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Acceptance of Food During Complementary Feeding

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According to the World Health Organization (WHO), complementary feeding should begin after exclusive breastfeeding for about 6 months. During the early period of introduction of solid food, the infants' diet not only provides essential nutrients for growth and development but also experiences that shape their food preferences.[1] The learning process about different foods has a long-term impact on their future food consumption patterns.

This article describes the empirical evidence on the effect of taste, repeated exposure and exposure to a variety of flavours on food acceptance during complementary feeding.

Basic Tastes and food acceptance

In the early stage when complementary foods are introduced, acceptance of foods is highly associated with the level of acceptance for a taste.[2] To help elucidate the development of taste acceptance, Schwartz et al investigated the development of preferences for the 5 basic tastes at 3, 6 and 12 months of age.[3] They found that at each time point, sweet and salty tastes were most preferred, umami taste produced neutral reactions, and bitter and sour tastes were the least accepted. Yet, the acceptance of bitter and sour tastes was more diverse from 6 to 12 months of age, which reflected that the taste preference is plastic and that early dietary experiences shape food preferences. The latter was supported by the observation that fruit consumption in the first year increased the acceptance of sour taste in the second year. [4]

Breastmilk as a bridge to accepting food flavours

Infants experience flavours even before their first exposure to solid foods. Flavours present in the mother's diet (e.g. fruit, vegetables and spices) during pregnancy and lactation may be transmitted to the amniotic fluid and swallowed by the fetus, and later to the breastmilk. The amniotic fluid and breastmilk sharing flavour profiles with foods eaten by the mother suggests that breastmilk may be a 'bridge' between experiences with flavours in utero and with solid foods. The variation in flavours in mother's milk according to her dietary exposure suggests that breastfeeding, unlike formula feeding, provides infants with the potential for a rich source of sensory variety.[5]

Experimental observation on infants who had exposure to the flavour of carrots in either amniotic fluid or breastmilk responded more positively to cereal of carrot flavour when starting complementary feeding.[6] Indeed infants who had just started complementary feeding consumed more cereal when it was added to mother's milk compared to when it was bland.[7] Breastmilk might have made the cereal more palatable either because of its flavour has inherent pleasantness or because of previous experiences with the flavour.

Repeated exposure facilitates food acceptance

While breastfed infants have an advantage in initial acceptance of food if they have been exposed to the flavour in mother's milk, once they are on complementary foods, both breast- and formula-fed infants respond to repeated exposure to a food.

In a longitudinal study, Sullivan and Birch examined the impact of dietary experience and type of milk feeding on the acceptance of new vegetables in 36 infants aged 4 to 6 months. They were randomized to 4 treatment groups receiving salted or unsalted green beans or peas 10 times over 10 days.[8] With repeated exposure, all infants significantly increased their intake regardless of the type of vegetables consumed or whether salt was added. Nevertheless, breastfed infants had greater increases in the intake of the vegetables and an overall higher intake compared with formula fed infants.

Birch et al further investigated infants' initial acceptance of food by studying 39 infants aged 16 to 31 weeks, who were offered repeated exposures to a new food puree (either peas or banana) over 10 days. They found that infants can generalize the enhanced acceptance of a new food after repeated exposure to foods of the same group (e.g. increased carrots or corns intake in pea exposure group) but not those of a different group (e.g. beef for the pea group).[9]

Maier et al investigated whether the consumption of an initially disliked vegetable improved with repeated exposure. At a mean age of 7 months, mothers were asked to offer an identified disliked vegetable for their babies on alternate days for 16 days, and to offer a well-liked one (carrot puree) on the other days. Mean intake of the initially disliked vegetable increased and by the eighth exposure was similar to that of the liked vegetable. After 8 exposures, more than 70% of the infants consumed the initially disliked vegetable.[10] Nine months after the exposure period, 63% of the infants (aged 15-19 months) were reported as still liked the initially disliked vegetable.

Forestell et al studied the behaviours of infant-and-mother pairs when the infants were fed new food (green beans). The infants' facial expressions during feeding were coded. Their facial expressions of distaste were identified. Repeated dietary exposure to green beans resulted in greater consumption, yet infants did not have fewer distasteful facial expressions.[11]

These findings are convincing that repeated presentation not only enhances infants' acceptance of new foods, but also foods that are less accepted initially. Yet they may still show distasteful facial expression upon acceptance of food.

Influence of exposure to a variety of flavours on new food acceptance

Gerrish and Mennella randomized 48 formula-fed infants to 3 groups who, over a 9-day exposure period, were fed: (i) only carrots, (ii)only potatoes or (iii)a variety of other vegetables. Their relative acceptance of carrot and chicken (a new meat) was assessed.[12] Infants in the carrot and variety groups, but not the potato group, ate significantly more carrots than at baseline. Infants in the variety group also showed enhanced acceptance of chicken when compared with the carrot group.

Maier et al studied 147 breast or formula fed infants allocated to 3 groups at mean age of 5.2 months.[13] All received carrot puree as a first meal. Over the next 9 days, Group 1 received carrots daily, Group 2 had three vegetables each given for 3 consecutive days, and Group 3 had the same three vegetables but changed daily. The high vegetable variety group (group 3) showed the greatest increase in intake of new foods introduced later while breastfeeding infants had higher intakes. This effect was still detectable 2 months later. A follow up study on these children was conducted in an experimental setting. The findings revealed that children who had experienced high vegetable variety at the start of weaning ate more new vegetables at 6 years of age. They liked vegetables more and were more willing to taste vegetables than those in the no or low variety group.[14]

Findings from Gerrish and Mennella and Maier's study likewise suggest that acceptance of new foods is enhanced by providing a variety of food and making frequent changes in the foods offered and that this effect may persist into mid-childhood. [14,15,16]

To study whether experience with a variety of fruits or vegetables would increase acceptance of a green vegetable or fruits, Menella et al conducted 2 studies in a group of infants between 4 and 9 months of age.[15] The results demonstrated again that repeated opportunities to taste a particular or a variety of foods may promote willingness to eat fruits and vegetables. However, acceptance of fruits cannot be generalized to vegetables.

Neophobia

In the second year of life, food "neophobia" emerges. Young children become highly vigilant for foods that look new or unfamiliar and reject the foods on sight without tasting it. Food neophobia begins around 18 to 30 months, and regresses after preschool age, as they have more experience with the food and develop a "trust" that the food is safe to eat.[16] Twin studies indicate that neophobia is a strongly inheritable trait.[17]

Canton et al conducted an intervention study in the laboratory setting to study repeated exposure on the consumption of a new vegetable in children. In this study, 332 children from 4 to 36 months were given 5 to 10 exposures to a new vegetable (artichoke).[18] According to the amount of new food consumed during the 5 to 10 exposures, children were categorized as the ''learners'' who increased intake over time, the 'plate cleaners" who consumed more than 75% of new food offered each time, ''non-eaters'' who ate less than 10 g after the 5th exposure and ''others'' whose pattern was highly variable. The result showed that age was a significant predictor of eating pattern, with older pre-school children more likely to be non-eaters.

An extensive literature indicates that with experience of repeated tasting or 'mere exposure', neophobia can be reduced, and disliked foods become liked.[19] Social influence provides another powerful tool for promoting tasting and intake of novel foods. A study assessed 2- to 5-year-old children's responses to novel foods with an adult model present in three settings: (1) the familiar adult was not eating the food, (2) the familiar adult was eating a food of a different colour, or (3) the familiar adult was eating a food of the same colour as that offered to the child. Children accepted and ate more of the novel food in the "same colour" condition, providing evidence that in young children, food acceptance is promoted by specific social influence.[20] Edelson et al. studied the effect of parents' prompts on acceptance of new fruits and vegetables at mealtime of children 12 to 36 months old by observing their interaction at mealtime. The prompts observed included pressure to eat, use of another food or a non-food item as a reward, reasoning

with the child, and modelling eating the food. It took on average 2.5 prompts before children ate the new food.[21] The most immediate successful prompt was modelling. Using another food as a reward worked less well than a neutral prompt for encouraging children to try a new fruit or vegetable.

Offering a liked food as a reward for eating a dislike food, however, has a negative effect on acceptance.[22] For older preschool children, giving a verbal praise and non-food rewards, such as stickers, for having touched or tasted the food are shown to be effective to promote acceptance and the effect is long lasting.[23,24] On the other hand, serving with a liked dip, for example yogurt and ketchup, was shown to be effective in encouraging preschool children to taste a disliked vegetable even though the long term effect on increasing the intake did not differ from presenting the vegetable alone.[25]

Conclusion

Complementary feeding is a period when children learn about foods and develop their food preferences. Breastfeeding helps infants adapt to new food taste at the beginning of introduction of solid foods. Infants accept new foods more readily with repeated exposure and experiencing a variety of food, which are the key determinants in acceptance of new foods in the first year. Modelling, neutral prompts or providing a dip are evidenced-base strategies that help children overcome neophobia to take the first bite. Eating with the family is crucial for infants during the complementary feeding stage. It does not only provide infants with the opportunity to taste different foods but also a context where parents model on eating a wide range of foods.

Key Messages:

1 The process of introducing solid food shapes the food preferences of babies and their subsequent food consumption patterns.
家長替寶寶引進固體食物的過程，會影響他對食物的喜好和日後的飲食習慣。

2 Breastfeeding provides early exposure of food flavors present in the mother's diet, which may promote food acceptance of the baby when complementary food is subsequently introduced.
母乳的味道會隨著媽媽的飲食而變化，所以吃母乳的寶寶很早已接觸到不同食物的味道，這有助孩子更容易接受引進的固體食物。

3 Repeated exposure (may need > 10 times) to a particular or a variety of foods (e.g. vegetables and fruits) enhances infants' acceptance of new foods as well as foods that are less accepted initially, albeit infants may display distasteful facial expressions.
引進固體食物時，寶寶初時會不太接受新的食物。要幫助他接受，可能需要重複嘗試進食某一種或多種的食物如蔬菜、水果 (可能多達十次以上)。過程中寶寶可能會作出一些厭惡的表情，家長無須擔憂。

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