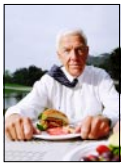

Food Preference and Consumption Among the Elderly

Food marketers and product developers must understand how age affects sensory perception, food preference, and consumption so they can meet the needs of the expanding mature market.

Richard Popper and Beverley J. Kroll

Worldwide, within the next 20 years, the number of people over 60 years of age will exceed one billion. By the year 2020, 25% of the United States population will be 60 years or older, a growth of 8% over today. This demographic trend makes older people one of the fastest-growing population segments in the U.S. As lifespan continues to increase, there will be a particularly sharp rise in the number of people living beyond the age of 85.

Aside from those companies that market products developed specifically for the elderly (e.g., nutritional supplements), the food industry does not appear to be paying very close attention to the older consumer, at least if current market research practices are any indication. Seniors often lack even a proportional voice in primary consumer research—many product tests exclude individuals over the age of 59, either because they do not represent the product's core target or because they are thought not to make good respondents. Similarly, Web-based concept research, which is rapidly becoming the research tool of choice for testing new product ideas, is likely to under-represent seniors, who currently lag the rest of the population in the use of Internet technology (Wydra, 2003).

Baby Boomers—those born between 1946 and 1964—will be entering their senior years in the not-so-distant future—the oldest Boomers turn 65 in 2011. Boomers have always had a strong generational identity—defined by an attitude of "It's all about me," a celebration of youth, and a desire for self-reward and the "catered experience" (Westfall, 2001). They have been a significant force in the U.S. marketplace ever since reaching adulthood, and aging Boomers will demand products and services tailored to meet their needs—even as they deny their age and refuse to be labeled as old. And unlike previous generations of seniors, they will have the purchasing power to get industry's attention.

For food marketers and product developers to be prepared to meet the needs of the expanding mature market, they must start with an understanding of how age affects sensory perception, food preference, and consumption.

Sensory Losses with Age

Aging affects our ability to taste and smell. For example, researchers have found that compared to younger people, older individuals have a greater difficulty detecting the presence of sweet, sour, salty, or bitter

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compounds in a water solution (see Murphy, 1986, and Mojet et al., 2001, for reviews). Such a decrease in sensitivity is also found for umami (a Japanese term referring to the taste of glutamate salts), which some researchers consider a fifth basic taste (Schiffman, 1997).

When the elderly do detect a basic taste, they experience it as less intense than younger people do (Murphy, 1986, 1993), although these intensity decrements have been more difficult to demonstrate in real foods than in water solutions (Rolls and Drewnowski, 1996).

The losses in sensitivity do not appear to be uniform across the basic tastes. Bitterness perception seems to show the greatest decline with age and sweetness the least (Murphy and Gilmore, 1989), although not all studies agree on this point (Mojet et al., 2001).

Age-related losses in taste sensitivity are most noticeable in individuals on medication (Schiffman, 1996). Medications affect basic tastes either by modifying the taste mechanism or by introducing a taste of their own (Schiffman, 1997). Given how medicated the elderly population tends to be, the side effects on taste are likely to be quite prevalent.

Much more dramatic than the effects on basic tastes are the effects of aging on olfaction, the sense of smell. It is the olfactory system that is responsible for our ability to perceive the panoply of food flavors, either by sniffing or during chewing, when volatile flavor compounds are released and are sensed as flavor as they stimulate the olfactory system retronasally. In what is probably the largest chemosensory survey conducted to date, six scratch-and-sniff odor samples were inserted in an issue of *National Geographic* and sent to more than 10 million subscribers worldwide; about 1.4 million subscribers responded. The results revealed a clear and substantial decline with age in the percentage able to detect an odor and an average 20% decline in perceived odor intensity from the twenties to old age among those who could detect it (Gilbert and Wysocki, 1987).

Not only does the ability to detect an odor decline with age, but the ability to identify it also does. Doty et al. (1984), using odors impregnated on paper strips, observed peak performance in odor identification in respondents age 20–40 years, but noted a sharp decline in performance after the age of 60. The elderly are also less able to identify food flavors while eating. In a study by Schiffman (1977), young and elderly were fitted with blindfolds and served blended foods (thereby eliminating visual and textural cues). The elderly had far greater difficulty identifying the foods than did the young people. The difficulty in identifying odors is taken as an indication of faltering odor memory and therefore as evidence for a cognitive, in addition to a peripheral (i.e., receptor), component in olfactory loss (Murphy et al., 1997).

While most of the research on the impact of age on food appreciation has focused on changes in taste and smell, researchers have started to turn their attention to other sense modalities. The burn from hot pepper, the pungency of mustard, and the tingle of carbon dioxide are the result of stimulation of the trigeminal nerve. In a recent study, Laska (2001) compared healthy elderly subjects (age 65–88) and a young control group (23–36) in terms of their ability to identify trigeminal sensations, such as the coolness of menthol and the pungency of vinegar. Laska also tested subjects' ability to discriminate different intensity levels of the same trigeminal stimulus. There were noticeable but relatively small differences in performance between the two age groups, suggesting that the trigeminal system remains relatively intact over the lifespan. This finding is consistent with those of previous studies (e.g., Wysocki et al., 1997).

Whether or not a decline with age is found in response to trigeminal stimuli may depend on the particular stimulus. In experiments in which elderly subjects judged the above-threshold intensity, some substances, such as CO_2, showed a reduction in perceived intensity (Stevens and Cain, 1986), while others, such as capsaicin, did not (Pelchat et al., 2000). Overall, it appears that the age-related losses in trigeminal sensitivity are less pronounced than the decline in olfactory sensitivity and perception.

The ability to differentiate various food textures and to chew effectively (thereby releasing important flavor volatiles) contributes considerably to the enjoyment of food. Studies reviewed by Fillion and Kilcast (2001) on chewing ability and oral tactile perception in the elderly confirm that older individuals have impaired chewing ability, especially those wearing whole or partial removable dentures. Some of the studies also concluded that the elderly receive less detailed tactile information from the mouth. One study measured tactile feedback using a test of oral shape recognition, in which respondents were asked to identify shapes in their mouth (letters of the alphabet made from sugar) without the aid of vision or hand manipulation. The results showed that adults over 65 did not perform as well as younger subjects age 20–35.

Given these documented declines in sensory perception, especially with regard to olfaction, it is surprising that older adults do not complain more often about the flavor of their

food. It appears that older adults are largely unaware of their loss of smell (Stevens, 1989). And despite the changes in their sensory world, the elderly rank a food's sensory properties, along with familiarity with the food, as significantly more important than other factors in their food purchase decisions, except when eating alone, an occasion where ease of preparation is most important (Rolls, 1993).

Rolls (1993) suggested that the reason the sensory losses go unnoticed is that they are so gradual, occurring over a period of many years. In fact, Murphy (2001) reported that when the elderly do experience a sudden change in olfactory performance, e.g., due to sinusitis, they are acutely aware of the diminution in flavor perception and seek remedies.

Food Preference Shifts with Age

Do the elderly adapt to lower flavor experience, or do they prefer higher levels of flavor in their food to compensate for their sensory losses? Murphy and Withee (1986) compared the effect of varying sucrose concentration on pleasantness ratings, in both young subjects and the elderly. For both groups, pleasantness, when plotted against sucrose concentration, showed an inverted U shape—the lowest and highest levels of sucrose were liked less than levels in the middle of the range. However, there were age differences. In an aqueous solution, the level of sucrose liked the most was higher for the elderly than for the young. In a flavored beverage base, the optimal levels were similar, but the elderly showed less dislike for higher-than-optimal levels of sucrose.

Zandstra and de Graaf (1998) also noted that the elderly preferred higher concentrations of sucrose in an orange beverage than younger adults and were more tolerant of higher concentrations of citric acid. Pangborn et al. (1983) reported that older subjects added more salt to soup to maximize liking, but Drewnowski et al. (1996) reported that older adults preferred less salt in soup.

In another study, de Graaf et al. (1996) set out to determine whether age-related differences in preferred concentration could be accounted for by differences in perceived intensity. They had elderly adults (age 67–86) and young adults (age 20–30) judge various foods (bouillon, tomato soup, chocolate custard, and orange lemonade) in which the flavor concentration was varied. Both intensity and liking ratings were collected. The maximally preferred flavor levels were higher for the elderly than for the young, and the difference could largely be explained by the difference in perceived intensity—it took a higher level of flavor to reach the same preferred intensity level.

However, the researchers found that in some instances (e.g., sweet as opposed to savory foods) the difference in perceived intensity could not fully account for the difference in maximally preferred flavor level. It those cases, the preferred level for the elderly was even higher than a difference in perceived intensity would have predicted.

These laboratory studies suggest that increasing flavor impact might be a viable means for increasing food enjoyment among the elderly, and some real-world studies support this strategy. Schiffman (2000) found that adding a combination of MSG and flavorants increased liking of foods served in a cafeteria at a retirement center compared to unenhanced versions of the same foods. Griep et al. (1997) found that added concentrations of flavors or spices enhanced liking of soup, yogurt, and a meat substitute. And de Jong et al. (1996) found that increasing sweetness in breakfast foods increased liking among the elderly in a laboratory taste test, although the benefit did not hold up in a consumption test held at a retirement center, possibly because the sweetness differences were not large enough.

Just adding more of an existing flavor to a product may not be the best solution, and its success most likely will be very product specific. For example, Koskinen et al. (2003) found that just increasing the flavor already present in a yogurt-like product did not enhance liking among the elderly. Drewnowski et al. (2002) cited a study comparing the success of flavor amplification to flavor enhancement. An example of flavor *amplification* involved adding carrot flavor to carrots. Examples of flavor *enhancement* included adding bacon flavor to peas and cheese flavor to cauliflower. Drewnowski et al. concluded that flavor enhancement was more effective than flavor amplification for increasing preference.

There is further evidence that the elderly may show a desire to compensate for their sensory losses. Duffy et al. (1995) studied elderly women living in a residential facility and found that those with smell losses consumed more sweets and fats, perhaps making up for their olfactory impairment with foods that tasted sweet and had a creamy mouthfeel. The suggestion that the elderly may compensate for flavor losses with sweetness was also made by de Jong et al. (1996).

Given the considerable variability among the elderly in ability to perceive flavor, an increase in flavor might be perceived as an improvement by some, but as an overpowering change by others. And because the magnitude of sensory loss also depends greatly on the specific taste or odor quality, achieving a well-balanced, high-impact flavor might be difficult.

In light of these challenges, multiple strategies for increasing food appeal may need to be considered, such as altering appearance, texture, or temperature (in a restaurant setting). Philipsen et al. (1995) suggested that it might be possible to compensate for the olfactory losses in the elderly with visual cues. Their study showed that the perceived flavor intensity evaluated by the elderly (age 60–75) increased with increasing color intensity, but did not do so for a group of younger adults (18–22).

Aside from differences in preferred flavor intensity, are there other systematic differences in sensory preference between elderly and younger adults? Because of the high incidence of dentures among the elderly and an age-related reduction in salivary flow (which can impede swallowing), the elderly are likely to prefer textures that make the food easy to chew and swallow. However, only a few studies have investigated texture preferences among the elderly (Forde and Delahunty, 2002; Kälviäinen et al., 2002).

Texture may take on added importance among the elderly, not just on account of chewing difficulties, but also in light of the decline in flavor perception. Moskowitz and Krieger (1995), testing non-elderly populations, showed that flavor was dominant over appearance and texture as a determinant of liking, across a range of product categories. Among the elderly, the relative emphasis among these dimensions may differ, as elderly consumers shift their attention from flavor to appearance and texture. Forde and Delahunty (2002) found that in products varying in both texture and chemical irritation (e.g., level of white pepper), the elderly were more affected in their liking ratings by texture than were younger adults (both groups were affected by the level of chemical irritation). Kälviäinen et al. (2003) examined the relative im-

portance of texture, taste, and aroma in a yogurt-type snack, in both the young and the elderly. In this instance, texture (variations in smoothness) did *not* take on increased importance among the elderly relative to taste and flavor, perhaps because of the nature of the specific product involved.

There may be a hidden benefit to the reduction in sensory sensitivity with age. Sour and bitter notes are often perceived as negatives, and a loss of sensitivity to these taste qualities might enhance the appeal of certain foods, such as cruciferous vegetables, which have important nutritional benefits (Mattes, 2002). And Pelchat (2000) found that elderly subjects were more willing to try novel foods than younger adults (at least in a laboratory setting), attributing this finding to a reduction among the elderly in their ability to perceive unfamiliar/unpleasant aromas.

Finally, regardless of how product developers choose to address the sensory deficits among older adults, products in many instances will be perceived differently by older and younger adults. Making inferences from trained or consumer panels composed of younger adults to how the elderly will perceive products and how much they will like them will likely lead to incorrect conclusions.

Food Intake, Aging, and Health

Not only do the elderly have different food preferences, but also their food habits differ from those of younger adults in profound ways. The elderly eat less than younger adults. This decline in energy intake is associated with the consumption of smaller meals, eaten more slowly, and with fewer snacks between meals (MacIntosh et al., 2000). Pelchat and Schaefer (2000) reported fewer food cravings among the elderly. One possible consequence of reduced craving and a reduced desire to snack is fewer spontaneous or impulsive food purchases, which may have a negative impact on the snack food industry. Meanwhile, the overall reduction in meal size means that food marketers will need to adjust the way they size their portions.

The reduction in energy intake, sometimes referred to as the "anorexia of aging," is largely a normal response to aging and reflects the reduced energy needs among the elderly. However, weight loss can represent a health risk for some elderly. And while the caloric needs might be reduced in the elderly, their needs for most nutrients are not, and for some nutrients may actually be higher (Blumberg, 1994; Chernoff, 1995).

Some authors, such as Schiffman and Graham (2000), suggest that sensory losses accompanying aging may be responsible for the reduced food intake in the elderly and that flavor enhancement or amplification might help overcome caloric deficits. However, while flavor modifications can increase preference (as noted above), there has been a failure to observe an associated increase in caloric intake with flavor enhancement. Schiffman and Warwick (1993) tested the effect of a flavor-enhanced diet on elderly adults over a three-week period and found that intake increased significantly only for three of the 20 enhanced foods. Total calorie and macronutrient intake did not differ between the enhanced and the non-enhanced diet. Similarly, de Jong et al. (1996) did not observe an increase in the amount of food eaten as a result of sweetness increases. Mathey et al. (2001), however, did find an increase in body weight in elderly nursing home residents when using a flavor-enhanced diet.

There is some reason to doubt an association between olfactory loss and reduced intake (Rolls, 1999; Mattes, 2002). De Jong et al. (1999) found no correlation in elderly subjects between sensory performance and energy or food intake, and Duffy et al. (1995) failed to show a connection between olfactory dysfunction and total energy intake or body weight among elderly women.

Dietary supplements, such as *Ensure*, may be more effective at increasing energy and nutrient intake than flavor enhancement. The elderly are less likely than younger individuals to compensate for the energy in supplements by reducing their intake of other foods (Rolls and Drewnowski, 1996), since regulatory mechanisms in the elderly are impaired (Rolls, 1989; Rolls et al., 1995). According to Rolls and Drewnowski (1996), most studies indicate that nutrient-dense supplements can increase energy intake and improve the nutritional status of the elderly.

A dietary concern with energy intake among the elderly, combined with Boomers' interest in health and in the functional benefits of the foods they eat, suggests that in the future there will be a growing demand for the development of good-tasting, nutrient-dense foods.

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Dietary Variety

The diet of older adults tends to be less varied than that of younger adults (Fanelli and Stevenhagen, 1976), although Drewnowski et al. (1997) found a more varied diet among a group of older adults who were healthy, educated, and of relatively high socioeconomic status. Reduced variety itself poses possible health risks, since consuming a varied diet tends to be more nutritionally sound.

One of the reasons the elderly diet may be more monotonous is that the elderly have diminished sensory-specific satiety. Normally, following consumption of a particular food, the liking for that food declines. This change in liking, called sensory-specific satiety (Rolls, 1986), is associated with decreased consumption of the previously eaten food and a shift in consumption to other food choices during a meal. Since most food is consumed in meals, sensory-specific satiety promotes the intake of a varied diet. Another consequence of sensory-specific satiety is that the presence of a greater variety of food choices at a meal tends to lead to greater consumption (which is why people eat more at buffets).

Rolls and McDermott (1991) showed that the elderly have reduced sensory-specific satiety, compared to other age groups. That is, the elderly show less of a reduction in the pleasantness of the food they have just consumed. This lack of sensory-specific satiety did not appear to be related to a loss of sensory function, suggesting that there is a cognitive

component involved in the observed age difference, related perhaps to a decreased desire in the elderly for change of all types. Rolls (1992) also cites evidence that the elderly are less responsive to the presence of an increased beverage variety, consuming no more when given a variety of beverage choices than when given a single choice.

There may be implications of this reduced sensory-specific satiety for restaurant companies and those packaged goods manufacturers offering meal solutions. At a restaurant, the elderly may respond less to menu variety, i.e., choose fewer items. With prepared foods, they may be more satisfied with single-item "entree bowls" than with multi-component meals.

Social Factors

Social factors and the eating environment are significant determinants of food intake (see review by Meiselman, 1996). De Castro and de Castro (1989) demonstrated that the amount people eat at meals increases in the presence of other people. The magnitude of this social facilitation effect depends on the number of people present at the meal. Interestingly, strangers have less of a facilitative effect than familiar people. De Castro (2002) has confirmed the social facilitation effect in the elderly.

Assisted-living facilities provide important socialization opportunities, and the communal aspect of the meals taken together plays a central role in contributing to the health and well-being of the residents. Similarly, the meal programs funded by the U.S. government's Older Americans Act that offer subsidized meals at community centers not only provide seniors with cost-effective meals, but also offer an important social setting that is likely to enhance food intake. Foodservice managers can benefit the elderly by exploring ways of further enhancing the social aspects of the meals they serve.

Preparation and Convenience

The need to provide user-friendly packaging and legible labels is especially important to the elderly, who may have limited dexterity, hand strength, and visual acuity, compared to younger adults.

Ease of preparation is a critical factor in the meal choices for today's time-stressed working men and women. Time stress may diminish with the onset of retirement, although Boomers are likely to stay active and continue to lead busy lives. Even with time more plentiful, the effort involved in obtaining and preparing food will remain an important factor in the food choices of aging Boomers.

Studies among younger adults have demonstrated that increased effort can affect food selection and can result in reduced intake (Engell et al., 1990; Meiselman et al., 1994). Similar effects can be expected among the elderly. Thus, effort is another barrier to consumption. Reducing effort can take a variety of forms, from minimizing the number of steps involved in preparing a meal to increasing convenience at the cafeteria line. And given the greater disposable income among aging Boomers compared to prior mature consumers, it is likely that the demand for high-quality, home-delivered meals—the height of convenience—will increase considerably in the future.

Implications for Research

As people age, there are physiological and cognitive changes that affect their sensory perception, preference, and consumption of food. Product developers and marketers will undoubtedly be increasingly motivated to understand the aging consumer, as the size of the mature market grows.

To support the food industry, both basic and applied researchers will be asked to furnish answers to the many outstanding questions about the effect of aging on preference, food choice, and consumption. For example, the European Union has recently launched an ambitious program called HealthSense, designed to investigate how changes in sensory physiology, sensory psychology, and socio-cognitive factors influence food choice. This multidisciplinary project involves the participation of 24 research centers from ten European countries and is likely to deliver new insights into some of the fundamental factors that drive food selection and intake among the elderly.

Meanwhile, corporate sensory and marketing research departments will find it a business imperative to develop deeper insights into the aging consumer, and couple a consumer understanding with appropriate marketing strategies that meet the needs of the aging Baby Boomers.

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continued on page 40 ▶

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