Pre-ingestive and Post-ingestive Influences on Dietary Fat Intake

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Abstract

There are various pre-ingestive and post-ingestive factors that can modulate dietary intake and specifically dietary fat consumption. This review on dietary fat consumption will examine pre-ingestive influences such as orosensory cues (texture, taste and perception of dietary fat), PROP sensitivity, age, gender, experience and post-ingestive, which consists of triacylglyceral (TAG) and satiety responses. Evidence reveals that orosensory cues modulate what is consumed by the texture, taste, and perception of the individual. Genetically determined PROP sensitivity has also been found to have a relationship with consumption. PROP tasters have been found to prefer or avoid certain foods. Differences in the perception of PROP tasters and nontasters create variations in their diets as well. Age differences were detected among the age groups of children, adolescents and adults, but no differences were found within these groups. The differences found could account for the discrepancy in the increased consumption of foods high in sugar of children in comparison to adults. Many differences also exist between male and female perception and neurological activity, which causes differences in their diets. Past experience with certain foods is key in determining what is presently consumed. Evidence reveals that experiences perceived as pleasant will likely be repeated while unpleasant experiences will be avoided. The post-ingestive factors that were observed involve humoral signals such as triacylglyceral (TAG) responses and satiety impact food assessment. Specific fatty acids have been found to enhance the postprandial rise of TAG. Satiety is active in helping individuals control their dietary fat intake. Certain foods are found to produce stronger satiation affects, and some of these were foods containing high amounts of fat.
Pre-ingestive and post-ingestive areas that were examined may be pertinent factors in the dietary intake and energy consumption of individuals. These various and complex components must be examined and understood for thorough analysis of the modulation of dietary fat intake.
Introduction

As obesity develops into a prevailing epidemic in our country today, much of the research has been geared towards establishing determinates of fat consumption. Fat found in foods is designated as dietary fat. There are three types of natural dietary fat—monounsaturated, polyunsaturated, and saturated fats (Rago, 2003). The majority of consumed foods have a combination of these three fats. Dietary fat has an essential role in physiological functioning, but only moderate amounts are necessary. Too much of the same types of fat can be harmful. Rago acknowledges that healthy diets consist of more unsaturated fat than saturated fat. Fats and oils are composed of lipids, whose basic units are fatty acids. Each type of fat or oil has a different combination of fatty acids. Monounsaturated and polyunsaturated fatty acids are two types of unsaturated fatty acids, and should be the primary constituent of fat in one’s diet (Rago, 2003). Monounsaturated fatty acids are found in olive oil, canola oil, and peanut oil (NIN, 2002). Food sources that contain polyunsaturated fats are safflower, sunflower and corn oils, soybeans, many nuts and seeds, and seafood (Rago, 2003). Saturated fatty acids are the most detrimental fats and should be consumed sparingly. Saturated fats are found in animal foods, coconut oil, and palm oil (NIN, 2000). Trans fat is another type that is concentrated in shortening, margarine, crackers and cookies (NIN, 2000).

This review examines the factors that influence dietary fat intake. Pre-ingestive as well as post-ingestive influences are included. Pre-ingestive factors include orosensory cues (texture, taste and perception of dietary fat), PROP sensitivity, age, gender, and experience, and post-ingestive factors consist of triacylglyceral (TAG) and satiety responses. One major pre-ingestive influence is taste. Therefore, the reader must be
provided with background information for comprehension of this review. The basic structures and mechanisms of the taste system are key concepts to comprehend. They primarily focus on taste buds, papillae, and transduction.

Taste signaling begins when receptors are stimulated on the tongue. On the tongue there are ridges and valleys called papillae, which contain taste buds (Goldstein, 2002). Fungiform papillae are shaped like mushrooms and found at the anterior two-thirds of the tongue. These papillae contain taste buds, which are made up of taste cells. These taste cells have receptor sites where transduction occurs when a chemical stimulates receptors in the membrane of the taste cells (Goldstein, 2002). There are four basic taste categories: sweet, bitter, sour and salty. Each of these categories has a different transduction mechanism. Molecules of bitter and sweet substances bind to the receptor site and stimulate the activation of g-proteins in the cell. In comparison, sour substances contain H⁺ ions that block K⁺ channels in the membrane. Sodium (Na⁺) of salty substances flows through the membrane channels directly into the cell. Each transduction mechanism affects the cell’s electrical charge, impacting the flow of ions into the cell (Goldstein, 2002). Each mechanism results in the depolarization of the cell, which facilitates the neurotransmitter release. In addition to the many pre-ingestive influences, such as taste, there are many post-ingestive influences that modulate the consumption of dietary fat.

An example of post-ingestive influences is humoral signals released after food consumption. Triacylglycerol (TAG) and cholecystokinin are two important post-ingestive signals of dietary fat. Triacylglycerols are stored lipids that are found in adipose (fat) cells and tissues. The TAGs are highly concentrated forms of metabolic
energy, consisting of three fatty acids connected to a glycerol backbone (Gunstone, 1999). Cholecystokinin (CCK) is a peptide that is created as a preprohormone and splits to form a family of peptides containing identical carboxy ends (Rushakoff et al, 1987). The primary function of CCK is to facilitate digestion within the small intestine. Mucosal epithelial cells secrete CCK in the duodenum, the first segment of the small intestine. CCK stimulates transport of digestive enzymes from the pancreas and bile from the gall bladder into the small intestine. The stimuli that initiate the secretion of CCK are digestive fats and proteins that enter the duodenum (Rushakoff et al, 1987).

It is apparent that there are many influences of dietary fat consumption. In order to comprehend the controls of dietary fat intake, these influences, which consist of pre-ingestive and post-ingestive, must be examined. First, we will look at the pre-ingestive influences, which include orosensory cues, PROP sensitivity, age, sex, and experience. Next, the humoral signal such as TAG and CCK will be examined, followed by the role of satiety.

The Role of Orosensory Factors on Dietary Fat Intake

Pre-ingestive orosensory cues influence the consumption of dietary fat. Some effects can be observed as early as when fatty acids enter the oral cavity. Evidence reveals that texture, taste, and perception may be key components in determining the different consumption patterns of individuals. These factors have greater importance than simply regulating food choice. Texture and viscosity may also determine the amount of food intake, and the taste of fat may be linked to a genetic predisposition. There may also be differences among children, adolescents, and adults in relations to food preferences.

Influence of Texture on Dietary Fat Intake
Texture and viscosity have been found to have a relationship with satiety and the consumption of various foods. It was found that viscosity might affect the amounts of beverages consumed and play a role in the detection of fat. There were also differences discovered in the tactile sensitivity on areas of the tongue. Also, neurons in the cortex of primates have been discovered that response to the texture of fat.

A study that focused on the effects of beverage viscosity discovered that viscosity affects an individual’s eating habits (Mattes and Rothacker, 2001). Though both thick and thin shakes resulted in a decrease in hunger and prompted fullness, the more viscous shake resulted in a significant decrease in hunger, which remained lower than the baseline up to four hours after the ingestion of the shake. A more viscous shake produced a lower hunger rating, a decrease in the desire to eat, and promoted fullness in the subjects. In contrast, significant associations were not observed in relation to the changes of hunger and other appetitive ratings following the ingestion of the less viscous shake. This research suggests that larger viscosity in beverages may produce a greater and longer decrease in hunger than less viscous beverages. Mattes suggests that since caloric beverage consumption is high, these beverages may be to blame for the increasing numbers of overweight and obese individuals (Mattes and Rothacker, 2001). This assumption depends on the caloric content of the beverage for if an individual was to consume beverages high in viscosity and low in calories, then weight loss may be a possible result. As the high viscosity beverage creates fullness and lessens the desire to eat, then it seems safe to assume that an individual would consume less energy in response to the perceived fullness.
In addition to psychophysical experiments, physiological evidence supports the interaction between texture and taste. Neurons in the primate cortex have found to be bimodally responsive to the texture and taste of fat in the mouth (Rolls et al., 1999). These neurons responded to pure fats based on their particular texture. More specifically, the neurons responded more intensely to fat in a liquefied and emulsified form rather than fat in a solid form. Neurons in the orbitofrontal region of the monkey cortex that were found to respond not only to fat, but also to substances that were not fat but had a similar texture. Neurons showed an increased firing rate to cream and the fat-like texture (Rolls et al., 1999). Based on the similarities between human gustatory cortices, it is likely that humans also have these ‘texture specific’ neurons. If humans do possess these neurons then they may account for the satiety effect of a more viscous beverage (Mattes and Rothacker, 2001), for the neurons may receive a stronger stimulation from the more viscous liquefied form of the substance. The existence of ‘texture specific’ neurons would also support the following study’s findings, which suggests that humans can perceive oiliness in salad dressing (a liquefied substance).

Two studies show a possible link between PROP sensitivity and sensitivity to texture and tactile cues. To be a PROP taster is to possess the ability to taste the bitter compound 6-n-propylthiouracil. The ability to taste PROP is a genetically inherited trait. The number of fungiform papillae also appears to correlate with PROP sensitivity. PROP tasters have a greater density of fungiform taste papillae than nontasters, with supertasters possessing the highest density (Tepper and Nurse, 1997). One study reveals that PROP medium and supertasters rated a 40% fat sample of salad dressing higher in perceived oiliness than the 10% fat sample, but nontasters could not (Tepper and Nurse, 1997).
This suggests that some individuals may be able to perceive levels of fat by means of texture. This suggests that there may be a difference in tactile perception among supertasters, medium tasters, and nontasters. Perhaps supertasters have specific receptors or simply more sensitive receptors in comparison to the non-tasters. If specific receptors exist they may be contained within the fungiform papillae; for, it has been established that tasters posses a greater number of fungiform papillae than nontasters (Tepper and Nurse, 1997).

Another study reports an increased tactile sensitivity of PROP tasters compared to nontasters. Supertasters had the highest sensitivity when the median section of their tongue was stimulated by a no. 2.36 Von Frey filament in comparison to tasters and nontasters. The nontasters were more sensitive in the median section of their tongue than the tasters. The hair was detected more strongly at the front of the tongue than the middle of the tongue among all tasters. For all tasters the front of the tongue was the most sensitive, followed by the whole tongue, and the median area of the tongue was the least sensitive of the three. Significant differences between groups were only observed when the midsection of the tongue was stimulated. All three groups seemed equally as sensitive to the front of the tongue (Yackinous and Guinard, 2002). This study’s results support the preceding study by Tepper and Nurse. Tepper and Nurse found, as recorded above, that PROP sensitivity has a possible role in texture and tactile sensitivity. Their study revealed that PROP medium and supertasters rated a 40% fat sample of salad dressing higher in perceived oiliness than the 10% fat sample, but nontasters could not, and this perception could have been attributed to the ability to detect the texture of fat (Tepper and Nurse, 1997). If certain areas of the tongue are more sensitive to the “feel” of a
substance or object, then perhaps this area of the tongue is the location of the receptors that become activated in response to texture.

The ability to perceive different textures is not always clear. One study presents evidence that subjects reported no variance in the perceived creaminess of butter, margarine, and jelly (Tittelbach and Mattes, 2001). The lack of variance reported could be due in part to the fact that the perception of texture was not a main focus of this study. In comparison to this study, another investigation reported that the subject’s perception of the creaminess of butter was similar to fat replacers such as Olestra, Simplesse, and Passelli. When subjects tasted butter and fat replacers there was no significant difference observed in how they rated creaminess (Mattes, 2001b). These results are not in accordance with the studies previously noted in this review. Studies by Mattes and Rothacker (2001), Rolls et al. (1999), Tepper and Nurse (1997), and Yackinous and Guinard, (2002) all suggest that humans may possess the ability to detect the texture of foods and possibly fats; this ability may effect what they consume. Therefore, we must examine the studies that do not support this and see if for any reason the discrepancy can be determined. A possible explanation for this established difference could be that in the studies conducted by Mattes (2001b) and Tittelbach and Mattes (2001) the term ‘creaminess’ was used. These studies used the word ‘creaminess’ when asking the subjects if a difference in texture existed. This word could have had adverse affects on the data, primarily because it requires subjective interpretation. The subjects had to define for themselves what they considered the ‘creaminess’ of the samples. Neither study by Mattes (2001b) or Tittelbach and Mattes (2001) placed a great emphasis on the subject’s sensitivity to the texture of the samples in the experiments. The perception of creaminess
of the samples did not and would not impact the primary results of the investigation. These could all be explanations for the conflicting evidence among the studies.

The evidence indicates that texture can affect the amount of food and dietary fat consumed; moreover, texture may assist in the perception of fat in existing foods. Studies found that viscosity effects satiety and food consumption. Viscosity appears to play a role in the detection of fat concentrations in beverages (Mattes and Rothacker, 2001). Differences were discovered in the tactile sensitivity on areas of the tongue, accounting for further differences of texture perception (Yackinous and Guinard, 2002). Physiological evidence was also discovered in that a neuron in the cortex of primates responds to the texture of fat (Rolls et al., 1999). Some conflicting reports may be explained by their lack of rigor in investigating the role of texture. These conflicting findings are derived from one or two ancillary questions regarding the subject’s perception of creaminess. The role of texture was not the main focus and the term creaminess is a subjective term that requires personal interpretation. Perhaps if the questions were re-worded and more thorough, then results would have been consistent with other studies reflecting the overall precept of a role or texture in fat detection and consumption.

**Influence of Taste on Dietary Fat Intake**

In addition to orosensory cues of texture influences, there is also evidence that the orosensory cue of taste may play a role in fat detection as well. Some of the research discovered a potential dependence on PROP sensitivity for the ability to detect fat that may suggest a taste component of lipids (Tepper and Nurse, 1997). Moreover, studies on primates have found possible biological evidence supporting the existence of fat taste
perception (Tolls et al., 1999). There appears to be evidence to support the ability of humans to correctly identify dietary fat content; however, other studies have not been able to show these effects. Furthermore, exhaustive studies need to be conducted in order to identify the source of possible experimental error. Only then will the fat detection abilities of humans be definite.

Research conducted by Richard Mattes (2001a) indicates the possibility of a taste component of human fat perception. Subjects that received oral (taste and smell) stimulation after receiving lipid load (50g safflower oil in capsules) had elevated serum triacylglycerol (TAG) concentrations that were significantly higher than the baseline at 2, 4, and 6h. All subjects received lipid loads followed by oral stimulation (taste and/or smell) or odor only stimulation. The subjects who received odor stimulation after ingesting the lipid load had a rise in serum TAG concentration at 4h. The taste only treatment group experienced significantly higher TAG responses than the other treatment groups who received the odor only stimulus (Mattes, 2001a). Since all groups received the lipid load, the differences in TAG levels must be the result of neural signals from the oral stimulation of taste or of taste and smell presented simultaneously. This study suggests that detection mechanisms in the oral cavity are related to the release of concentrated forms of fatty acids (TAG).

More studies support this conclusion that fat receptors do exist in the oral cavity. A study assessing TAG responses to particular fat replacers in comparison to butter revealed higher elevations of TAG after oral stimulation of butter. The subjects were asked to rate the perceived amount of fat of the samples of butter, Passelli, Simplesse, and Olestra. They rated butter and Olestra as having the highest amounts of fat content.
The perceptions of the subjects were accurate in determining the sample that contained the highest amount of fat; this sample was butter. This accurate detection of fat composition is proof that humans can accurately detect high-fatty substances (Mattes, 2001b).

There is further biological evidence to support the existence of fat perception based on taste in the oral cavity. In primates, neurons in the orbitofrontal cortex have been discovered that respond to fat in the oral cavity. This research discovered several patterns of responsiveness for the “fat detection” neurons. A bimodal neuron was found that responded to the texture and taste of fat in the mouth. Ten out of 1145 neurons in the orbitofrontal region of primates responded to fat stimuli. The neurons that responded to the texture and taste fat had specific stimuli, which they responded to stronger; these include: glucose, NaCl, MSG, water and cream, and complex food like an apple or banana (Rolls, et al., 1999).

One study uncovered a possible association between fat perception based on taste and PROP sensitivity (Tepper and Nurse, 1997). Medium and supertasters possessed the ability to discriminate between 40% fat and 10% fat salad dressing, while the nontasters could not (Tepper and Nurse, 1997). If supertasters and medium tasters obtain a keener perception of fat based on taste, perhaps a correlation could be detected between obesity and PROP tasters. If individuals can truly perceive fat by taste, maybe more research in the future could produce a mechanism that would block the transduction mechanism of the fat receptors as a treatment for obesity.

Another study did not support these recorded results. This study found no differences in fattiness ratings among the PROP taster groups, except for a sample of
mashed potatoes. The samples were potato chips, chocolate drink, mashed potatoes, and vanilla pudding. The author notes that this finding could be due to the small difference in fattiness rating observed between low- and high fat samples (one of two points on a sixteen point scale) (Yackinous and Guinard, 2002).

The reports indicate the possible existence of a taste receptor for fat. Research found that subjects could accurately discriminate between butter and fat replacers (Mattes, 2001b). Biological evidence supports Mattes’ findings in discovering that primates have cortical neurons that respond to the taste of fat (Rolls, et al., 1999). It was also discovered that PROP sensitivity might be a key factor in the ability to detect fat by taste (Tepper and Nurse, 1997). If humans possess the ability to taste fat, this evidence may transform attitudes about the obese. For some obese individuals might have more fat receptors in the oral cavity, which promotes their consumption amounts. New treatment mechanisms would probably be created as well, and perhaps slow down this raging epidemic facing our country today. The taste as well as the perception of fat reveals crucial information in research of what modulates fat intake.

Influence of Perception on Dietary Fat Intake

Various findings of individual’s perceptions have revealed that perception is a key component in why people consume what they do. Many different variables effect an individual’s perception of foods; some of these include PROP sensitivity and age. We will examine studies that discovered PROP sensitivity and age may influence the perception of individuals. Studies also examined the perception of sweetness and fat. Moreover, reports reveal that subject’s accurately perceived the fat content of butter and
fat replacers. Studies also suggest that perceptions of pleasantness greatly influence consumption.

PROP sensitivity seems to have a large impact on individual’s food choice. One study found results that relayed the difference in perception among PROP tasters and nontasters. This study revealed that PROP medium tasters and supertasters perceived more oral burn from capsaicin (Tepper and Nurse, 1997). This allows a clear conception as to why some individuals may refrain from consuming products, which contain capsaicin. This same study also found that medium and supertasters could discriminate between 40% fat salad dressing and 10% fat salad dressing (Tepper and Nurse, 1997). This may lead to a possible explanation as to why some individuals have a more difficult time controlling what they consume. If some individuals can perceive the taste of fat more efficiently, then they may be more prone to consume meals that contain higher amounts of fat content. Therefore, perception may be a contributor in determining what is in one’s diet.

Age also seems to affect perception of foods and beverages. Perceived intensities for sugar in water and sugar in orange lemonade show that psychophysical function is increased as an individual’s age increases. Thus, sensitivity to sucrose shows a positive correlation with age. Therefore, younger individuals are less sensitive to sucrose, and need higher concentrations of sucrose to perceive food as sweet. In comparison, adults obtain a higher sensitivity to sucrose, so less sugar is necessary to reach a palatable level. Individuals of a younger age appear to have a great preference for concentrations higher in sucrose (Degraaf and Zandstra, 1999). The children in this study preferred the beverages higher in sucrose, while the adults preferred the beverages containing lower
sucrose levels. This study by Degraaf and Zandstra obviously could account for the discrepancy between the diets of children and adults. Many of the snacks and drinks produced for children, tend to be high in sugar, such as cookies and kool-aid. Children appear to consume foods high in sugar on a regular basis in comparison to adults. Perhaps, the manufacturers of these high sugar products target children, because they know that children will continue to consume these foods high in sucrose. The fact that children readily consume sugar and will likely continue doing so may be due to the evidence found in the present study by Degraaf and Zandstra, which found children to be less sensitive to sucrose. The perception of sucrose seems to be the key factor in the difference between the diets of adults and children. If differences exist between adults and children in their perception of sucrose, perhaps differences exist in their perception fatty acids.

Individuals in one study perceived greater fat composition of given samples that contained higher concentrations of fatty acids. The subjects that were given a cracker as a vehicle for various stimuli such as jelly, margarine, and butter, reported that the stimulation of jelly and a cracker alone as having the lowest levels of fat in comparison to butter, a saturated fatty acid (SFA), margarine, an unsaturated fatty acid (UFA), and the margarine and jelly combination (Tittelbach and Mattes, 2001). This suggests that the subjects correctly identified the samples with the higher fat content. Perceived sweetness was greater for jelly, a carbohydrate (CHO) and jelly, and a margarine (UFA) combination in comparison to a group that included butter (SFA) and margarine (UFA) alone on the cracker. Perceived sweetness did not differ between the two jellies. This may suggest that fatty acids did not affect sweetness perception. (Tittelbach and Mattes,
Perception was pertinent in correctly identifying the fat content of the samples in this study.

Another study, in concordance with the previous findings, reported that subject’s ratings for butter and other fat replacers were similar in response to most perceptions except fat (Mattes, 2001b). Subjects rated all samples, which included butter, Passelli, Simplesse, and Olestra, similarly in respects to sweetness, saltiness, sourness, and bitterness (Mattes, 2001b). Also, all samples were rated equally in palatability. Palatability was the subject’s perceived pleasantness of the sample. However, perception diverged in the subject’s estimation of fat content. Individuals perceived various levels of fat in butter, Passelli, Simplesse, and Olestra. Olestra and butter were rated as containing significantly higher amounts of fat concentrations (Mattes, 2001b). The perceptions of the subjects were correct in identifying butter as having the highest fat content, suggesting that individuals may indeed be able to perceive fat. However, this perception of fat content apparently did not affect the palatability of the samples, for they were all rated equally palatable. An earlier study supporting this concept found that a prior knowledge of the fat content of chips did not affect the subject’s intake (Miller, 2000). This may lead to the conclusion that subjects consume what they perceive as pleasant regardless of fat content. Therefore, individual’s perception of palatability may be a primary determinant of what they choose to consume.

Individuals consume what they consider to be appetizing, and this seems to be an intuitive fact. One study determined the percent of palatable foods consumed on a daily basis. Results revealed most self-selected meals consumed are palatable with only 9.3% of the food rated as unpalatable (DeCastro et al., 2000). Therefore, if people consume
what is palatable, what they consumed in the past they likely considered palatable. So, an individual that found a certain food appetizing is likely to continue to consume that food. This may lead to the conclusion that what people consume in the past may have a direct effect on what they eat in the future, in regards to the perceived palatability. The perception of food will determine what individuals include in their diets.

All these studies reveal the utmost importance of individual perception of food. Personal preference seems to drive most to consume what they do, and what they eat in the past may dictate what they eat in the future. PROP and age also account for differences among the contents of diets. Studies on PROP discovered that supertasters might be able to perceive fat, whereas nontasters may not possess this ability (Tepper and Nurse, 1997). Age influences perceptual differences of sucrose between children and adults (DeGraaf and Zandstra, 1999). Individuals also appear to be able to perceive fat; yet, it may not be considered when choosing what to consume.

Non-sensory Pre-Ingestive Influences on Dietary Fat

Some pre-ingestive factors that may modulate dietary fat consumption are non-sensory and are out of the control of the individual. These characteristics include the genetic trait of PROP sensitivity, age, gender, and personal experience of past consumption. These four factors can also influence present and future dietary content.

Studies reveal that the perception of certain foods depends greatly on PROP sensitivity of an individual. PROP sensitivity may also affect the amount of fat consumed. One study provides evidence that age affects food choice. There are discrepancies among the three age groups of children, adolescents, and adults in how they perceive sucrose. Food choice is also affected by gender. Studies have revealed various
postprandial reactions between men and women. Moreover, their brain activity in response to consumption differs. Past experience appears to have a large impact on what people will consume. A palatability rating of food that has been consumed determines if that food will be consumed in the future. All four factors influence the dietary intake as well as fat consumption.

Studies reveal that PROP tasters are more sensitive to selective bitter and sweet substances, sharp tasting foods, and to the trigeminal irritant capsaicin (Tepper and Nurse, 1997). Medium tasters and supertasters perceived more oral burn from capsaicin. This may lead to the likely assumption that if a supertaster were presented with a food that contained capsaicin, the individual would perceive a stronger oral burning sensation and would most likely refrain from consuming that product. Medium and supertasters appeared to possess the ability to discriminate between 40% fat salad dressing and 10% fat salad dressing. (Tepper and Nurse, 1997). Therefore, PROP may be a determinant in what individuals prefer to consume, and this preference may be dependant on the perceived fat content. Moreover, if supertasters and medium tasters have a keener perception of fat, perhaps a correlation could be established between obesity and PROP tasters. In contrast, one study found no differences in fattiness ratings among the PROP taster groups except with a sample of mashed potatoes. The author notes that this finding could be due in part to the small difference in fattiness rating observed between low and high fat samples (one of two points on a sixteen point scale) (Yackinous and Guinard, 2002). Perhaps the indistinguishable difference in the detection of fat was due to the fact that the increasing flavor levels in the potato chips and mashed potatoes led to an increase in the perception of fattiness.
The numbers of fungiform papillae appear to correlate with PROP sensitivity as well. PROP tasters have a greater density of fungiform taste papillae than nontasters, with supertasters possessing the highest density (Tepper and Nurse, 1997). A subsequent study by Yackinous and Guinard (2002) found comparable results to support the notion that supertasters have the highest papillae density. Therefore, greater numbers of fungiform papillae may lead to more transduction in the oral cavity; the result would be a greater perceived intensity, which would effect food consumption. So, PROP sensitivity would then impact food choice and consumption.

Differences in tactile sensitivity were observed among the supertasters, medium tasters, and nontasters when the median section of the tongue was stimulated with the no. 2.36 Von Frey filament. The supertasters had the highest tactile sensitivity, followed by the nontasters and tasters (Yackinous and Guinard, 2002). If part of the tongue is more sensitive to touch, then the texture of certain food may result in different effects on various tasters. This study identifies another gustatory cue that could produce differences among dietary fat consumption related to PROP sensitivity.

Another attribute that may contribute to dietary intake is age. DeGraad and Zandstra (1999) discovered that age has an impact of the perception of sucrose. Children, age’s nine to ten, were found to have a lower slope of psychophysical function (less sensitive), of the perceived sweetness intensity of sucrose than adolescents. Therefore, it takes larger amounts of sucrose for children to perceive the same amount of sucrose perceived by adults. Adolescents appeared to be less sensitive to sucrose than adults. So, children and adolescents in comparison to adults require more sugar to reach a preferred level of sweetness. Children were less able to distinguish between different sucrose
concentrations than any other age group. Moreover, this study reveals that preferred sugar concentrations increase as the age decreases. Therefore, younger children appear to have a greater preference for food or beverages containing high amounts of sucrose. Children’s higher preference for sucrose seems to be reflected in the daily food consumption. This study gives evidence for the different eating habits of children and adults, in revealing that children require more sugar to reach a preferred level that adults achieve with smaller amounts of sugar.

Though only one study is examined, it provides results revealing that age creates variation in the diets of children and adults. If children need more sucrose to detect the equivalent amounts presented to adults, then it is possible that children would consume greater amounts of sucrose to reach a palatable concentration similar to adults. This may lead one to assume that children, who receive higher caloric intakes, should also have a higher prevalence of obesity. However, one must take into consideration the activity rate of children, which is much higher than most adults. Thus, their energy expenditure and metabolic rates would be higher, and overcompensate for the higher intake of sucrose.

Examining the brain activity, using position emission tomography of men and women, during and following consumption, has identified both similarities as well as significant differences. The male response to hunger showed a greater activation in the frontotemporal and paralimbic areas of the brain in comparison to the female response (Del Parigi et al, 2002). Overall, in response to hunger, men had higher neuronal activity in the temporal lobe. When the temporal lobe is activated in response to hunger there is an association of processing emotion. However, in comparison to the male response to satiation, the women had a greater activation of the occipital, pariental sensory area, and
the dorsolateral prefrontal cortex. Yet, the male response to satiation revealed a greater activation in the ventromedial prefrontal cortex. As satiation occurred, the women had higher neuronal activity in the occipital lobe. This greater activation in the occipital lobe may suggest that visual imagery is a key factor in the cognitive processing of satiation and other similar behaviors in women. Satiation elicits a greater activation of the neocortial areas, which are involved in sensorial association and behavioral planning in women (DelParigi et al, 2002). This study revealed numerous differences in the male and female neurological responses to hunger and satiation. These neurological differences can lead to different diets between men and women. Their diets depend on how the specific neurological response was perceived. Thus, gender could contribute to the variance seen in food choice between men and women.

Similarly, another study examining the effects of low-fat high carbohydrate meals and high-fat low carbohydrate meals found more disparity between men and women’s reaction after consumption of each meal. Men showed an increase in tension (felt more tense) following consumption of the low-fat high carbohydrate meal. This was not observed in female subjects nor was it seen after the men consumed the high fat low carbohydrate. After consumption, of a high-fat low carbohydrate meal, males had higher CCK concentrations than females, but the difference was not significant (Wells et al, 1997). This study also found that thirty minutes after consuming the low-fat high carbohydrate meal, female subjects felt less excited and more relaxed. Women were more excited and less relaxed following the high-fat low carbohydrate meal. Furthermore, this variance was not observed in male subjects. Also, after thirty minutes had elapsed after ingestion of the high-fat low carbohydrate meal, women felt less sleepy than before,
while no difference was experienced after the low-fat high CHO meal. This occurrence was not reported among the men (Wells et al, 1997). This study demonstrates various differences between women and men following consumption of specific meals. These postprandial changes in tension, arousal level, and lethargy could have prominent impact on what the individual chooses to eat in the future. Feelings of drowsiness and tension could be assessed as negative consequences resulting from what was consumed. Therefore, the likeliness of consuming a meal that creates negative consequences would significantly decrease.

In contrast to the above studies mentioned, other research failed to find significant differences between men and women. One study found that gender did not affect subject’s ratings of postprandial hunger in respects to a beverage’s viscosity (Mattes and Rothacker, 2001). Likewise, there was no variance observed in hedonic ratings between women and men in response to meals varying in fat and carbohydrate level (Wells et al, 1997). Though women were found to have a higher papillae density than men, no interaction between gender and perceived taste intensity was determined (Tepper and Nurse, 1997). Also, a study found no significant differences between men and women in their dietary content or the palatability ratings of their diets (DeCastro et al, 2000).

Previous dietary consumption has a direct impact on future consumption in both men and women. Dietary experience holds a crucial role in dictating the content future diets. Experience can also influence both the amount and rate of intake for present consumption.

Differential results produced by Kirkmeyer and Mattes (2000) determined that the consumption of a specific food can alter the palatability or subsequent intake of that
particular food. Kirkmeyer and Mattes (2000) found that consumption of peanuts and chocolate leads to a decrease in the desire to consume additional peanuts and chocolate as well as other high-fat and high-protein items. Likewise, peanut butter led to a decrease in desire for additional peanut butter. The consumption of chocolate and to a lesser extent peanut butter reduced the desire for salty snacks. Peanut butter consumption also led to a decrease in the desire to consume sweet snacks but only approximately two hours after initial ingestion. Peanut and chestnut consumption resulted in a decreased desire for foods containing carbohydrates. (Kirkmeyer and Mattes, 2000). This research strongly suggests that food consumed may affect the desire to eat additional food possessing similar qualities.

However, one study found that the continuous intake of peanuts neglected to lead to a decline in pleasantness of hunger ratings, and did not lead to any hedonic shift for other snack foods with varying taste qualities. Perhaps increased chronic consumption of peanuts may be well tolerated without changing the perceived pleasantness of the nuts or other foods (Alper and Mattes, 2002). The variation between these two studies may have resulted from the small number of subjects tested in the first study administered by Alper and Mattes as this study only used fifteen adult subjects. This small number could have increased the influence of confounds not found in the subsequent study. The study by Kirkmeyer and Mattes obtained only twenty-four subjects; therefore, the number of participants may not have been the sole causal agent for the deviance. Alper and Mattes (2002) offer an explanation for the lack of decrease in palatability rating for peanuts indicating that the peanuts used in the experiment were high in fat and salt and may have been the factor producing consistent high pleasantness ratings.
Evidence shows that individuals consume what they consider to be appetizing (DeCastro et al, 2000). Therefore, what people consume in the past may direct what they eat in the future. De Castro et al. (2000) found that if a meal is perceived as pleasant, there is an increased probability that the same type of meal will be subsequently consumed in the future.

There was another intriguing observation that meals rated highest in palatability were forty-four percent larger than the other meals. Perhaps individuals find larger meals more appealing and place less emphasis on the content of the meal. If people find larger meals more pleasing then their future eating habits may include meals of great size. However, this assumption may not be valid, because of the methods of this study. This research by DeCastro et al (2000) drew conclusions from food intake diaries of the subjects. Therefore, subjects may have found food more appealing, so they consumed larger portions of it. Research also reveals that palatability seems to act on intake levels without reliance on other influential factors such as the time of day, the number of people present, the amount of time since the last meal, location of meal, and the previous meal’s contents in the stomach. Nevertheless, it is likely that the appearance of palatable food increases hunger, which may lead to increased intake (DeCastro et al, 2000).

It is possible that food might affect the subjective state of particular individuals. Studies of various margarines have shown that olive oil enriched margarine induced an anxiety-like behavior. This may suggest that the ingestion of fats may modify particular behavioral responses (Orosco, 2002). Similarly, a study by Wells et al (1997) reveals that men showed an increase in tension (felt more tense) following consumption of the low-
fat high carbohydrate meal. If behavioral responses are prompted by specific foods, then the outcome may increase or diminish consumption of that food in the future.

A compelling group of evidence suggests that factors such as PROP sensitivity, age, gender, and experience may dictate dietary consumption and influence future dietary intake. The evidence presented on PROP sensitivity shows an overwhelming convergence of information. These studies support the concept that a difference in perception, specifically of sensitivities (bitter, sweet, capsaicin), fat detection, fugiform papillae density, and tactile sensitivities, exists among PROP supertasters, medium tasters and nontasters (Tepper and Nurse, 1997). These differences in perception could create a direct impact on what the individual decides to consume. Sensitivity also could have an effect on the amount of fat consumption that is in one’s typical diet. Another attribute that may contribute to dietary intake is age. Differences among children, adolescents, and adults are observed in their perception of sucrose (DeGraaf and Zandstra, 1999). The younger individuals are less sensitive to sucrose and they prefer more sucrose in what they consume in comparison to adolescence and adults. This may explain why children consume more sweets than adults. Therefore, age is an attribute that may influence consumption. Research has also determined that gender has a direct influence on dietary consumption. Gender may determine dietary content as well as the amount and pattern of consumption. Men and women have different neurological responses after consumption. Differences were seen in feelings of tension and sleepiness between men and women. The gender differences that were reported appear to have a vital role as a factor that modulates food intake (DelParigi et al., 2002). Experience appears to hold a crucial role in dictating what will makeup a future diet. Experience will also effect what is presently
being consumed in relation to the amount and rate of intake. Experience, which is directly manipulated by the individual, has been investigated in an extensive body of research (DeCastro et al., 2000). When considering the effects of dietary fat intake and intake overall, experience is a necessary element to quantify. However, these results only account for some variance of intake. For instance, experience is based largely on but not just palatability, but it also relies heavily on post-ingestive influences.

**Post-Ingestive Influences of Dietary Fat Intake: Signal from the Digestive System**

The post-ingestive influences on dietary consumption, specifically fat intake include signals from the digestive system including humoral and triacylglycerol (TAG) postprandial responses that can modulate the consumption of specific dietary components. The effects of these chemicals are significantly dependent on the individual’s perception of the responses. Another post-ingestive component is satiety. Satiety, the opposite of hunger, largely establishes the amount of food consumed but also has other influences in regulating consumption. We will examine one study that suggests that postprandial chemicals released may produce psychological changes. Numerous studies suggested that oral stimulation, without ingestion of fatty acids increase postprandial TAG concentrations.

Investigations of specific postprandial humoral influence such as CCK, gastin, and insulin and their particular effects on altering consumption have not been extensively explored. However, one study indicates the possible impact of these postprandial chemicals on consumption.

Recent studies conducted by Wells et al (1997) compared the psychological and humoral responses to high-fat, low-carbohydrate and low-fat, high-carbohydrate meals.
Concentrations of plasma insulin and glucose were found to be significantly higher after low-fat, high-carbohydrate meals. CCK concentrations were higher after the consumption of high-fat, low-carbohydrate meals. Moreover, multiple regressions denote that gastrin, insulin, and CCK concentrations were associated with the feeling of lethargy (Wells et al, 1997). Subjects reported feeling sleepier during the two to three hours that followed consumption of the high fat-low carbohydrate meal. Likewise, ratings of fatigue were greater three hours following the high-fat low carbohydrate meal. This study suggests that sleepiness, the release of insulin, and CCK release are induced by the presence of specific nutrients in the duodenum. Therefore, the association between CCK and insulin and feelings of lassitude may be due to the movement of food from the stomach to the duodenum (Wells et al, 1997). The present investigation reveals a positive correlation between increased concentrations of CCK and fatigue. The highest concentrations of CCK existed at similar times to the greatest postprandial heightened ratings of sleepiness and fatigue (Wells et al, 1997). These findings imply that postprandial chemicals released may produce psychological changes. Therefore, these chemicals may deter or promote the continued consumption of a particular food or a specific composition of dietary intake based on the psychological effects.

There are other postprandial responses, which impinge on food choice. One of the most researched and apparently influential effects is postprandial change in triacylglycerol (TAG) concentrations. Numerous studies have targeted these stored lipids to provide feedback in the effect of dietary fat consumption on the level of stored lipids. They have also attempted to determine the dietary fats that produce the greatest influence on TAG levels.
A study conducted to determine the effect of specific oral stimulation stimuli, which was no ingested, on postprandial triacylglycerol (TAG) concentrations, used four stimuli and a cracker as the vehicle. The stimuli were: butter, a saturated fatty acid (SFA), margarine, a unsaturated fatty acid (UFA); jelly a carbohydrate; and UFA margarine plus the jelly, each presented on a cracker. The cracker was also tested by itself (Mattes, 2001a). TGA concentrations were significantly higher after the oral exposure to the UFA and the UFA and carbohydrate (jelly) stimulus. Therefore, an elevation of TAG concentrations only occurred after oral stimuli that contained UFA. These findings lead to the conclusion that oral exposure to an unsaturated dietary lipid enhances the postprandial rise of TAG. This rise in TAG would cause an increase in stored lipids in adipose (fat) cells. It may be inferred that the UFA effect can be attributed to its orosensory stimulation, since the oral stimuli were not ingested. Perhaps these results may be explained with the notion that specific lipids may be detected in the oral cavity by a gustatory mechanism (Mattes, 2001a).

Subsequent research by Richard Mattes (2002) further supports The relationship between oral stimulation of lipids and TAG levels suggesting that the rapid release of lipid stored from a previous meal is activated by oral stimulation by fat. Oral exposure to dietary fats appears to enhance TAG concentrations through increased lipid absorption. In every subject, oral stimulation of a fat sample (cream cheese) stimulated rapid lipid release from the preceding meal of almonds. This sensory-enhanced release of lipids activated a rise in TAG level (Mattes, 2002). This study also supports the possible existence of taste receptors in establishing that oral stimulation alone creates TAG increases. This suggests that fat receptors could have been stimulated by the presence of
fatty acids in the oral cavity. Transduction of the signal could be what prompted this rise in TAG levels.

An additional study by Mattes (2001b) discovered that postprandial TAG surges resulted from the oral stimulation of butter, than any other treatment group of fat replacers. This difference cannot be accounted for by different stimuli ingested, palatability, or perceived content (Mattes, 2001b). Moreover, exposure to butter resulted in a longer TAG elevation than any other treatment. Amounts of linoleic acid were found to be higher in the butter sample than in the samples containing Passelli or Simplesse. The sample of butter also contained more oleic acid than any other sample. The fat replacers tested did not result in significant increase of TAG. Another study corresponded with the present findings, which compared a low fat butter substitute to an average butter. This study found that a ‘high fat lunch’ (pasta which contained the real butter) resulted in a slight difference in the glucose concentrations after the consumption, but this high-fat meal led to a higher plasma tracylglycerol and fatty acid concentration (Himaya et al, 1997).

Compiling evidence reveals that TAG levels are greatly influenced by the stimulation or ingestion of dietary fat. Concentrations of linoleic and oleic acids also seem to facilitate TAG release and increase TAG levels. Unsaturated fatty acids were discovered to have a greater effect than saturated fatty acid or carbohydrates on TAG levels. This information suggests a possible taste component of fat, for TAG levels rose by oral stimulation alone of samples consisting of fatty acids. It is pertinent for the comprehension that we know that TAG leads to lipid storage in adipose cells and tissues. So, people may experience an increase in weight after consuming large amounts of foods
that contain fatty acids. Gaining weight is a negative consequence for most individuals, so they should decrease their fat intake to avoid further weight gain. However, with the large amount of overweight people in our country, it is apparent that individuals do not refrain from consuming large amounts of fat. This suggests that a stronger factor must exist which overcompensates for weight gain. Perhaps this factor is the taste of fat. If fat does have a taste component, the perception of fat may positively reinforce the consumption of dietary fat. Another post-ingestive response, satiety, may work to reduce this drive to consume fat, by signaling satiation to the individual.

**Post-Ingestive Influences: Satiety Responses and Effects**

The satiating action proceeding consumption of certain foods may be an active ingredient in helping individuals control their dietary fat intake. One study discovered that palatability effects satiation (meal termination) but not satiety (fullness) (DeGraat, et al., 1999). Another study examined found that total energy content might be the key contributor to food’s impact on hunger. This study also found that specific foods might have a satiety effect for foods similar or of the same composition as the food previously ingested (Kirkmeyer and Mattes, 2000). Specific foods were also examined and research discovered that peanuts have a high satiety value (Alper and Mattes, 2002). A study included suggests that specific fatty acids have greater satiety effects in comparison to other fatty acids (Orosco, 2002). Research has additionally observed the relationship between satiety and specific neurological responses in rats (Rolls et al., 1999) and in humans (Delparigi et al., 2002). Overall, satiety has been found to have a tremendous effect on food choice, amount of consumption, and dietary fat intake.
Research has examined the relationship between satiety and palatability of foods. One study specifically observed the effects of palatability on satiation (meal termination) and satiety (fullness) (DeGraaf et al., 1999). The study revealed subjects consumed about 40 to 65% less of soup that they rated unpleasant in comparison to a pleasant soup. This suggests that palatability effects satiation, for meal termination was delayed while consuming the palatable soup. The experimenters varied the palatability of the soup by modifying the amounts of citric acids in each of the three soup levels. When the subjects had to wait approximately ninety minutes for the test meal, they ingested about 20% more soup in comparison to a 15 minute wait. The satiety, or perceived fullness, was not affected by palatability. For example, hunger ratings and test meal intake shows no deviance between the three standardized soups. A possibility is that rated palatability effects satiation (meal termination) but not satiety (fullness). Another conclusion is that individuals consume greater amounts of food when they have prior knowledge of an absence of food for a specific time period. This shows that cognitive factors also affect the amount of food consumed at a meal. The individuals manipulated their amount of intake in regards to how long they would be without food. This reveals that people may consume larger amounts of food in order avoid potential negative consequences due to the deprivation of food (DeGraaf et al., 1999). This study shows that palatability effects satiation (meal termination) but not postprandial satiety. Consumption appears to increase when individuals know they have no access to food for an amount of time. Various foods may have different effects on palatability and satiety as well.

One study attempted to distinguish the contributors to hunger by observing satiety effects of various foods. The subjects were given preload of peanuts, peanut butter,
almonds, chestnuts, chocolate, rice cakes, pickles, and no load and asked to rate their hunger following the consumption of 2092kJ (500kcal) of each (Kirkmeyer and Mattes, 2000). The results indicated that the lowest hunger ratings were detected after the consumption of the peanuts, peanut butter, almonds, chestnuts and chocolate. After the high energy preloads were consumed free-feeding subjects showed a decrease in the amount of energy intake. Results from this study suggest that total energy content may be the key contributor to food’s impact on hunger rather than the food’s macronutrient makeup, energy density, fiber content, weight, volume, or sensory properties, which were all controlled (Kirkmeyer and Mattes, 2000).

This study also found variations in what the subjects wanted to consume after eating certain samples. Consumption of peanuts and chocolate led to the decrease in desire to consume additional peanuts and chocolate as well as other high-fat and high-protein items. Peanut and chestnut consumption resulted in a decrease in desire for high carbohydrate foods. This may suggest that specific foods may have a satiety effect for foods similar or of the same composition as the food previously ingested.

Another study found that peanuts alone might have a strong satiety property. When subjects were given peanuts and given no dietary guidance free-feeding, peanut consumption elicited a strong compensatory dietary response; subjects compensated for 66% of the energy provided by the peanuts. The body weight gain during the free-feeding period was minute, not statistically significant and much lower than the researchers predicted. When the subjects were asked to add peanuts into their daily diet in the following three weeks, the recorded weight gain was significantly lower than predicted (Alper and Mattes, 2002). The predominant reason for the small increase in body weight
could be attributed to the satiety-inducing properties of peanuts. The researchers concluded that peanuts have a high satiety value and chronic consumption creates a strong dietary compensation and little change in energy balance (Alper and Mattes, 2002). This research and those that establish foods that create high-satiety effects may provide vital information for those individuals struggling with weight problems. Also, satiety properties are essential information when determining reasons for food choice and amounts consumed, for it is evident that satiety is a significant contributor.

Some studies have also looked at the satiety values of various margarines, and suggest a possible link between saturated fatty acids and satiety. One study found that a vegetable margarine, in comparison to a sunflower oil and olive oil enriched margarine, has a higher satiety affect than the other two. The primary variations between the margarines are that vegetable margarine contains a higher content of saturated fatty acids, while sunflower oil and olive oil margarines have higher concentrations of polyunsaturated fatty acids. The oils also appeared to have an effect on the meal size that the rat consumed after ingesting the specific margarine. After rats ingested sunflower oil and olive oil margarine, the amount of food consumed was larger than the vegetable oil margarine (Orosco, 2002). This study indicates the possibility of saturated fatty acids possessing greater satiety abilities than polyunsaturated fatty acids. Therefore, in observing modulation of dietary fat, satiety effects from specific fatty acids must be taken into consideration. Research on neuron activity in primates, supports this finding in that this study found that neurons may have specific satiety effects for specific types of fats (Rolls, et al., 1999). Moreover, if ingestion of fatty acids create satiety (Orosco, 2002) and fatty acids result in a rise in TAG concentrations following consumption (Mattes,
2001a), then a relationship between satiety and TAG levels could exists. Perhaps, TAG concentrations could signal satiety. This could be a defense mechanism of the body to decrease the amount of dietary fat consumed.

Neurological responses to satiety have been researched in human as well as in primates. One study conducted by Rolls et al. (1999) examined some satiety effects in relation to monkey’s neurological responses. A monkey was fed to satiety with cream, and it was observed that the response of a neuron decreased to cream in the mouth but not significantly to groundnut oil. This specifies that there may be sensory-specific satiety effects, which only respond to specific types of fats. This study additionally discovered that monkey’s cortical neurons that respond specifically to fat were more strongly activated to liquefied fats than to fats in a solid form. Therefore, the activation from liquefied fat may be more effective and the result may be a more rapid sensory-specific satiety. This is because the sensory stimulation would build up more quickly (Rolls et al, 1999). Thus, it may be assumed that if an individual chews slowly to emulsify in the ingested fats, then satiety would occur faster and more efficiently. The result would be a smaller amount of fat being consumed. This could be an important discovery for those attempting to lose or control weight as well as researchers attempting to determine what factors modulates dietary fat intake.

Neurological responses to satiation have been examined in humans as well. One study indicated that satiation elicits a greater activation of the neocortical areas that are involved in sensorial association and behavioral planning in women (DelParigi et al, 2002). The women also had a greater activation of the occipital and pariental sensory areas as well as in the dorsolateral prefrontal cortex, in response to satiation. In contrast,
the male response to satiation revealed a greater activation in the ventromedial prefrontal cortex. Overall, in response to satiation, the women had higher neuronal activity in the occipital lobe. This greater activation in the occipital lobe that is found in women may suggest that visual imagery may be a key factor in the cognitive processing of satiation and other similar behaviors in women. These results strongly indicate the possibility that satiety affects specific areas of the brain. Furthermore, these areas differ in relation to the gender of the individual.

A study on rats provides information about physiology in response to satiety. This study suggests that fat satiation abilities depend on particular chemical activities that are driven by endogenous cholecystokinin (CCK) and afferent fibers of the abdominus vagus (Greenberg and Smith, 1996). The satiating ability of fats relies on the chain length and degree of saturation of fatty acids. When a two-bottle choice test of 75 and 50% corn oil or 100 and 50% corn oil was offered to the Zucker rats, they preferred the higher concentration whereas lean rats preferred the lower concentrations. The genetically obese rats (Zucker) showed greater orosensory positive feedback in response to oils in comparison to the lean rats in the test of preference. The suggestion of this evidence is that orosensory properties of fat drive the Zucker rats to increase fat intake. This may relate to the problem facing obese individuals in avoiding foods that are most desired. This research reveals that orosensory and postingestive stimuli in normal and obese rats may help regulate fat intake (Greenberg and Smith, 1996).

Not all studies support the notion that satiation is correlated with fatty acids. For example, one study indicated that there was no difference in consumption among subjects after consuming 3% vs. 10% fat ice cream. The subjects ate equal amounts of the ice
cream and ate similar amount in the meals that followed (Specter et al., 1998). Thus, this suggests that variations in amounts of fat showed no differences in satiety effects. However, this could be due to the small variance of energy contents of the ice cream.

Satiety appears to be an important factor in determining the amount of dietary fat consumption. The satiation may be a key factor that helps individuals control their dietary fat intake. It was discovered that palatability effects satiation (meal termination) but not satiety (fullness) (DeGraaf, et al., 1999). Perceived pleasantness influences the length of a meal, but it does not affect the perceived fullness of the individual. It was also found that total energy content might be the key contributor of the impact of food on hunger. This study also found that specific foods have satiation effect on foods similar or of the same composition as the food previously ingested (Kirkmeyer and Mattes, 2000). Therefore, if a certain food is consumed an individual will feel full and not wish to consume more of that food. It was also discovered that peanuts have a high satiety value (Alper and Mattes, 2002). Perhaps, in identifying foods that have a high satiation effect, foods can be discovered which promote weight loss in prompting fullness. A study included suggests that specific fatty acids have greater satiety effects in comparison to other fatty acids (Orosco, 2002). So, larger amounts of some fatty acids will be consumed before an individual perceives fullness. This shows us that the fatty acids (unsaturated), which have a less satiety effect may lead to weight gain if consumed regularly; for fullness would not be perceived following considerable consumption of the unsaturated fatty acid in comparison to the saturated fatty acid. Research has additionally observed the relationship between satiety and specific neurological responses in rats (Rolls et al., 1999) and in humans (Delparigi et al., 2002). This study discovered that monkey’s
cortical neurons that respond specifically to fat were more strongly activated to liquefied fats than to fats in a solid form. The activation from liquefied fat may be more effective and the result may be a more rapid sensory-specific satiety. Therefore, if an individual chews slowly to emulsify in the ingested fats, then satiety would occur faster and more efficiently. The result would be a smaller amount of fat being consumed. This could be an important discovery for those attempting to lose or control weight as well as researchers attempting to determine what factors modulates dietary fat intake. Overall, satiety has been found to have a tremendous effect on food choice, amount of consumption, and dietary fat intake.

**Conclusion**

In determining the factors that modulate consumption of dietary fat, the aspects that impede overall dietary consumption must be examined. These numerous causes can be separated into pre-ingestive and post-ingestive components. Evidence reveals that orosensory influences such as texture, taste, and perception may be key components in determining why individuals consume what they do.

The evidence indicates that texture can affect the amount of food and dietary fat consumed and may influence the perception of fat in foods. Studies found that viscosity effects satiety and food consumption. Viscosity appears to play a role in the detection of fat concentrations in beverages (Mattes and Rothacker, 2001). Differences were discovered in the tactile sensitivity on areas of the tongue, accounting for further differences of texture perception (Yackinous and Guinard, 2002). Physiological evidence was also discovered. Neurons in the cortex of primates were found to responses to the texture of fat (Rolls et al., 1999). These studies reveal the possible existence of texture
receptors for fat. These studies also show the influence texture of foods and specifically dietary fat influences consumption and amount of food consumed. If viscosity affects satiety, then perhaps weight loss programs could be created that use this information. If more viscous beverages promote satiety then the individual would consume less, resulting in weight loss. The evidence of the different tactile sensitivity of the areas of the tongue shows that individuals may perceive certain food differently. Future studies should investigate a correlation between certain types of tongue sensitivities and the weight of the individual. Perhaps relationships may exist between the two.

The reports indicate the possible existence of a taste receptor for fat. Research found that subjects could accurately discriminate between butter and fat replacers (Mattes, 2001b). Biological evidence supports Mattes findings in discovering that primates have cortical neurons that respond to the taste of fat (Rolls, et al., 1999). It was also discovered that PROP sensitivity might be a key factor in the ability to detect fat by taste (Tepper and Nurse, 1997). If humans possess the ability to taste fat, this evidence may transform attitudes about the obese. For some obese individuals might have more fat receptors in the oral cavity which promotes their consumption amounts. New treatment mechanisms would probably be created as well, and perhaps slow down this raging epidemic facing our country today. The taste as well as the perception of fat reveals crucial information in research of what modulates fat intake.

Studies revealed the utmost importance of individual perception of food. Personal preference seems to drive most to consume what they do, and what they eat in the past may dictate what they eat in the future. PROP and age also account for differences among the contents of diets. Studies on PROP discovered that supertasters might be able
to perceive fat, whereas nontasters may not possess this ability (Tepper and Nurse, 1997).

Age influences perceptual differences of sucrose between children and adults (DeGraaf
and Zandstra, 1999). Individuals also appear to be able to perceive fat; yet, it may not be
considered when choosing what to consume.

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age, gender, and experience may dictate dietary consumption and influence future dietary
intake. The evidence presented on PROP sensitivity shows an overwhelming
convergence of information. These studies support the concept that a difference in
perception, specifically of sensitivities (bitter, sweet, capsaicin), fat detection, fugiform
papillae density, and tactile sensitivities, exists among PROP supertasters, medium
tasters, and nontasters. These differences in perception could create a direct impact on
what the individual decides to consume. Sensitivity also could have an effect on the
amount of fat consumption that is in one’s typical diet. If PROP sensitivity was found by
future research to be linked to weight, it would indicate that obesity may be genetic, by
means of the ability to detect PROP.

Another attribute that may contribute to dietary intake is age. Difference among
children, adolescents, and adults is observed in their perception of sucrose. The younger
individuals are less sensitive to sucrose and they prefer more sucrose in what they
consume in comparison to adolescence and adults (DeGraaf and Zandstra, 1999). This
may explain why children consume more sweets than adults. Therefore, age is an
attribute that may influence consumption.

Research has also determined that gender has a direct influence on dietary
consumption. Gender may determine dietary content as well as the amount and pattern of
consumption. Differences were seen in feelings of tension and sleepiness between men and women (Wells et al., 1997). The gender differences that were reported appear to have a vital role as a factor that modulates food intake. Experience appears to hold a crucial role in dictating what will makeup a future diet. Experience will also effect what is presently being consumed in relation to the amount and rate of intake.

In addition to pre-ingestive influences, post-ingestive influences have a large role in determining dietary intake and specifically fat intake. Signals from the digestive system including humoral and triacylglycerol (TAG) postprandial responses can modulate consumption of specific items. Another influential component is satiety, which largely establishes the amount consumed, but also correlated with components of consumption.

Compiling evidence reveals that TAG levels are greatly influenced by the stimulation or ingestion of dietary fat. Concentrations of linoleic and oleic acids also seem to facilitate TAG release and increase TAG levels. Unsaturated fatty acids were discovered to have a greater effect than saturated fatty acid or carbohydrates on TAG levels. This information suggests a possible taste component of fat, for TAG levels rose, by oral stimulation alone of samples consisting of fatty acids is pertinent for the comprehension. We know that TAG lead to lipid storage in adipose cells and tissues. So, people may experience an increase in weight after consuming large amounts of foods that contained fatty acids. Gaining weight is a negative consequence for most individuals, so they should decrease their fat intake to avoid further weight gain. However, with the large amount of overweight people in our country, it is apparent that individuals do not refrain from consuming large amounts of fat. This suggests that a stronger factor must exist which overcompensate for weight gain. Perhaps this factor is the taste of fat. If fat does
have a taste component, the perception of fat may positively reinforce the consumption of dietary fat.

Satiety appears to be an important factor in determining the amount of dietary fat consumption. The satiation may be a key factor that helps individuals control their dietary fat intake. It was discovered that palatability effects satiation (meal termination) but not satiety (fullness) (DeGraaf, et al., 1999). Perceived pleasantness influences the length of a meal, but it does not affect the perceived fullness of the individual. It was also found that total energy content might be the key contributor of the impact of food on hunger. This study also found that specific foods have satiation effect on foods similar or of the same composition as the food previously ingested (Kirkmeyer and Mattes, 2000). Therefore, if a certain food is consumed an individual will feel full and not wish to consume more of that food. It was also discovered that peanuts have a high satiety value (Alper and Mattes, 2002). Perhaps, in identifying foods that have a high satiation effect, foods can be discovered which promote weight loss in prompting fullness. A study included suggests that specific fatty acids have greater satiety effects in comparison to other fatty acids (Orosco, 2002). So, larger amounts of some fatty acids will be consumed before an individual perceives fullness. This shows us that the fatty acids (unsaturated), which have a less satiety effect may lead to weight gain if consumed regularly; for, fullness would not be perceived following considerable consumption of the unsaturated fatty acid in comparison to the saturated fatty acid. Research has additionally observed the relationship between satiety and specific neurological responses in rats (Rolls et al., 1999) and in humans (Delparigi et al., 2002). This study discovered that monkey’s cortical neurons that respond specifically to fat were more strongly activated to liquefied
fats than to fats in a solid form. The activation from liquefied fat may be more effective and the result may be a more rapid sensory-specific satiety. Therefore, if an individual chews slowly to emulsify in the ingested fats, then satiety would occur faster and more efficiently. The result would be a smaller amount of fat being consumed. This could be an important discovery for those attempting to lose or control weight as well as researchers attempting to determine what factors modulates dietary fat intake. Overall, satiety has been found to have a tremendous effect on food choice, amount of consumption, and dietary fat intake.

This review establishes the numerous aspects that influence dietary fat consumption. When deciphering the components that modulate fat intake, all the present factors should be considered.
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