

Picky Eating

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Picky eating is a complex phenomenon that is often characterized by parental perception of behaviors such as avoiding the intake of certain food groups, avoiding certain foods based on their sensory characteristics, requiring specific food presentations or preparations, eating a limited variety of food, and not eating an adequate amount of food. Several factors contribute to these mealtime behaviors, including early feeding practices (i.e., breastfeeding, introduction to solid food), repeated exposure to novel foods, and genetic taste sensitivity to certain compounds. It is important to better understand the contributors to picky eating in order to develop effective interventions, as persistent picky eating can have detrimental effects on long-term dietary intake and mealtime behaviors.

Keywords: picky eating ; vegetable intake ; eating behavior ; exposure ; taste sensitivity

1. Characterizing Picky Eating

The phenomenon of picky eating encompasses a variety of child and caregiver behaviors. Currently, there is no widely agreed-upon definition of this phenomenon as the characterization is largely based on parental or caregiver perception of mealtime behaviors. Measuring picky eating is also inconsistent as various tools are used to evaluate these behaviors ^[1]. However, common behaviors that are associated with picky eating include avoiding the intake of certain food groups, avoiding certain foods based on their sensory characteristics, requiring specific food presentations or preparations, eating a limited variety of food, and not eating an adequate amount of food ^[1]. Food neophobia, or the unwillingness to try new foods, is another common behavior that is often associated with children who are perceived as picky eaters ^{[2][3]}. Although picky eating and food neophobia are often seen as normal childhood behaviors and generally resolve with little intervention, strong and persistent food refusals and very limited ranges of food intake can cause worry amongst caregivers and should be addressed ^{[4][5]} as they may lead to more serious health consequences, such as nutrient deficiencies and growth impediments ^[2]. Children's early experiences with food are crucial to the development of long-lasting preferences and eating habits. It is suggested that preferences that develop during this time are likely to persist into adolescence and can predict diet quality in adulthood ^{[6][7]}. Several factors contribute to the development of picky eating behavior ^{[6][8]}. Many of these factors can be grouped into the categories of *nature* and *nurture* in order to illustrate the multifaceted concept of picky eating.

2. Nature

Certain elements of picky eating behavior may be attributable to innate, genetically determined taste preferences present in young children ^[6]. The preference for and ability to detect sweet taste are innate attributes in children as sweet taste typically indicates caloric density, a property that is important during periods of growth ^{[7][9]}. The ability to taste certain bitter thiourea compounds, such as 6-n-propylthiouracil (PROP) and phenylthiocarbamide (PTC), is genetically determined. In the U.S., about 70% of the Caucasian population can detect the taste of PROP and are called tasters, while 30% are insensitive to the taste of PROP and are called non-tasters ^[10]. PROP/PTC tasters have shown to be more sensitive to bitter compounds such as caffeine and quinine ^[11]. This is of note as vegetables, which are the least liked food category amongst children ^{[12][13]}, often contain dietary phytonutrients that impart bitter taste ^[14]. In addition to bitterness, PROP taster status may be related to perception and preference for sweet taste, fat texture, and the oral sensation from capsaicin, the active irritant compound in chili peppers ^[11]. A study conducted by Cole et al. ^[15] in pre-school-aged children determined that genetic variation in certain bitter taste receptor genes was associated with picky eating behaviors such as reduced dietary variety and struggle for control at mealtime. It has also been shown that traits such as food neophobia and 'food fussiness' are highly heritable ^{[16][17]}. Innate and genetic taste sensitivities play a key role in the development of picky eating behaviors in young children.

3. Nurture

Aspects of nurture including early life exposures to flavor, parenting style, parental feeding practices, food availability, and repeated exposure, play a major role in the development of childhood eating behaviors.

Early life exposures to flavor can occur in utero, via amniotic fluid, and during infancy through breastfeeding [18][19]. Studies have investigated the influence of the maternal diet during pregnancy and lactation on flavor transfer through amniotic fluid and breastmilk, respectively [20]. Exposure to various flavors in formula has also been shown to influence preferences [21]. Introduction to a variety of flavors during weaning, as well as the age at which this occurs, may also play a role in later food acceptance and preference [8].

Parenting style is related to mealtime behaviors exhibited by both the parent and the child, and to the perception of picky eating and non-picky eating behaviors by parents. Implementation of authoritative parenting strategies such as encouragement, modeling, and child involvement can help combat picky eating behaviors [22]. Additionally, the home food environment and food availability play a role in food behavior development. Children living in homes with higher availability of fruits and vegetables tend to consume more of these foods. This also applies to unhealthy foods as more accessibility to sweet and salty foods leads to greater consumption of these foods [23].

Children tend to prefer foods that are more familiar to them. It has been noted that upon being offered a novel food, young children may hesitate to taste it, and may spit it out. However, low levels of exposure to a novel food can increase its acceptance and preference [24]. Additionally, exposure to a variety of flavors can even enhance the acceptance of new vegetables and novel foods from other categories [25].

4. Interaction of Nature & Nurture

Several developmental factors interact to shape the eating behaviors and food preferences of young children [8]. Elements of nurture, such as taste exposures and parental feeding practices, can modify child feeding behaviors that may be based on innate taste sensitivities. Conversely, a child's innate preferences and behaviors, as well as their temperament, can affect nurture components like parenting style and food availability [8]. Thus, feeding interactions within the child-caregiver dyad are bi-directional [26]. Additionally, since the development of picky eating is multidimensional, with various combinations of *nature* and *nurture* factors at play for each child, future research and mitigation strategies must be individualized.

5. Mitigation of Picky Eating

Strategies to mitigate picky eating include improving the sensory characteristics of vegetables to increase their intake. This can be done by pairing vegetables with herbs, spices, and dips, and modification of texture and flavor through cooking [27][28][29][30][31][32][33]. Combining intervention strategies such as repeated exposure with flavor-flavor learning may be beneficial as well. Child-friendly names and packaging can also help increase vegetable acceptance [33][34]. It is also important that strategies for mitigation of picky eating target both the child and their family given the links between the home food environment and child eating behaviors.

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