Physiology of taste and food acceptance by infants

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Abstract
Taste allows to human beings to detect and to distinguish food, setting a nutritive diet by means of the gustatory signs that balance the quantity and the quality of meals. The physiology of taste has been studied since intrauterine life, concerning its important role in the future dietary pattern of the child. As food intake is directly related to oral health, it is recommended that dentists know and help parents to select their own and their children dietary pattern. The present article reviews research about the physiology of taste and the process of food acceptance by infants according to their metabolic needs, with the aim of giving health professionals a set of additional information on this subject.

Key Words
taste, child, nutrition
Introduction

Palatability promotes selection, digestion and absorption of food. The five senses are involved in this process, although taste is the most evident. Taste sensations boost the satiety and the pleasure of a meal. They merge from the interaction of taste, smell and other sensorial signs generated by physical factors – as touch and vision – and chemical substances released by food during meals.

The basic sensations of taste are sweet, sour, salted and bitter. However, recent experimental data indicate that there are other tastes like umami (monosodium L-glutamate; 5'-ribonucleotides), metallic (iron salts) and astringent; many kinds of food and ingredients are rich in substances that provide these tastes. The umami compounds themselves are not an independent flavor characteristic, but they are able to increase the palatability of a variety of food and to improve the pleasure of eating.

The gustatory organs that are responsible for tasting appear around the 7th or the 8th week of intrauterine life. These structures reach morphological similarity to adult’s from the 13th to the 15th week, except the degree of keratinization. Studies suggest that the fetus gives preferential answers to stimulation of taste, repeating this pattern after birthing.

During meals, the facial expressions of infants show liking or rejection that suggest to parents the level of food acceptance. However, it has been shown that the capacity of a newborn to modulate this kind of answer is not well accepted or rejected. The diminishing of taste sensibility for salted and the amplifying taste for sweet may occur due to zinc deficiency for long periods of time.

Krebs still emphasizes that zinc and iron are trace elements of critical importance to the children’s growth and ordinary development and they are present in adequate quantities in breast milk.

The peripheral sensorial organs of taste are polarized neuroepithelial cells that get together in spread bulbs of dorsal surface, lateral and in the base of the tongue next to the ducts of sublingual glands, in the soft palate, pharynx, larynx, epiglottis, uvula and the first third of the esophagus. Nowadays, taste receptors cells are also found in the stomach and intestine mucosa.

The gustatory bulbs of tongue are placed in specialized epithelial projections named papillae, which are formed around the 7th and 8th week of intrauterine life, and are subdivided in fungiform (placed in the two thirds of the front of the tongue and they get the sweet and salted tastes); foliate (back lateral of the tongue and get the sour taste) and circumvallate (placed in “V” in the back of the tongue and they get the bitter taste); and the filiform papillae do not have gustatory bulbs.

The gustatory papillae are able of conducting sensorial information to the central nervous system in the 6th month of intrauterine life and the neural connections are adequate to provoke alterations in salivation and suction.

According to Schiffman and Drewnowski the tongue movements may stimulate the length of taste sensations. The odor sensations complement the taste when the odorants reach the epithelium through the nostrils and the retro nasal region through oral cavity. The olfactory cells are also found in constant renewal three times bigger than the taste ones. The olfactory system is very developed when the baby is born and studies have suggested that the fetus may be exposed to smelling sensations characterized by the substances consumed by the pregnant.

During the first hours of life the breastfed infants express their favoritism in their faces in relation to the sweet taste, rejection to the sour and bitter ones and no reaction to the salted ones. These observations make the parents interpret erroneously to the non-acceptance to the food provided, when, in fact, the newborn needs to module the flavor through the taste maturation. This preference for the sweet has been described as innate, i.e., nourished or malnourished infants, whose mother has eaten or not much sugar, have the same appetite to this flavor. This predisposition is related to the instinct of breastfeeding since the lactose and casein (constituents of breast milk) promote a sweet flavor to the milk in order to satisfy the baby’s taste.
The sensation of salted flavor comes to the 4th month of life after the baby is born due to the maturation of peripheral and central mechanisms. Many gustatory systems of the fetus are developed after the baby’s birth, and they can be influenced, therefore, to environmental experiences. The palatability of flavors is influenced directly by umami substances present in many kinds of food. Even though these kinds of food do not own a characteristic of peculiar flavor, they enhance the palatability of the other categories of flavor, thus increasing the pleasure of digesting the food. The development of taste occurs during the intrauterine life and reaches its maturation around the 8th month of life after birth. It is necessary, then, the intervention in this period of life to promote the knowledge and realization of guiding attitudes towards parents in order to give positive intervention in the food preference.

**The babies’ pattern of food acceptance**

The food behavior must be seen as a complex phenomenon that involves motor coordination, cognition, social development and emotional aspects of the child, and it can interact with the genetic predisposition producing phenotypes of food preference. The concept of preference involves the choice of a determined kind of food instead of others and may be influenced by intrinsic and extrinsic factors. Among the intrinsic factors there are those related to the food characteristics such as texture, appearance, temperature and those belonging to the individual such as the genetical factors. The extrinsic are related to a variety of social, cultural, environmental and economical factors. Even though the babies accept the sweet food innately and reject the bitter and the sour ones, their preferences, for the great majority of food, are formed for the repetition of flavor experience.

The determination of food acceptance pattern is also influenced by neophobia (reluctance in consuming new kinds of food) and the capacity of learning, selecting, and accepting food when they are offered repeatedly. Thus, the facial expressions of liking and disliking of the baby when dealing with a new kind of food could not be seen as unencouraging, but as a signal of immaturity of the taste system. The alteration of the pattern of acceptance requires from 8 to 10 expositions to the same kind of food and the parents must be encouraged to do that. Pliner affirms that parents tend to be more neophobic than the babies influencing directly to their acceptance pattern.

Another aspect of great importance is the emotional interference on the food choice. The baby must get his food in a pleasant place, since the social contexts are noticed and may reinforce the preference or rejection to the food offered. Many times it can be noticed vomiting and sickness, which can reveal a conditioned aversion from the parents and the babies.

According to Blundell et al., the human appetite is a mixture of psychological and physiological phenomena that include hunger, energetic and nourishing food ingestion, distribution and size of meals. The appetite control involves post digestion mechanisms, including signals sent to the gastrointestinal tract and hormones liberation. The act of eating is not tied to the biological need of growth and homeostasis, but it may be strongly tied to the social interaction, to the mother-child relationship and lately in a social context.

After studying the food behavior of babies, Young and Drewett observed that children until one year old are very vulnerable to the food behavior varying their preferences within meals, and that refusal is an ordinary characteristic from this age. Another aspect also observed by Wyrwicka is that the quality of food offered to babies is similar to those consumed by mothers.

The food experience with adults and children differ in the taste sensibility, in cognitive, emotional and physical maturity considering the social context they are in. The maturity of taste system occurs around the 8th year of age, occurring faster with girls. Thus, the child improves her capacity of integrating the information in different areas of the taste sense, through more efficient transmissions, better processing of information and synaptic connections. Even knowing that early experiences influence the preferences along life, these may be modified and amplified in terms of physiological development.

Another aspect to be considered is that there is a preference for food of high energetic density from children and adolescents due to their intense metabolism and daily waste of energy. This way, it is understood that an adequate diet plan to these ages must be developed in order to promote a contact with a broad category of flavors searching, at the same time, the satisfaction of affective and physiological needs.

The patterns of food acceptance in the first years of life develop and modify themselves in a very diverse and broad way. The responses not learnt to the flavors and the predispositions to respond to energetic density of food are modified by the food experiences, by the contexts in which the food is offered and by the physiological consequences of digesting. The individual differences in pattern are associated to the genetic factors within an environmental context.

Thus, educational programs that have the goal of informing parents about the ordinary food behavior and strategies to promote positive dietary practices must be promoted. The role of dentist that gives the primary care to parents of newborns must incorporate information of this kind due to the fact that dietary habits has a strict reflection in odontogenesis, to the maintenance of oral health and to the
development of pathologies such as dental caries, so frequent at this age.

The protein, mineral and vitamins prenatal deficiency gives the child more chances of having oral problems since there are alterations in the dental and salivary formation and function. The authors say also that the ingestion of carbohydrates must be moderate, since these are the basis for the bacterial action and, consequently, to development of caries disease.

The dentist, therefore, is an important expertise that must be part of a group to advise the parents in early treatment of their babies in order to promote health. To do that, s(he) must know the taste physiology and the children’s pattern of food acceptance to promote positive consequences in the oral cavity and in the formation of positive habits which will lead to their physical, mental and social development that will result in a balanced human being.

References