nutrition because, unlike adults, children are in a state of ongoing growth with nutrition and exercise being the most potent stimulators of physical growth and development [1–3]. To support normal growth and this activity-induced augmentation of lean mass, adequate dietary protein ingestion is important for providing the requisite substrates to support the remodeling and growth of these lean tissues, including muscles [1]. Skeletal muscle is the most abundant tissue in the body comprising 40–50% of body mass in humans and making up a large component of the overall lean tissue component. Beyond locomotion, skeletal muscle plays a key role in central metabolism and is responsible for about 60–70% of total glucose uptake and, therefore, directly impacting metabolic health [4]. Skeletal muscle as well as the whole body protein pool is highly metabolic and undergoes rapid diurnal turnover, a process that is intricately regulated by the balance between the rates of protein synthesis and degradation. The increase in whole body protein balance is an important adaptive response to both contractile activity (i.e., exercise) and nutrient availability (i.e., protein ingestion) [4].

In terms of nutrient availability, current research supports the concept of nutrient timing intake. For example, the diurnal turnover of whole body protein which in turn impacts whole body protein balance (Fig. 1) may to some extent be dictated by specific need states where macronutrient intake such as protein and carbohydrates may be imperative to support healthy physical growth and development. Specifically, similar to
adults, a typically observed overnight fast in children (i.e., a ~10-h overnight fast) has recently been shown to result in a physiological state of increased catabolism as measured by increased rates of whole body protein breakdown. It is, thus, important that specific amounts of macronutrients be consumed at breakfast in order to attenuate such losses in whole body protein, which, therefore, provide an environment that supports healthy physical growth and development. The consumption of both carbohydrates and proteins seems to be important since both components contribute to the attenuation of whole body protein breakdown and the stimulation of whole body protein synthesis, which ultimately results in increased rates of whole body protein balance. Specifically, consuming as little as 7 g of milk protein as part of a CHO-containing breakfast seems to be sufficient to promote a positive net protein balance which persists up to 9 h following breakfast consumption when habitual diet and activity are controlled. Future research utilizing long-term studies is ultimately required to validate whether or not the benefits observed in the short term are translated into long-term benefits in terms of promoting increased lean tissue mass and, consequently, favorable body compositions in healthy active children.

References

Breakfast Consumption versus Breakfast Skipping: The Effect on Nutrient Intake, Weight, and Cognition

Carol E. O’Neil and Theresa A. Nicklas

Foods consumed at the breakfast meal are culturally different, but to most individuals, when they hear the local word for “breakfast,” it is understood what is meant. However, for researchers, nutrition educators, and nutrition policy makers there is no standard definition of breakfast, breakfast consumers, or breakfast skippers. This hinders interpretation of individual articles and makes it difficult to compare the literature. It has also led to conflicting results, compounding the difficulty for educators and policy makers to make recommendations for what to consume at breakfast.

Breakfast has also been heralded as the “most important meal of the day,” not only because it is for most people the first major eating episode after the longest period without eating, but because it has been championed as a meal that contributes significantly to nutrient intake, can be used to lose weight or maintain a weight loss, and improve cognition and school performance in children. But is it the most important meal? There are two considerations here – what does “important” mean? Again, there is no definition. Further, how does the contribution of the breakfast meal to nutrient intake, weight management, or cognition compare with other meals and snacks? Breakfast has been intensively studied – lunch, dinner, and snacks, less so.

How breakfast consumption or breakfast skipping is defined influences the results of studies. In general, nutrient intake and diet quality is better if breakfast is consumed. Weight and weight management also depends on the type of breakfast consumed. It has been demonstrated clearly that the type of breakfast consumed affects nutrient intake, diet quality, and weight; therefore, a simple definition of “breakfast” does not significantly add to the literature. Less well defined is the role breakfast plays in the cognition of students. Although accepted as fact, results evaluating acute and chronic consumption of breakfast and cognition
are equivocal. Systematic reviews and one carefully conducted clinical trial have suggested that there is no association between consumption of breakfast and cognition in school-age children.

More carefully controlled studies that use a standardized definition of breakfast consumption and breakfast skipping are needed to determine the effects of nutrient intake, health parameters, and academic performance. In addition, equivalent studies of the lunch and dinner meals are also needed, before it can be determined if “breakfast is the most important meal of the day.”

**Suggested Reading**


Breakfast has been claimed to improve cognitive function and academic performance, leading to the provision of breakfast initiatives by public health bodies. Children may be particularly sensitive to the nutritional effects of breakfast due to greater energetic needs compared to adults. However, there is a lack of acute intervention studies assessing what type of breakfast is optimal for cognitive performance. Dietary carbohydrates are of interest as they provide the main source of energy for the brain's metabolic functioning, and there is mechanistic evidence linking postprandial glycemia to cognitive performance in both children and adult populations [1]. Therefore, when considering what type of breakfast may be beneficial, the rate at which breakfast increases and maintains blood glucose, i.e., “the glycemic index” (GI) might be an important factor. Related to this is the concept of glycemic load (GL), which takes the amount of carbohydrates consumed into account. A review of studies investigating the optimal rate of glucose supply following breakfast consumption suggests that a lower postprandial glycemic response may be protective against a decline in cognitive performance over the morning. More specifically, findings to date suggest that beneficial effects of a low-GI or -GL breakfast are usually observed later in the morning. In terms of aspects of cognition, a low-GI or -GL breakfast was most consistently associated with beneficial effects on attention, but beneficial effects in memory and executive function have been observed [2]. Although the evidence to date is promising, it is currently insufficient to allow firm and evidence-based recommendations. What limits our ability to draw conclusions from previous findings is that the studies have differed widely with respect to subject characteristics (age, sex, and habitual breakfast consumption), cognitive tests used, and timing of cognitive assessment. In addition, few studies have profiled glycemic response in children [3, 4]. There is, therefore, an urgent need for
hypothesis-driven, randomized, controlled trials that evaluate the role of different glycemic manipulations on cognition. These should incorporate cognitive tasks that are sensitive to nutritional manipulations but also relevant to the specific learning situation encountered. Moreover, for future studies, multiple assessments at various time points, including baseline assessment and testing in the later period of the morning, are necessary to reveal the effects and time course of glycemic effects on cognition. Furthermore, there is a clear lack of intervention studies that employ ecologically valid research conditions, such as school-based testing. In addition, more data are needed in terms of the glycemic response to breakfast manipulation in children. These will also help to clarify the nature of the relationship between postprandial blood glucose concentrations and cognition (see Fig. 1 for important conceptual and methodological considerations when carrying out research into the effects of breakfast on cognition). Understanding the potential influence of breakfast interventions on children’s cognitive function remains a high priority given its application to learning and achievement at school. To date, the evidence is insufficient to allow firm conclusions as to what type of breakfast is most beneficial, but low-GI or -GL breakfasts which result in a lower postprandial glycemic response might be a promising strategy to optimize performance across the morning. However, further work is needed to substantiate this notion.

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The prevalence of childhood obesity has significantly increased worldwide over the past 40 years in nearly all of 200 countries studied [1]. Currently, approximately 50 million girls and 74 million boys, aged 5–19 years, are obese. Although comparable global statistics are not available, nationally representative studies from the United States report that about 8.0% of infants and young children ≤2 years of age have anthropometric values ≥95th percentile of weight-for-length. Overweight and obesity are realized in even greater proportions among some groups of infants and young children [2]. The World Health Organization [3] recommends that a multifaceted approach should be taken for obesity prevention and that interventions in early life, when biology is most “plastic” and amenable to change, are likely to have the greatest positive sustained effects. Despite the rise in obesity prevalence, globally, more children are underweight than obese. In 2016, approximately 75 million girls and 117 million boys were moderately or severely underweight. Many regions of the world continue to deal with the double burden of rising obesity with persistent malnutrition and consequent stunting in infancy and childhood. While access to a safe food supply remains a factor in parts of the world, nutrition education remains paramount in improving the health of these populations.

**Nutrition Education: Definition and Features**

While there may be no international standard definition, the Society for Nutrition Education and Behavior adopted a definition of nutrition education as: “any combination of educational strategies, accompanied by environmental supports, designed to facilitate voluntary adoption of food choices and other food and nutrition related behaviors conducive to health and well-being and delivered through multiple venues, involving activities at the individual, institutional, community, and policy levels.
Embedded within is the explicit distinction that nutrition education is not synonymous with the provision of nutrition information. Instead, comprehensive nutrition education strategies require actionable behaviors that individuals readily choose to achieve an intended effect.

**Components of Interventions for Healthy Growth Consistent with a Nutrition Education Approach**

Factors associated with healthy growth of infants and young children have previously been identified [5]. In addition to optimizing maternal health and lifestyle in preparation for pregnancy, some modifiable and actionable dietary and feeding-related behaviors have been included in a limited number of interventions (Table 1). Assessment of behavioral mediators, defined as underlying determinants that precede adoption of behaviors, is critical to nutrition education intervention success. Often, the resultant potential mediators included attitudes, beliefs, self-efficacy, social norms, skills, knowledge, and environmental constraints that influence whether or not a target behavior is adopted.

Evidence indicates that nutrition education strategies and interventions, likely to benefit participants, are guided by a theory of healthy behavior. The most frequently reported theories utilized with success include: Social Cognitive Theory, including promotion of self-efficacy, Theory of Planned Behavior, and the Health Belief Model. An educational approach rooted within anticipatory guidance, as a method to proactively
deliver components of culturally appropriate behavioral messages to parents/caregivers during the period just prior to when the issue would be developmentally relevant to the infant or child has a strong theoretical rationale.

For maximum scalability, consideration of the delivery format of nutrition education interventions requires careful assessment. At present, randomized clinical trials that have included multiple intervention components during the first 1,000 days with outcomes related to growth of infants or young children are primarily clinic- or home-based. Although mHealth or digital interventions document encouraging results, results from multicomponent intervention trials with infants or young children addressing the prevention of excess weight gain, healthy growth, or measures of adiposity in scale-up interventions are limited.

References

Nutrition Education during the Preconception Period

Usha Ramakrishnan

Women’s nutrition, starting from infancy through the school-age years, early adulthood, during pregnancy and lactation, and between pregnancies has the potential to affect the health and well-being of the next generation. Nutrition education and counseling (NEC) during pregnancy has been associated with significantly improved pregnancy outcomes; however, the overall quality of the evidence is low. Further, nutrition during the peri-conceptual period may play a crucial role, and practices prior to conception may influence the dietary habits. Observational studies support the importance of nutrition during the peri-conceptual period for improving maternal and child outcomes, but evidence from intervention studies is limited. The most well-known example is the benefits of preconceptional folic acid supplementation to reduce the risk of neural tube defects. The primary studies that evaluated the preconception interventions such as supplementation and/or fortification with micronutrients, cash transfers or incentives, and behavior change approaches to improve dietary intakes and maternal nutritional status prior to conception have mixed findings, and NEC is often included as part of the above approaches and/or included in health promotion packages targeted towards women of reproductive age including adolescent girls and/or young adults. A few studies have evaluated the preconception NEC primarily in developed countries, and qualitative studies from poor resource settings suggest that issues such as food insecurity/access need to be addressed along with NEC.

Adolescence is a critical period for physical and psychological growth and development, and it is advisable to track health and nutrition behaviors from adolescence to adulthood. There are examples of case studies and/or subnational programs that have been implemented as part of anemia prevention strategies targeting adolescent girls in countries such as Egypt and India. These programs typically combined NEC with the distribution of iron-folate supplements using different delivery platforms and were found to be successful in reducing the burden of
anemia. There are also examples of school-based programs from Mexico and the US that promote healthy lifestyles by delivering messages to increase physical activity, dietary diversity, and/or reduce the consumption of sugar-sweetened beverages as part of ongoing efforts to reduce the burden of overweight and obesity and other non-communicable diseases such as diabetes which is increasing worldwide and associated with poor pregnancy outcomes.

Reaching young adults is a great challenge, especially in settings where girls are out of school. Efforts to integrate NEC along with the provision of reproductive health services such as family planning and post-partum care in healthcare settings, work-site programs or other innovative platforms including social media are needed. The findings of a large, cluster-randomized controlled trial, evaluating life skills building education provided bimonthly along with the provision of twice weekly MMP supplementation to improve the health and nutritional status of adolescent and young women (15–24 years) in Matiari District, Pakistan is of great interest in this context. The primary outcome is anemia along with other measures of nutritional status and psychosocial well-being. Targeting newlywed couples is another approach that has a lot of potential for delivering NEC, which could be effective in improving preconception health and nutrition and/or delaying age at first birth. There are examples of newlywed programs in Bangladesh, Indonesia, India, and Malawi but these typically include information regarding family planning services and/or health seeking and promotional messages to reduce the risk of HIV and other sexually transmitted diseases. In summary, there is increased global awareness for the need to promote preconception care but further work is needed to carefully develop, implement, and evaluate cost-effective preconception care packages that include NEC using different approaches and delivery platforms, such as schools, health facilities, daycare centers, and/or worksites.
Prenatal Nutrition Education: Updates and Best Practices for Optimal Diet and Weight Gain during Pregnancy

Anna Maria Siega-Riz and Leeza Constantoulakis

Maternal nutrition plays a critical role in establishing the course of pregnancy and the health of the mother and child at birth and beyond. Current work in the examination of diet with health outcomes focuses on dietary patterns because of the inherent inter-correlation between nutrients and food groups. Recently, the U.S. Department of Agriculture (USDA) and the U.S. Department of Health and Human Services (HHS) initiated the Pregnancy and Birth to 24 Months Project to examine diet-related topics of public health importance during pregnancy, infancy, and toddlerhood [1]. Four systematic review (SR) questions assessed how dietary patterns before and during pregnancy relate to outcomes in mothers and their offspring during the period January 1980 to January 2017 [2]. These outcomes included gestational diabetes (GDM), hypertensive disorders during pregnancy (HDP) (i.e., gestational hypertension, pre-eclampsia, and eclampsia), birth weight, and gestational age (preterm birth, PTB). Evidence on the relationship between diet during pregnancy and GDM was mixed and considered insufficient to draw a conclusion. Five articles examined the association with HDP; the evidence in this review was found to be limited in support of an association between dietary patterns higher in vegetables, fruits, whole grains, nuts, legumes, fish and vegetable oils and lower in meats and refined grains and a reduction in the risk of HDP. For the outcome of PTB, more consistent evidence was found with 5 of the 8 studies that examined the relationship between dietary patterns during pregnancy and overall PTB reporting a significant association. While there were more studies assessing the relationship between dietary patterns and birth weight during pregnancy (n = 17), the evidence was considered inconclusive due to the substantial inconsistency and methodological limitations including a lack of standardization of birth weight for gestational age and sex and no assessment of modification by maternal pre-pregnancy BMI.
There are two additional studies that lend support to the association between dietary patterns and birth outcomes. Martin et al. examined the association between the DASH diet and cardiometabolic markers at mid-pregnancy and found that greater adherence to DASH diet was related to lower maternal fasting glucose, insulin, HOMA-IR, and triglyceride levels with pre-pregnancy BMI attenuating the associations. However, there was no association with total cholesterol levels [3]. The Healthy Start cohort found that a dietary pattern higher in poultry, nuts and seeds, whole grains, cheese, fruits as well as added sugars and discretionary solid fat was positively correlated with maternal gestational weight gain but not mid-pregnancy fasting glucose [4]. Whereas a diet higher in eggs, potatoes, other starchy vegetables, non-whole grains, fruits (citrus, melons, and berries), and discretionary solid fat was correlated with both gestational weight gain and mid-pregnancy fasting glucose levels.

While evidence in support of following specific dietary patterns during pregnancy for an optimal outcome is weak, due to the many methodological limitations of previous studies, there are guidelines that make sense for women to follow. These guidelines include, for example, the healthy dietary patterns included in the 2015-20 Dietary Guidelines for Americans (Table 1) [5]. Key characteristics of these patterns include higher intakes of fish and seafood, vegetables, fruits, whole grains, nuts and seeds, legumes, and vegetable oils.

Maternal weight status, in particular a high BMI (≥30) prior to conception itself, is strongly associated with many adverse birth outcomes. Current gestational weight gain guidelines are dependent on a woman’s starting weight, and intervention studies that have been successful in

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**Table 1.** Main Recommendations of the 2015–2020 Dietary Guidelines for Americans. Retrieved from [5]

<table>
<thead>
<tr>
<th>Recommendation</th>
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<tbody>
<tr>
<td>1. Choose a healthy eating pattern at an appropriate caloric level for maintaining a healthy body weight and supporting nutrient adequacy.</td>
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<tr>
<td>2. Focus on nutrient density, the amount consumed (portion size), and eating a variety of foods across all food groups.</td>
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<tr>
<td>3. Limit calories from added sugars and saturated fats, and reduce sodium intake.</td>
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<tr>
<td>4. Shift to healthier food and beverage choices that consider an individual’s culture, personal preferences, and socioeconomic situation.</td>
</tr>
<tr>
<td>5. Change is needed at all levels of the social ecological model (individual, interpersonal, policy, environment, cultural) in order for Americans to follow and support a healthy eating pattern.</td>
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helping women gain within the target require frequent, high intensity
diet counseling. Intervention studies conducted in overweight and obese
women show greater heterogeneity in terms of what works, but it seems
prudent to provide counseling to these women even through the inter-
conceptional period to help mitigate pregnancy complications and child
outcomes associated with a high BMI in future pregnancies.

Reference
Reading Appetite Cues in Infancy – A Role for Nutrition Education

Marion M. Hetherington and Janet McNally

It is known that babies are capable of varied and numerous communication cues to indicate hunger, appetite, satiation, and satiety. In the hours following birth, neonates signal hunger through agitation, arousal, and ultimately a distress cry. Newborns are also capable of indicating preferences for familiar odors through orientation of the head and mouth. They show a liking towards sweet tastes and a dislike towards bitter tastes. Breast milk contains diverse flavor components, and is perceived as sweet. Thus, infants are equipped to prefer sweetness from birth as a highly adaptive mechanism, whereas an aversion to bitterness may be a protective mechanism against toxins in early life. Breastfeeding increases the likelihood that infants will accept new tastes including bitter tasting vegetables. In addition to the gusto-facial responses associated with basic tastes, which are shared with other non-human primates, infants are known to use gaze, gesture, and vocalization to signal interest and disinterest in foods. These behaviors change over the course of a meal, indicating that infant communication cues are sensitive to changes in need state. These behavioral cues have been coded during mealtime interactions between caregivers and infants, providing evidence of the dynamic nature of the experience. We have conducted a series of studies to investigate communication of infant appetite. These studies have revealed that the number and sophistication of appetite cues increases with age; more frequent feeding cues are observed at the beginning than at the end of a meal showing that cue frequency changes with satiation, that breastfed infants exhibited more engagement and disengagement cues than those who had been formula-fed and that breastfeeding mothers provided fewer distractions during the meal, set up a more ideal feeding environment, and fed more responsively than those who did not breastfeed.

Responsive feeding, where caregivers identify, interpret, and respond to infant cues is recognized as important in promoting self-regulation and preventing over or under-feeding. Research suggests that parental responsiveness to their child’s hunger, appetite, and satiety signals is critical for
the development of healthy eating habits and may affect the weight status and growth rates of their child. For example, a non-responsive feeding style may affect both the frequency of meals offered and the quantities eaten. It is important to support parents to identify, interpret, and respond to these cues (feeding in response to hunger cues, ending feeding in response to satiety cues). However, issues related to attachment, mental health, feeding beliefs, and practices may interfere with responsive feeding. For example, mother-infant attachment and experience of breastfeeding facilitates maternal responsiveness. In addition, babies who have been breastfed display a greater frequency of feeding cues during the meal [1–3]. This demonstrates the bi-directionality and interdependence of infant communication during a feed, namely that more responsive feeding is associated with more proficient communication by the infant. Overall, observational methods have revealed the complex ways in which infants signal energy needs to their caregivers, and in turn whether or not caregivers recognize and react to these signals as part of responsive feeding.

Recently, educational resources have been developed to enhance responsive feeding in caregivers. We have developed an online, video-facilitated educational tool to support parents, caregivers, and healthcare professionals to recognize ways in which infants communicate appetite. To date, we have found that mothers are able to identify hunger cues with ease but are less confident in recognizing and responding to satiety cues. Potential applications of these methods include interventions to prevent overfeeding and childhood obesity.

Reference

Nurturing Care Framework: Implementation Strategies

Maureen M. Black

Childhood development during the first 1,000 days forms the foundation for lifespan health, academic success, productivity, and well-being, and is a cornerstone of the United Nations Sustainable Development Goals (SDGs). At least 7 of the 17 SDGs are particularly relevant to young children: goals to end poverty and hunger, to ensure access to quality health, education and sanitation, to achieve gender equality, and to reduce income inequality. Recent evidence has shown that over 249 million children under age 5 years are not reaching their developmental potential [1] largely due to undernutrition, including both macronutrient and micronutrient deficiencies [2]. Children’s growth and development tracks over time, meaning that children who do not reach their developmental potential early in life are at increased risk for poor health and academic outcomes throughout life. Although effective interventions to promote early development have been implemented throughout the world [3], most have been small scale with limited reach, investment, and sustainability.

Nurturing Care Framework

The Nurturing Care Framework, introduced in the 2017 Lancet series on Early Child Development and adopted by the World Health Assembly in 2018, provides a global framework to promote early childhood development (Figure 1) [4]. Nutrition is a key domain of Nurturing Care, along with health, protection, early learning, and responsive caregiving. These domains are indivisible, meaning that each domain is necessary and no single domain is sufficient.

Implementation of the Nurturing Care Framework is dependent on an enabling environment. Although Nurturing Care is implemented primarily by families through home-based care practices, changing family patterns and increases in maternal employment have resulted in increases in out-of-home care for very young children, often in child care centers.
Thus, to ensure that children are exposed to an enabling environment requires support to households and to child care providers to ensure that caregivers have the physical and mental health, resources, and capacity to provide Nurturing Care.

**Scaling Up Nurturing Care**

As national governments and global leaders adopt the Nurturing Care Framework to ensure that young children reach their developmental potential, implementation guidelines and metrics are needed to help countries monitor and evaluate the effectiveness of implementation strategies and establish sustainable programs. In addition to evaluating changes on SDG indicators, such as the number of children with access to quality early childhood development programs, countries need systematic information on indicators of services, such as reach, coverage, cost, and requirements for training, coaching, and supervision. This information can be generated by a system of accountability that includes valid indicators, quality data, and timely feedback, thereby facilitating continuous quality improvement [4].
**Implementation Science**

Implementation science includes the methods needed to adopt and integrate evidence-based practices and programs into routine care. Through a continuous cycle of monitoring, evaluation, learning, and adaptation, implementation science provides the tools to adapt programs and practices to increase quality, reach, and sustainability.

This presentation draws on the principles of implementation science, including the methods and strategies needed for families and child care providers to incorporate Nurturing Care into their daily routines. It focuses on child development policies, on program reach to ensure that programs reach families most in need, on monitoring and metrics to learn whether programs are delivering interventions as intended, and on continuous quality improvement to ensure that programs learn and improve: the elements that are necessary for sustainability. The success of the SDGs depends on ensuring that children throughout the world reach their developmental potential, thereby building the capacity for future generations of adults to have the health, intelligence, creativity, and humanitarianism to move the global agenda forward.

**References**

Supporting Healthy Eating: Synergistic Effects of Nutrition Education Paired with Policy, Systems, and Environmental Changes

Mary T. Story and Emily Duffy

A healthy diet is central to overall health throughout the lifecourse and is protective against all forms of malnutrition, as well as non-communicable diseases (NCDs) such as cardiovascular disease, diabetes, obesity, and certain types of cancer. Unhealthy diets and physical inactivity are among the leading causes of NCDs throughout the world and contribute significantly to the global burden of disease, death, and disability. Other conditions related to diet, such as hunger, dental caries, and osteoporosis are widespread causes of morbidity [1].

In the United States, about half of all adults – 117 million individuals – have one or more preventable chronic diseases, many of which are diet-related [2]. More than two-thirds of adults and nearly one-third of children and youth are overweight or obese. These high rates of overweight, obesity, and chronic disease have persisted for more than two decades and come not only with increased health risks, but also at high cost in terms of personal quality of life and economic and societal costs. The United States spends approximately $400 billion on obesity and diagnosed diabetes-related health costs each year [2]. Many of the risk factors for diet and weight-related diseases are modifiable and preventable.

Healthy dietary patterns associated with positive health benefits are high in vegetables, fruits, whole grains, seafood, legumes, and nuts; moderate in low- and non-fat dairy products; lower in red and processed meat; and low in foods and beverages with added sugars, and refined grains and sodium and provide a balanced caloric intake [2]. Inadequate nutrition, poor diet quality, and obesity are prevalent among all Americans, but are most pronounced among lower-income households and communities, which often lack access to healthy foods or have access to an overabundance of unhealthy foods, as well as in households with limited time to prepare healthful foods.
Eating behavior is highly complex, resulting from the interplay of multiple influences across different contexts and conditions. Improving dietary and lifestyle patterns and reducing obesity will require addressing not only individual behaviors but the environmental context and conditions in which people live, make choices, and eat. This work will also require addressing inequities that exist in access to healthy foods and healthy environments more broadly in low-income and disadvantaged communities.

Table 1. Definitions and examples of policy, systems, and environmental change approaches to supporting healthy eating

<table>
<thead>
<tr>
<th>Type of change</th>
<th>Definition</th>
<th>Examples</th>
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| Policy         | Policies at the legislative or organizational level that create or amend laws, ordinances, resolutions, mandates, regulations or rules | – Calorie and nutrient labeling on menus and displays in restaurant and food retail venues  
– Nutrition standards for food and beverages available in childcare facilities and schools |
| Systems        | Systems change impact elements of an organization, institution or system, such as changes in rules, processes, procedures, or infrastructure. Systems change and policy change often work hand-in-hand | – Screening for food insecurity in community clinics and developing comprehensive mechanisms to refer food insecure to food  
– Incorporating healthy eating education into all federally funded, evidence-based home visiting models |
| Environmental  | Environmental changes involve physical or observable changes to the economic, social, cultural, or physical environment | – Initiatives to increase the availability and affordability of healthier foods and beverages in food retail environments  
– Charging higher prices for less healthy food and beverages to decrease their use |
communities. This paper presents a conceptual framework for understanding the multiple influences on what people eat (Fig. 1) and the linkages between individual-level factors, social environments, physical environments, and macroenvironments [3]. Collectively, these environments influence what, where, and how much we eat. We then discuss policy, systems, and environmental (PSE) dietary change strategies; the goal of which is to make the healthy choice— the easy, safe, and affordable choice and have impact at the population and community level (Table 1). We highlight selected examples of synergistic linkages and interactions between nutrition education and PSE strategies that have proven effective in supporting healthy eating behaviors. Examples include efforts in
federal nutrition assistance programs, nutrition and food labeling, and food retail settings. This paper will also explore new sectors where this synergistic approach holds promise for improving population health and reducing health inequities. Accelerating progress in improving healthy eating and dietary quality and achieving and maintaining a healthy weight will require multi-level and multi-sectoral approaches by combining direct nutrition education with broader PSE efforts. To have the greatest population health impact, models that have proven effective should be maintained and new approaches that hold promise for underserved communities should be implemented and evaluated. Nutrition education combined with PSE approaches is more effective than either strategy in isolation and both will be needed to reduce the global burden of diet-related chronic diseases.

References

Multi-Level Opportunities to Improve Nutrition Education in Childcare Settings

Dianne S. Ward and Amber Vaughn

Early childhood, from birth to age 5, is a critical period for growth and development. Lifelong dietary habits are being formed, which in turn affect immediate and long-term health, including risk of cardiovascular disease, obesity, and diabetes [1]. Eating a healthful diet and developing a positive relationship with food sets children on a pathway to a lifetime of good health. Unfortunately, poor dietary habits are common among today’s young children [2].

Early care and education settings (ECE) have the potential to exert considerable influence on the eating habits of young children. In the US and most other countries, ECE programs serve large numbers of children. Enrolled children spend 32–36 hours per week and consume 50–75% of their daily caloric intake while in childcare [3].

ECE programs can support children’s development of healthy eating habits through nutrition education, defined as a comprehensive, multi-level approach including education, environmental support, and policy [4]. A useful mnemonic when describing the multiple opportunities for nutrition education in ECE programs is the 4-Ps, which refers to provisions, practices, planned education and outreach, and policy. Explanation and examples of the 4-Ps are presented in Figure 1.

Provisions refer to the facilities, services, amenities, and resources offered by the ECE program in support of children’s nutrition. Specific examples include the food and beverages served; how meals and snacks are provided to children; and the physical support for eating (e.g., child-size utensils), learning (e.g., books and posters), and hands-on experiences (e.g., gardens and play kitchens). When children are served healthful food, allowed to serve themselves, and are reinforced by a physical environment that respects food and its importance, they develop a lifelong appreciation for healthy food.

Practices refer to the relationship teachers and other staff establish with the children around food and eating. Teachers and staff can
support healthy eating by sitting with the children during meals, eating the same food, using enthusiastic language to talk about healthy food, and offering praise and encouragement when children try new or less familiar food.

Planned education and outreach includes formal nutrition lessons for children, professional development for staff, and engaging families in the support of healthy eating. Nutrition lessons can be stand-alone educational sessions about a nutrition topic or integration of nutrition concepts with other learning standards. Professional development builds necessary knowledge and skills needed to support children’s nutrition, but can also be beneficial for the staff’s own nutrition education. Outreach to parents should foster partnership between ECE and home to ensure that children receive consistent nutrition messages.

Policies are written plans or course of action that govern how ECE programs operate. By formalizing policies in written documents and sharing those with families and the public at-large, ECE programs solidify their commitment to children’s nutrition education.

Most ECE programs fail to implement the full range of best practices possible to provide optimal nutrition education. An example of an effective strategy for improving ECE program’s nutrition education is Go NAPSACC – an online, interactive, change management system that provides a suite of tools that guide ECE programs through continuous quality improvement [5]. Go NAPSACC’s 5-step change process encourages reflecting on current nutrition practices, setting goals and planning for
action, taking that action, obtaining education and training, and revising/repeating the process (Fig. 2).

An important “call to action” directed at nutrition experts, health professionals, and policy-makers encourages them to support ECE programs in the implementation of a comprehensive nutrition education program that supports young children and their families.

**Reference**


**Fig. 2.** Go NAPSACC – an on-line change management system for nutrition education development in ECE programs.
The importance of food and nutrition education in schools has never waivered in my personal view, having originally trained as a “food” teacher. What has changed is the societal context in which food and nutrition education now sits: increasing rates of childhood obesity, resource challenges in schools, and issues relating to teacher recruitment and training.

In the context of child health in the UK, the focus is centered on childhood obesity, with one in ten children aged 4–5 years being overweight or obese when they start school, rising to one in three children by the age of 11–15 years. There is clearly a call to action in relation to obesity; however, there are also concerns over other aspects of children’s diets.

The National Diet and Nutrition Survey shows low intakes of a number of micronutrients, as well as fiber, and 16% of children aged between 5 and 15 years ate the recommended five or more portions of fruit and vegetables a day. This suggests that there is an issue with the whole diet, not just one that focuses on overweight and obesity. In addition, many children are also not reaching the recommended one hour of physical activity per day.

The UK government has introduced a number of measures through the Childhood obesity – a plan of action, including a soft drinks levy (sugar tax), a sugar reformulation program reduction in the food most commonly eaten by children, introducing a Healthy rating scheme for schools, promoting physical activity, and updating school food standards. While the importance of food education in the formal school curriculum is mentioned, no specific recommendations are made.

The curriculum in England specifically includes ‘cooking and nutrition’, requiring pupils aged 5–14 years to be taught about food origins and provenance, cooking and food preparation, and applying healthy eating and nutrition. However, research indicates that since its introduction in 2014 there has been no change (or a decrease) in lesson length, funding, and teaching resource provision. Teachers also report that they are
constrained by a lack of time, budget, and resources to deliver the food skills and knowledge in the curriculum and have limited opportunities for continuing professional development. All teachers should receive training in relevant aspects of nutrition and have an understanding of the important role they play in supporting the health and wellbeing of children in their care. It has been suggested that Key Performance Indicators for delivering food education in schools should be established, helping to set out minimum learning experiences that school pupils should receive as part of their education entitlement.

Another vehicle to support the promotion of food and nutrition is through health promotion programs. A number of such programs are funded by local authorities, providing holistic support through a whole school perspective. In addition, there are many other organizations nationally and locally, typically non-profit, that also offer advice and support in health promotion. For example, British Nutrition Foundation runs a Healthy Eating Week for schools providing a focal point during the year. Schools welcome these types of health promotion programs, enabling them to engage in national initiatives, implement health promotion activities, and develop competence.

While it is acknowledged that there are a number of issues, it must be remembered that there is also a lot of great work happening in our schools every day. The focus must be on ensuring that policy and practice directly address these issues. Food and nutrition education must be compulsory in all our schools; teachers should be supported professionally through their teaching career; and those supporting food and nutrition in schools must work together to make a lasting difference which is lifelong for children.
It is well established that poor diet is a major contributor to many conditions including cardiovascular disease, obesity, type 2 diabetes, dental caries, and some cancers. The sheer number of individuals affected suggests that new intervention strategies must be employed to reach large segments of the population, and in particular, the most vulnerable populations with the highest rates of disease. Changing the food environment to provide more healthful, affordable, accessible foods is an effective and feasible strategy for improving the nutritional health of the population and reducing disparities. In addition, there is increasing evidence that changing the local food environment can be a determinant of population weight status [1].

Underlying food environment changes to improve the nutritional health of the population is healthy food access. This includes both increased access to healthy foods and reduced access to less healthy foods. The community strategies deemed most likely to improve the nutrition and health of the population are interventions to alter food and beverage pricing and interventions to change the availability of healthy foods in nutrition assistance programs [2]. Changing the food environment in the retail food sector is a third community strategy that is promising.

**Strategy 1. Reducing access to less healthy foods and beverages through the use of food and beverage taxes**

Food and beverage taxation addresses the affordability dimension of food access. Current interest is particularly high in implementing sugar-sweetened beverage taxes to reduce consumption of less healthy beverages as they have been demonstrated to be associated with serious health issues such as obesity, type 2 diabetes, and cardiovascular disease. Countries around the world have implemented beverage taxes beginning decades ago [3] (Fig. 1). The data from evaluation studies in Mexico and
Berkeley, California have documented significant reductions in sugar-sweetened beverage purchases. In both these studies, reductions in purchases were particularly high among lower income households. Early results from a study of Philadelphia’s relatively recent beverage tax found significant reductions in the consumption of soda and energy drinks, as well. While the primary benefit of a beverage tax has been to decrease consumption, revenue generation can be employed to support government programs linked to community health and education. Further, beverage taxes have contributed to the current movement to increase water consumption and ultimately, may contribute to the reformulation of sweetened beverages.

**Strategy 2. Improving access to healthy and decreasing access to less healthy foods and beverages in food programs serving low income populations**

Some government food programs such as the school lunch program and the WIC have found that regulating the kinds of foods offered in the programs can positively affect the diet quality of program participants. The charitable food system comprised of food banks from across the
United States is estimated to serve one out of seven Americans every day. Food banks have redirected contributed foods to the poor without regard to nutrition guidance until recently. Now with a better understanding of the food preferences of the users of the charitable food system [4] and a better understanding of the benefit of nutritious food provided in this setting with the control of disease [5], food banks are making great strides in changing food offerings (Fig. 2). Feeding America, a non-profit organization supporting the charitable food system, has developed new nutrition guidance for food banking which is presently being adopted by food banks across the nation.

**Strategy 3. Promoting healthy food purchases in the food retail environment**

Retail food outlets play a critical role in food availability. Retail interventions generally fall into three areas: price interventions in the form of incentives, vouchers, coupons, and rebates; food access interventions including the opening of new stores and various food delivery programs; and store-based interventions including nutrition education, product placement, and food and beverage stocking changes. The
effectiveness of retail strategies to improve nutrition varies by the ways in which these strategies are employed to increase access to healthy foods.

References

Philippines Case Study: Government Policies on Nutrition Education

Mario V. Capanzana and Divorah V. Aguila

The global and national food and nutrition situation indicates that more than 900 million people are hungry worldwide, yet more than 1 billion are overweight adults. In a study carried out by DOST-FNRI and Save the Children in 2013, Php 328 Billion or 2.84% of the Gross Domestic Product are lost due to child undernutrition while around Php 1.23 billion are lost due to stunting-related grade level repetition.

With cognizance of the malnutrition problem, an integrated plan of action for nutrition was formulated by the national multi-sectoral nutrition community, consistent with the global call to eradicate malnutrition. Commonly known as the Philippine Plan of Action for Nutrition (PPAN) 2017–2022, the plan is an integral part of the Philippine Development Plan 2017–2022. It is consistent with the Administration’s 10-point Economic Agenda, the Philippine Health Agenda, and the development pillars of malasakit (protective concern), pagbabago (change or transformation), and kaunlaran (development).

Major changes in our food system and eating environments over the past decades have been driven by technological advances, food and agricultural policies, and economic, social, and lifestyle changes. More processed and convenience foods are available in larger portion sizes and at relatively low prices. There are fewer family meals, and more meals are eaten away from home. Thus, policies and programs are extremely important to help make the healthful choices.

In the Philippines, Republic Act (R.A.) No. 11037 known as the Masustansyang Pagkain para sa Batang Pilipino, aims to combat hunger and undernutrition among Filipino children. Under this, the Department of Social Welfare and Development (DSWD) implements a supplemental feeding program for daycare children while the Department of Education (DepEd) enforces the school-based feeding program. On the contrary, the rising obesity rates among Filipino children and adults have motivated policy makers to implement policies that can improve access to affordable, healthy foods, and increase opportunities for physical activity in
schools and communities across the country. One example is the DepEd Order 13, S. 2017 on Policy and Guidelines on Healthy Food and Beverage Choices in Schools and in DepEd Offices for the promotion and development of healthy eating habits among the youth and its employees. This DO from DepEd led to a subsequent issuance of a local ordinance in some cities (Pasig and Quezon City). Excise tax on sweetened beverages (SBs) is one of the new taxes imposed under Republic Act (RA) 10963 or Tax Reform for Acceleration and Inclusion (TRAIN) Law which took effect last January 1, 2018.

The Industry sector has its respective shares in various nutrition education campaigns in the country. To name a few, the NutritionSchool.ph was launched in support of a common passion for wellness and nutrition education. To address the problem of child undernutrition, the United for Healthier Kids (U4HK) was launched in 2014. Other initiatives also include promotion of fortified milk drinking among school children through Laki sa Tibay School Nutrition Education and Pamilyang Laki sa Tibay Community Nutrition Education.

While it is apparent that eliminating hunger and malnutrition is technically feasible, the challenge lies in generating the requisite political will, developing realistic policies, and taking concerted actions nationally and internationally. Action and advocacy by many stakeholders are needed to overcome these barriers. Past successes that can point the way forward include effective public health approaches to complex problems such as tobacco use, motor vehicle crashes, and occupational safety. These successes provide a template for a healthier food system: address the consumer, the product (agricultural commodities, food), the environment (retailers, restaurants), and the culture (unhealthy eating, marketing). Strong government policy is crucial to achieve a healthy, equitable, and sustainable food system that benefits all.
Counterbalancing the Uncertainties of Medical Nutrition Education with Effective Online Instruction

Martin Kohlmeier

Practicing physicians need to recognize nutrition-related health challenges in their patients and know what to do about the detected problems [1]. It takes at least 25 to 30 hours of medical school instruction to achieve just basic nutrition competencies. Because most medical students get significantly less than this minimum, they are not adequately prepared to deal with common nutrition-related challenges in practice. The majority of all accredited US medical schools require less than 25 hours of nutrition instruction across the entire four-year curriculum and a few still fail to require any nutrition education at all. Medical schools in other countries struggle with the same instructional deficits, and many fail altogether to address the need for proper nutrition training. It is clear what physicians need to know about nutrition to serve their patients. First, the science, how foods work in health and disease; then best nutrition practice, recognizing nutrition problems, and what to do about them; and finally getting the message across, which often means to help their patients help themselves. The greatest deficits exist in assessing individual patient needs, blending nutritional therapies with medical treatments, and finding effective solutions for better health.

The Nutrition in Medicine project (NIM, nutritioninmedicine.org) has demonstrated that computer-based nutrition instruction is effective and efficient, particularly as an integral component of clinical training. A majority of US medical [2] and osteopathic [3] schools use the NIM materials. Institutions in more than twenty countries also find them useful.

The online courses cover a full curriculum from basic science to clinical practice. Interactive lessons, skill-building exercises, and practice challenges allow learners to progress at their own pace. Since lifestyle change depends on effective communication, the lessons teach specific phrases to be used for motivational interviewing and other proven approaches. There is also an opportunity to hone clinical skills with simulated patient
interactions (Fig. 1). These are timed exercises that reflect the situation in patient care where assessment and guidance have to be provided in an appropriately efficient manner.

A particularly useful feature of computer-based teaching is that machines can measure learning success, even while the session is still in progress. If they have not achieved the required learning outcome, instruction can seamlessly loop through another set of lessons or exercises to improve comprehension. This ensures that all users learn what they need to know, not just a few with interest in the topic. Yet another strategy is to test content familiarity beforehand to tailor instruction to the needs of the individual learner and thereby shorten required session duration while retaining much of the learning effect and long-term retention [4].

**Table 1.** Improved practice patterns after just one hour of online training

<table>
<thead>
<tr>
<th>In your last four patient encounters how often did you</th>
<th>Baseline, %</th>
<th>Three months later, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>address nutritional issues at new OB appointment</td>
<td>57.9</td>
<td>64.5</td>
</tr>
<tr>
<td>advise about gestational weight gain</td>
<td>33.2</td>
<td>77.4</td>
</tr>
<tr>
<td>calculate BMI at OB visit</td>
<td>78.4</td>
<td>93.3</td>
</tr>
<tr>
<td>discuss nutritional issues during GYN visit</td>
<td>16.2</td>
<td>43.3</td>
</tr>
<tr>
<td>refer to an RD</td>
<td>36.8</td>
<td>56.7</td>
</tr>
</tbody>
</table>

**Fig. 1.** Screen capture of a patient simulation to practice nutrition assessment and dietary guidance of a patient with an atherogenic lipoprotein profile.
Online nutrition instruction can change practice patterns. In one study [5], residents and fellows in gynecology and obstetrics learned to use effective assessment and counseling tools with their patients. Before their one-hour learning session, most of these physicians rarely or never advised their pregnant patients about proper weight gain. Three months later, most of them had made it a routine part of patient work-up (Table 1). There was similar improvement in several other practice activities, such as discussing nutritional issues during a gynecological visit or referring to a dietitian. This is at least a start that can be replicated without too much difficulty across all medical disciplines and worldwide.

It should be evident that computer-based instruction can help to reduce the worrisome training deficits of physicians and other healthcare providers. Because the materials are provided online, the instruction is highly scalable and also cost effective. Something needs to change, and we know how to get it done.

References

The NNEdPro Global Centre for Nutrition and Health: A Consolidated Review of Global Efforts Towards Medical and Healthcare-Related Nutrition Education

Sumantra Ray

Whilst there is much focus on applying resources to the generation of evidence from human nutrition research, whether these involve experiment, observation or intervention, there is considerably little investment in development and evaluation of effective approaches to apply the available knowledge base. Furthermore, when translating nutrition knowledge to the population at large, there are barriers to implementation, retention, and sustained impact, often due to largely unregulated public information on nutrition causing significant confusion and conflict. Healthcare professionals therefore have a key role in becoming reliable knowledge brokers translating nutrition science to clinical or public health practice. However, with the exception of dietitians, who are relatively few in number, other segments of the healthcare workforce receive little or relatively inconsistent training in practice-ready aspects of nutrition.

Over the past decade, the NNEdPro Global Centre in Cambridge (www.nnedpro.org.uk) has been working as a partnership between doctors, dietitians, nutritionists and others, both within and across borders to assess practice gaps affecting patients and the public. This is typically followed by taking a step back to look at the available nutrition evidence base – where this is adequate but can benefit from better evidence synthesis for education versus where there is a need for further primary research to strengthen the evidence base – and then taking a step forward to develop, deliver, and evaluate the impact of bespoke nutrition education interventions on the knowledge, attitudes, and practices of the healthcare workforce. Whilst focusing on
the nutrition education of healthcare professionals, the NNEdPro lean-innovation approach spans over 40 projects and initiatives in over 12 countries using the Knowledge-to-Action Cycle as a framework to ignite the implementation potential of high quality research to promote best practice.
Update on Nutrition Curricula for Medical Education, Research, and Practice: USA Perspective

Carine M. Lenders and Gwen Twillman

Nutrition and physical activity behaviors influence health and disease, and contribute to the leading causes of death in the US. Yet, studies have shown that nutrition education in medical schools is inadequate and there have been minimal to no improvements over the past 30 years. Although physician in the US are not confident to counsel patients in nutrition-related conditions, little is known about nutrition education and training in residency and fellowship programs.

In recognition of the need to develop and enhance undergraduate and graduate medical nutrition education, the National Heart, Lung, and Blood Institute (NHLBI) and the National Institute of Diabetes and Digestive and Kidney Diseases of the National Institutes of Health established the Nutrition Academic Award (NAA) Program in 1997 [1]. The NAA awarded grants to 21 US medical and osteopathy schools to improve teaching of nutrition principles and clinical practice skills with an emphasis on preventing cardiovascular diseases, obesity, diabetes, and other chronic diseases. Educational resources were developed including the Nutrition Curriculum Guide for Training Physicians (2002) which offered more than 400 educational objectives that medical students, residents, and fellow need to attain upon graduation.

Since the NAA effort, nutrition and lifestyle champions have developed several models to incorporate nutrition in the medical school curriculum. Examples include online educational modules, hands-on culinary workshops, dedicated courses, and integrated content that may include threads throughout undergraduate medical education. In some schools, nutrition groups of interests (or clubs) led by medical students facilitated education and dialog on nutrition from the bottom up. These champions have also continued to advocate for inclusion of nutrition content in the US Medical Licensing Examination and for recognition of medical nutrition as a national subspecialty in medicine.
In 2012, NHLBI in partnership with the American Society for Nutrition (ASN) convened a workshop *Future Directions for Implementing Nutrition across the Continuum of Medical Education, Training, and Research* to develop recommendations for remodeling nutrition education, training, and research [2–4]. As medical education has shifted to a competency-based system [5], a subsequent NHLBI workshop held in 2017 recommended an inter-professional approach to update the NAA curriculum guide; the development of medical nutrition Entrustable Professional Activities (EPAs), competencies, and milestones; and further research in medical nutrition, metabolism, and lifestyle.

In both NHLBI workshops, establishment of a mechanism to coordinate multiple stakeholders was identified as critical to advance a medical nutrition education agenda. Given its leadership role in nutrition research and education, ASN was identified as the organization best positioned to coordinate activities to promote effective development and implementation of nutrition education in medical and allied health professional schools; and harmonize ongoing efforts to achieve the best possible outcomes. Recently, the ASN Board approved the establishment of a coordinating center to guide the nutrition education of healthcare professionals. A planning committee defined the effort’s scope, governance structure, and timeline and completed a gap analysis. This effort will focus on the following to impact medical nutrition education:

- **Coordination of Resources:** Collect, centralize, and distribute multidisciplinary educational resources, credentialing resources and practice and reimbursement resources
- **Networking and Community Building:** Develop a repository of links/networks/contact information to organizations/schools/committees in order to increase the organization of already available educational data, educational materials, exam questions etc.
- **Confirmation of Objectives:** With stakeholders, define 1) provider competencies (specific tasks that involve knowledge, skills, and attitudes) for medical schools and 2) Entrustable Professional Activities (EPAs, tasks that define a profession) for residence programs.
- **Capacity Building:** Train “nutrition ambassadors” to conduct and consult on education programs for healthcare professionals within and outside of the US.
- **Research:** Identify and disseminate funding opportunities
- **Advocacy:** Advocacy for education, legislation, and/or research funding

Funding and partners are currently being sought to launch and administer this coordinating center through a public-private partnership platform.
Reference

Culinary Medicine Basics and Applications in Medical Education in the United States

Michelle E. Hauser

Culinary medicine is an evidence-based field of medicine that combines nutrition science and culinary arts to create food that is delicious, promotes wellness, and prevents and treats disease. The field was created to address the missed opportunities presented by nutrition education at all levels of medical education and in medical practice. Current nutrition curricula are limited in time, scope, and content applicable to direct patient care. An additional barrier to adequate and effective nutrition education in medical school is that the majority of instruction occurs in the preclinical years, disconnected from active patient care. Moreover, the content is primarily comprised on topics, such as biochemistry, molecular biology, and micronutrient deficiencies, which are of little use when conducting dietary counseling with patients.

It is difficult to parse the limited nutrition offerings in most medical schools with data identifying diet as the single most significant risk factor for morbidity and mortality in the U.S. [1]. There has never been a more important time to equip physicians with the abilities to effectively evaluate, prevent, and treat food-related disease. Skills required to do this include taking a dietary history, assessing food access and cultural aspects of diet, motivational interviewing around making healthy dietary changes, and counseling on how to cook and eat healthy, delicious food that is accessible in terms of budget, time, skills, and other resources.

Culinary medicine is a hands-on, practical approach to nutrition education that brings students into the kitchen to learn how to prepare delicious, healthy food while simultaneously learning key nutrition lessons. It moves nutrition education away from a focus on nutrients towards a focus on food. This, in turn, aligns the healthcare professional’s approach to dietary counseling with the way that patients understand it best.
Table 1. Considerations in planning a culinary medicine course for healthcare professionals or trainees

**Teachers and Students**
- Who are the students? What level of medical training do they have?
- Who will teach the course (e.g., physician-chef, chef, dietitian, nutrition faculty, students, etc.)?

**Time and Duration**
- How much time is reasonable to expect from participants and what time(s) would be most convenient for them?
- What type(s) of class sessions will be held (e.g., demonstration, hands-on, online, lecture, direct patient care, etc.)?
- How long will class sessions be? (Hands-on cooking sessions are generally 1-1/2 hours or longer.)
- How many class sessions will be held? If more than one session, will they be condensed into a limited timeframe or organized into a longitudinal course?

**Curriculum and Content**
- Will a preexisting curriculum be used as is, modified for use, or will a new curriculum be created?
- How will the culinary medicine course be connected with the broader medical curriculum, if applicable?
- What dietary philosophy will be used? What are the nutrition science underpinnings of this?
- What supportive or preparatory materials will accompany the hands-on sessions? Will they be required before, after, or during the session?

**Course Credit**
- Will the class be for credit? What type of credit?
- What is the timeline and process for making credit available (e.g., listing in the course catalog or getting approval to offer CME, etc.)?

**Cost**
- Costs that may need to be planned to include space rental, groceries, equipment/supplies, instructor/assistant salary, cleaning staff, printing/administrative, and curriculum (if not creating your own).
- How will costs be covered (e.g., institutional support, grants, donations, fundraiser, charge a class fee, etc.)?

**Rules, Regulations, and Safety**
- Who will learn, explain, and enforce kitchen sanitation and safety rules?
- What health and fire codes must be adhered to and how does this impact what can be cooked?
- When will the course leader obtain Servsafe (or similar) certification to ensure sanitary cooking practices throughout the course?
- What is your plan if anyone gets hurt? Do you have a waiver of liability and emergency contact information from participants?
- Do you have a basic first aid kit for minor cuts and burns?
- Will class participants sign waivers so photos and videos from the course can be posted publicly for promotional purposes?
The first nutrition elective with a cooking focus held in a U.S. medical school was taught in 2003 at the State University of New York-Upstate campus [2]. However, culinary medicine courses started to become more widely available in the past five years, due largely to the opening of the Goldring Center for Culinary Medicine in 2013 at Tulane University School of Medicine. Tulane's culinary medicine curriculum is the most widely used in medical education; to date, the program has been licensed to 39 medical schools across the U.S. [3, 4]. A separate, novel curriculum was developed in 2016 by the author and colleagues

| Table 1. (continued) |

**Preparation and Clean-up**
- Who will grocery shop and set up for the class sessions?
- Where will refrigerated items be kept until the start of the class?
- Who will clean the space used and return it to its original sanitary condition?

**Space**
- What space is available and at what time(s)?
- What modifications, if any, can be made to the space to make it the best fit for course needs?
- Is the space conveniently located for students?
- If demonstrations will be done? Will people be able to see clearly? Is additional equipment such as an overhead mirror or video camera and monitor needed to give everyone a good view?
- Where will class equipment and supplies be stored in between classes?
- When and how often will the kitchen be accessible?
- If a kitchen is being used, are all materials available or do any new items need to be purchased?
- If a non-kitchen space is used:
  - What limitations does the place put on what dishes can be prepared?
  - What equipment is available? What needs to be purchased?
  - Are a sink and clean-up supplies available?
  - Is there sufficient ventilation to cook with heat?
  - Are there tables at a reasonable height for cooking? If not, folding table risers may need to be purchased.
  - How will the stations be set-up?
  - Is there sufficient time planned for set-up and clean-up if using a multiuse space or conference room?
  - Do carpets, tabletops, or other furniture need to be protected?

**Evaluation**
- Will any feedback be collected for use in course improvement? If so, when and how will it be collected?
- Will any data be collected from students and/or a control group to evaluate the effectiveness of the course?
- What metrics will be used and how will they be administered?
- Does this type of data collection require institutional approval?
at Stanford University School of Medicine [5]. The course is taught as a quarter-long elective by physician-chefs using a blended classroom approach. Evaluation of knowledge, attitudes, and behaviors around cooking, eating, and patient dietary counseling have been compared between students and waitlisted controls. Preliminary data analysis showed significant improvements in numerous areas including basic cooking techniques, health eating behaviors, and confidence in planning balanced meals [5].

As the number of culinary medicine courses grows among medical education programs, so do the number of approaches to teaching the topic. Courses range in number of classes, placement in the larger medical school curriculum, and type of instructor. No single dietary philosophy is employed, and classes take place in settings ranging from pop-up conference room kitchens to dedicated teaching kitchens. This flexibility affords nearly any medical practice or educational setting the ability to provide some amount of culinary medicine content. Other important considerations when planning a culinary medicine course are shown in the Table 1. Beyond medical school, residency programs – primarily those focused on prevention and lifestyle medicine – are also beginning to add culinary medicine classes to their curricula. Culinary medicine continuing medical education opportunities have been available since the annual Healthy Kitchens, Healthy Lives conference began in 2007 in California. Additionally, some large healthcare systems offer physicians on-site culinary medicine courses, such as Kaiser Permanente’s Thrive Kitchen [3]. Finally, those seeking in-depth training can become certified in culinary medicine through programs like the Certified Culinary Medicine Specialist from Tulane or the Plant-based Nutrition Certificate from Cornell.

Culinary medicine makes nutrition education practical and directly applicable to the lives of both practitioners and patients. For these reasons, it has led to greater engagement in nutrition education by trainees and practicing clinicians alike. Given the increasing prevalence of diet-related diseases, demand for culinary medicine courses will likely continue to grow.

References

Integrating Nutrition Education into Clinical Practice

Helen K. Delichatsios and Anastassios G. Pittas

The physician-patient interaction is a prime opportunity for patients to appreciate the link between nutrition and health. Integrating nutrition education into clinical practice has challenges and opportunities, which can be considered from three distinct, yet overlapping perspectives: physician, patient, and self [1].

Even for physicians who understand the importance of nutrition and intent to practice nutrition education, there are numerous barriers including brief contact times, lack of financial incentives, competing demands, skepticism of the effectiveness of nutrition education, fear of offending patients, lack of a clear approach to nutritional counseling in clinical practice, and inadequate training, skills, and tools [2, 3]. These challenges and barriers can be addressed with tactics and tools that are simple, effective, affordable, and scalable, thereby making nutrition counseling feasible with only incremental burden in physicians’ time and energy.

Tactics for physicians include: (1) Assess BMI at every visit. A weight gain of one or two pounds per year is insignificant, but a trend can progress to a clinically significant weight gain over a decade. (2) Add obesity or overweight on the problem list alongside other chronic problems, such as hypertension and diabetes. This prompts the physician to think about and manage obesity/overweight as a separate condition. (3) Assess diet. This can be done in a time-efficient fashion by any dietary assessment method that is easy to administer and provides immediate feedback by identifying areas of improvement that address nutrition priorities [4]. (4) Acknowledge risk. Patients may not appreciate the risks, given the high prevalence of overweight and obesity in today’s world. (5) Be mindful of language. For example, say “a person with obesity” rather than “obese person.” (6) Write a prescription. Like other medical conditions (e.g., hypertension), prescriptions for dietary advice can be powerful, e.g., “cook once per weekend with your family.”

When trying to incorporate healthier eating habits into their lives, patients report many of the same barriers that physicians face when
counseling patients about nutrition – lack of time, competing demands, skepticism of the effectiveness of nutrition change, lack of a straightforward approach to following healthy nutrition at home or work, fear of offending family members, and inadequate skills and personal tools. A focus on psychology, technology, and team approach can pay dividends. Concepts such as mindless eating, decision fatigue, and food environment should be included in nutrition counseling. Digitally savvy patients can maintain healthy nutrition habits through numerous apps for tracking of behaviors and counseling. Any change requires persistence and can be more successful if a team is employed. Such a team includes the patient, his/her environment, other components of the healthcare team (e.g., dietician, counselors), and the physician serving as a pivot to leverage the expertise of other members of the team.

An approach to nutrition education that addresses challenges faced by both physicians and patients is a Culinary Shared Medical Appointment. Bringing a group of 8–10 patients together for a session lasting 90 minutes offers a more relaxed environment to discuss both medicine and nutrition, and offers an opportunity to engage in cooking of simple recipes, tasting, and eating together. Patients re-learn to enjoy food in the company of others and get reconditioned to associate healthy food with authentic pleasure: the pleasure of real food, enhanced by its visual, acoustic, tactile, and gustatory qualities.

Many physicians do not prioritize personal wellness and eating habits. Looking inward and taking care of themselves not only reduces the probability of burnout but also translates to providing better care for patients [4]. Healthcare professionals should take advantage of their influential role in promoting healthy nutrition. By understanding challenges faced both by physicians and patients, practicing physicians can use simple tactics to seamlessly integrate nutrition education in clinical practice.

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