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Running head: RELATIONSHIP BETWEEN OBESITY AND SENSORY SEEKERS

Possible Relationship between Childhood Obesity and Sensory Seeking Behaviors

Alyssa Rea OTS

Abstract

Childhood obesity is a health condition that is expanding rapidly within the United States. Children who are obese make the act of bringing food to their mouth a habit, as well as chewing and swallowing the food. This constant, unsatisfying action can be compared to the habits and actions of those children diagnosed with Sensory Processing Disorders (SPD). Children who live with SPD lack the neurological process within their nervous system, which is responsible for taking information from their body or the environment and organizing it within the brain (Murphy, 2012). The lack of ability to organize sensory information to the brain may explain why children who are obese are unable to receive messages of fullness. A potential relationship between behaviors of children with sensory processing disorders and childhood obesity may be relevant. There has been little research regarding the relationship between children with both obesity and sensory seeking behaviors. In order to gather a comprehensive understanding of the possible relationship, the author conducted two interviews with parents of children who struggle to keep a healthy weight. The interview questions focused on children's behavior and eating patterns. The clinical question investigated is: Is there a relationship between childhood obesity and sensory processing disorders? The purpose of the study is to inform practitioners and therapists about a possible relationship, to therefore better prepare them as they create treatment plans and interventions for children who are diagnosed as obese, and may also be sensory seekers. Further research can be conducted, measuring the sensory processing behaviors of children who are obese/overweight using the Short Sensory Profile assessment.

Possible Relationship between Childhood Obesity and Sensory Seeking Behaviors

Childhood obesity is a health condition that is expanding rapidly within the United States. With body mass indexes exceeding 25, children are experiencing weight gain that is adding excessive fat percentages to their body. Obesity is different from being overweight, in that being obese means the individual has too much body fat, and overweight signifies when someone weighs too much from muscle, bone, fat, or water. Typically, obese children do not eat to fuel their bodies or to subdue hunger; however, they continue to eat because their brains do not receive the chemical signal to stop (Murphy, 2012). Children who are obese learn to enjoy the feeling of bringing food to their mouth, as well as chewing and swallowing the food. This constant, unsatisfying action can be compared to the habits and actions of those children diagnosed with Sensory Processing Disorders (SPD). Children who live with SPD lack the neurological process within their nervous system, which is responsible for taking information from their body or the environment and organizing it within the brain (Murphy, 2012). The lack of ability to organize sensory information to the brain may explain why children who are obese are unable to receive messages of fullness. A potential relationship between sensory seeking behaviors and childhood obesity may be relevant.

Obesity has affected approximately 1/3 of all children within the United States over the past 30 years. Less than half a century ago, approximately 7% of children ages 6-11 years old were obese, which increased to nearly 18% of children in the United States (Murphy, 2012). The increase of childhood obesity is due to the increase of snacking and junk food, and the decrease of exercise sedentary lifestyles. The problem leading to the epidemic of childhood obesity is caused by the confusion of hunger versus appetite. Hunger is defined as the physical drive that signals the need of energy for the body (Murphy, 2012). Appetite, on the other hand, is the desire

for food. Appetite can generally be triggered by one's emotions or feelings as a way to feel comforted. One can gain an appetite after smelling or seeing food. Overeating usually begins with the inability to control one's appetite (Murphy, 2012). However, when someone eats more than the amount of food their body requires for energy and growing, the extra calories and food store as fat. Someone with an average weight typically feels hunger pains when their body needs more fuel. These warnings go through the digestive system to the brain, telling the body to begin searching for food. When food is eaten, chemicals are fired to sense the feeling of being satisfied; this is how appetite is controlled (Murphy, 2012). However, obese children lack the satiety signal, and therefore try to feel satisfied by increasing the amount of food they pick up, bring to their mouth, and eat. Many children partake in binge eating, where they eat a large amount of food over a short period of time. This affects 5% of children who are obese, as they eat fast when not hungry until they reach physical discomfort. Binge eating can be caused by stress or anxiety, enabling the children to feel out of control during their binge episode (Murphy, 2012).

Obesity has become a crisis in the United States over the years. People tend to have limited self-control, causing one to choose foods that are not good for their health (Cohen, 2013). Sometimes when busy, people use limited cognitive capacity and reserve their cognitive processing system, which decreases the amount of thought and planning that is used when choosing food to eat. This can create an issue, causing eating to become an automatic function and process, not requiring full attention or awareness (Cohen, 2013). Senses work automatically and reflexively as well, which in this case, allows individuals to be alerted when there are new food sources. Sensory signals are picked up by other senses and messages that are transmitted directly to an individual's muscles. Signals that are sent to the muscles travel a half of a second

faster than it takes for signals to reach conscious awareness. Therefore, conscious awareness comes after action. This is where the issue of obesity often begins, and how eating for individuals with obesity becomes automatic and a habit rather than a task in order to keep them alive. The automatic reaction to continue eating food is related to an individual's sensory processing to-and-from the brain (Cohen, 2013). Therefore, the chance of people who are obese, also having a sensory processing disorder may be possible.

Obesity is known as one of the largest health problems in which American's struggle with to this day (Keiss & Boetner, 2002). An examination survey and National Health and Nutrition Survey, were implemented and have identified a dramatic increase in the number of individuals who are overweight and obese in the last decade (Kuczmarski, Flegal, Campbell, & Johnson, 1994). An individual's psychosocial factors may be related to obesity as well. (Mechrabian and Riccioni ,1986) Mechrabian and Riccioni held a study which found a relationship between depression and overeating, which also related to obesity (1986). Typically men who were overweight were more likely to be mentally unstable and depressed compared to underweight men (Carpenter et al., 2000). Also, Weil et al. (2002) discovered that individuals who typically had sensory, motor or mental health disabilities were more likely to be diagnosed as obese, compared to other individuals who were not diagnosed.

One factor that influences a child's lifestyle is the food that is eaten and made in their home environment. As years pass, many unhealthy foods have been created containing empty calories and offering no nutritional benefits to the children's bodies. Some foods such as candy, doughnuts, chips, and soda contain many additives like salt, flavorings, preservatives, and additional colors which negatively affect the health of children (Weltens, Zhao & Oudenhove, 2014). Food companies have introduced as many as 3000 new candies, desserts, ice creams, and

snacks in a single year, which all are foods heavy in sensory input either in taste or proprioception. Advertisements on TV, movies, and magazines are grabbing children's attention and luring children towards desiring unhealthy food only, especially those children who watch countless hours of television. With increase of food advertisements and the number of hours spent watching television, unhealthy eating is more socially acceptable, negatively influencing the health of children (Weltens, Zhao & Oudenhove, 2014). This may be due to the heavy sensory input through taste or proprioception, that foods high in sugar, fat, and carbohydrates present, posing a possible relationship to eating and sensory processing behaviors of children.

Often times, fatty foods signal an intrinsic reward within the nervous system when they are consumed, influencing a child's eating routine and lifestyle. This signal is created when exteroceptive signals interact among different sensory modalities, hunger, and cognitive processes. In Weltens, Zhao, and Oudenhove's study, the comfort from comfort foods and the mechanisms that link fat signaling to reward and emotion were studied (2014). This may help conclude an understanding of why children diagnosed as obese consume copious amounts of food. The purpose of Weltens, Zhao, and Oudenhove's research is to provide an overview of past research on neurophysiological mechanisms being linked to fatty foods and their reward value and emotional responses when consumed by individuals. Over time, the pleasure human beings associate with fattening foods has evolved by natural selection. Dietary fat consists of fatty acids and fat-soluble vitamins that help with development and well-being. Palatability and pleasure is felt when fat is eaten, due to the intrinsic reward value. However, an increase of fatty foods consumption is one of the main influences towards obesity. Obesity is said to be associated with abnormalities and alterations within the brain regions. These brain regions deal with sensory processing, such as processing taste. Sensory signals from sensory receptor cells activate one's

primary sensory cortices (Stice, Spoor, Bohem, Small, 2008). However, individuals who are obese are more sensitive to the sensory stimuli given off by food, which makes them more sensitive to the rewarding and responses that typically are generated from the food. This can easily cause over eating, and eventually lead to obesity (Szalay, Aradi, Schwarcz, Orsi, Perlaki, et al., 2012) There has been proven studies that support the idea that the gustatory system or “taste” receptors specifically sense fatty acids (Mizushige, Inoue, & Fushiki, 2007). This research article indicated a difference between ‘liking’ a food and ‘wanting’ a food. This is based on different neural mechanisms that influence one’s expression and response while consuming food. ‘Wanting’ a food is usually prompted by palatable foods. Typically dopamine is the neurotransmitter that causes the reward value feeling towards food. When dopamine acts on the reward stimulus, individuals tend to learn to enjoy the food that caused the dopamine increase, causing a reward association which motivates the individual to eat. Food ‘liking,’ however, is more of a pleasurable response which is triggered by foods that are enjoyable and palatable to an individual. These feelings are associated with the activation of opioids in the limbic system. It is common for ‘wanting’ and ‘liking’ to be confused (Weltens, Zhao, & Oudenhove, 2014).

Another article that studied the processing of food stimuli in abnormal eating was a study conducted by Wolz, Fagundo, Treasure, and Fernandez-Aranda (2015). This study also helps illustrate the signals and sensations that occur in the mind and body of a child with obesity. The qualitative research study analyzed sensory processing of participants and how it is related to motivated attention. There were inconsistent attentional biases towards pictures that illustrated food when compared to neutral pictures by the two participating groups. Obese individuals commonly showed more attention to pictures of food (Wolz, Fagundo, & Fernandez-Aranda, 2015). Typically loss of control eating is related to emotional eating as well as high attention

towards foods high in calories. Attention towards different foods as well as the selection and purchasing of foods is typically influenced by the situational context that is available, including one's physiological and emotional state and availability of food. The levels of dopamine is important in the value of food, which can eventually lead to higher visual attention and an increased craving and 'wanting' feeling (Berridge, 2009; Schupp et al., 2004; Stockburger et al., 2009).

Wolz, Fagundo, & Fernandez-Aranda's research study used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines to conduct a systematic review (2015). All participants that were part of the study were recognized or diagnosed with a disorder, including anorexia nervosa, bulimia nervosa, according to the DSM-IV, or obesity. One study that was mentioned in the review stated that obese individuals had higher early electrophysiological processing of high-caloric food stimuli, when compared to people of a normal weight category (Nijs, Franken, & Muris, 2010a). This was found by analyzing that people who craved chocolate had higher levels of anterior positivity towards chocolate which continued even after satiation compared to the neutral stimuli that was located in their left hemisphere. Also, this study noted that research has indicated that there is a correlation between hunger and attentional bias in obese and overweight individuals; however this is not related or caused by food intake (Nijs et al., 2010a,b; Svaldi, Tuschen-Caffier, Peyk, & Blechert, 2010). Oddly enough, when obese participants were hungry and food deprived, they showed a decrease in their attention to the food around them compared to satiated, when compared next to normal-weight individuals who had an increase in attention towards food (Nijs et al.2010b). In fact, the BMI of younger children negatively correlated with the amplitude towards food stimuli when visualizing food, which suggests that children with higher BMI percentages process foods higher

in fat and calories using less attention (Hill et al., 2013). Evidence suggests that people who are obese process food stimuli more thoroughly compared to people who are within normal weight during the early processing stage. The act of controlling one's attention has been associated with the control of cognitive skills and difficulties in emotional regulation, in which they use to cope with the exposure to food cues surrounding them. With children paying closer attention and devoting their emotions towards the food surrounding them, the environmental stimuli they are processing includes fatty and high caloric foods, potentially increasing the risk of obesity.

Obesity can be caused or related to the wide variety of foods that are palatable and available to people each day. It has been found that sensory properties of different foods are highly influential on obesity. Knowing this, Naish and Harris questioned whether differences of sensory processing of different people can possibly affect which foods that are eaten as more or less palatable, in turn resulting in the amount of food that is eaten. Dunn's Model of Sensory Processing states that the way individuals process is impacted by one's neurological threshold as well as their behavioral response (Dunn, 1997). When someone is known to be highly sensitive, they have a lower neurological threshold, and can perceive sensory stimuli at low levels of input. To measure the sensitivity of one's senses, a self-report measure can be used, measuring six sensory processing principles: taste/smell, movement, vision, touch, audition, and activity levels. When analyzing one's behavior related to eating, sensory sensitive people tend to be picky eaters, and may tend to avoid fruits or vegetables due to the textures and tastes of these particular foods (Dunn, 2000).

Sensory processing is the neurological process of the nervous system to take information from one's body or the environment and organize the information into the brain. This organization and processing determines the correct behavior or physiological response (Lashno,

2010). In Lashno's book entitled, "Mixed Signals," Lashno discusses the brain's lack of ability to process certain information correctly, specifically in children with sensory processing disorders. Typically in normal sensory integration, feedback is natural and quick. However, people with poor sensory processing systems are unable to make sense of environmental information and may display odd behaviors in response to sensory input. This is known as Sensory Processing Disorder (SPD). Typical children with SPD can have over or under reactions to sensory input, especially when relating to food or the act of eating. Behaviors may include stuffing one's mouth with food or constantly chewing on nonedible objects (Lashno, 2010). These children are unable to process, regulate, or organize incoming sensory information which may result in poor or absent adaptive response. In the case of eating, this may cause children to over eat and not receive the feeling of satisfaction and fullness similar to children who are obese (Lashno, 2010).

Children with SPD commonly do not find satisfaction in their sensations from the environment, due to the lack of communication and processing to the brain. Particularly when looking at the sensation of proprioception, one's joints and muscles receive senses through their receptors (Lashno, 2010). Typically a child with SPD has intact oral motor aspects so they are able to chew and swallow. When an individual has a sensory processing disorder that causes them to be sensory seekers, they may find comfort in constant pressure or the use of muscles in order to calm their brain. However, they may not register sensations and may try to continue the sensational input by chewing on blankets, clothes, and often times, food. The feeling of constant motion and chewing may help satisfy their brain; however when the object that is being chewed is food, it could easily lead to over eating (Lashno, 2010).

When people are sensory seeking, they tend to associate certain foods as more desirable and enjoyable. Due to the decreased palatability and aversion affect towards certain foods, a higher positive perception of senses towards other foods may be increased. A past study focused on determining the effect of sensory perception on the consumption of food. The research incorporated participants, ages 18-25 years old who all were psychology students in college. Each of the participants had easy access to a sum of chocolate as they completed a survey and a paper-based anagram task. The researchers assessed sensory sensitivity using a self-report measure, as well as measuring chocolate intake of the participant during the experiment. The study began with focusing on the effect of sensory sensitivity on food consumption during stress; however the researchers were not able to increase stress of the participants (Asmaro, D., Jaspers-Fayer, F., Sramko, V., Taake, I., Carolan, P., & Liotti, M., 2012). Each participant had a BMI between 16.3 to 33.2. The measures that were used included the Adult Sensory Profile and the Dutch Eating Behavior Questionnaire (DEBQ) (van Strien, Frijters, Bergers, Defares, 1986). The Adult Sensory Profile is a 60-item questionnaire with four sensory processing styles, including sensory sensitivity, sensory avoidance, sensation seeking, and low registration (Brown CE & Dunn W, 2002). Researchers indicated whether each individual had “high” or low” sensory sensitivity. An ANOVA test was used to analyze the amount of food eaten by low and high sensory sensitive participants. The ANOVA test showed significance between highly sensitive participants and the consumption of more chocolate ($p=0.022$). There was also a correlational relationship between sensory sensitive participants and emotional eating ($M=35$, $SD= 21.9$) (Asmaro, D., Jaspers-Fayer, F., Sramko, V., Taake, I., Carolan, P., & Liotti, M., 2012). .

When analyzing the results of past studies, it is found that foods higher in fat and sugar content are typically perceived as highly palatable (Asmaro, D., Jaspers-Fayer, F., Sramko, V.,

Taake, I., Carolan, P., & Liotti, M., 2012). Chocolate is a food that has both, high fat and sugar content, which can cause individuals to crave sweet food. Sensory sensitive individuals tend to have a higher perception of senses for the palatable food. Food consumption can increase as one's palatability increases, which lead to the assumption that when sensory sensitive participants perceive palatability while eating chocolate or other indulging foods, they are more likely to eat more. Results also show that individuals may tend to eat as an adaptive response to cope with their negative mood. It is a possibility that people who are sensory sensitive deal with their mood with strategies such as overeating (Asmaro, D., Jaspers-Fayer, F., Sramko, V., Taake, I., Carolan, P., & Liotti, M., 2012).

With past literary support of obesity, and the over consumption of food in individuals with SPD, other studies were conducted to determine if there were relationships between sensory processing styles and one's BMI. A study conducted by Kimball, Birstler, Bosse, Nelson, and scientists recruited 50 female subjects from a community who ranged from ages 19-59 years old, all varying in weights (2012). None of these participants were diagnosed with sensory processing disorders in the past. Each participant filled out a questionnaire regarding their home and living situation, as well as two self-reports. The researchers used The Adult/Adolescent Sensory Profile (AASP) to find a person's sensory processing style. Also, any possible diagnoses of a sensory process disorder could be determined as well. Out of the 50 subjects who participated in the research, a few individuals within the sample had a BMI indicating obesity. Each participant completed the AASP (Brown & Dunn, 2002), the Brief Pain Inventory (Jackson, 1996), and a questionnaire regarding the area in which they live. Informed consent was collected before the completion of this study. A Pearson correlation was run to illustrate the relationship among sensory processing, temperament, and BMI. Results for this study did not show a strong

relationship between BMI, temperament, and sensory processing styles. There was significance in the inverse relationship between BMI and sensation seeking in the younger age group (Kimball, Birstler, Bosse, 2012). Sensation seeking, sensation sensitivity and sensation avoiding are all aspects of a sensory processing disorder, and were all found to be correlated with the participants' mood. Also, in the younger group of participants, individuals who were sensation seeking did correlate with an impulsive expression. This study illustrated uncertain relationships between BMI and sensory processing styles (Kimball, Birstler, Bosse, Nelson, 2012).

When gathering information and data that has been collected and dated over time regarding the topic of obesity and the way sensations are processed in the brain, it can be concluded there may be a possible relationship between obesity and sensory seeking behavior in children. The lack of ability to organize sensory information to-and-from the brain may explain why people who are obese are unable to receive the feeling of satiety when eating. Some of the studies mentioned in this literature review state there was more significance between sensory seeking and Body Mass Index among people of a younger age. Typically younger participants who were defined as sensory seekers did express an impulsive behavior as well, which may be related to obesity (Kimball, Birstler, Bosse, 2012). This draws up the idea of a stronger association between sensory seeking behaviors within young children, who are also obese or overweight. With that being said, there is scientific data that supports the idea of a possible relationship between childhood obesity and sensory seeking behaviors. The purpose of the following study is to inform practitioners and therapists about a possible relationship, to therefore better prepare them as they create treatment plans and interventions for children who are diagnosed as obese, and may also be sensory seekers.

Methods

Participants

Two subjects participated in the study. Inclusion criteria for the study required the subject to be the legal guardian of either a child diagnosed as obese, or the guardian of a child with whom a professional, in a medical facility, had discussed the unhealthy weight of the child. The child of each participant was required to be between the ages of 6-12 years old. The participants were conveniently recruited through social media and through the Elizabethtown Community. Informed consent was obtained from the subject prior to the participation in the study.

Materials

This study included the use of a question template for the interviewer only, which listed the composed questions created by the researcher (**Table 1**). Each question was asked during both open response interviews.

Design:

Both participants were asked the same interview questions, regarding the behaviors and eating habits of their overweight/obese children. The independent variable within this study is the interview questions, while the dependent variable is the responses of the parents to the interview questions, and the behaviors of their children they mentioned during the interview process.

Procedure

Each participant was asked to take part in an interview, between them and the researcher. The interview was offered to be held in person or over the phone, depending what was most convenient for the participants. Both participants in the study chose to hold the interview over the phone. The interview questions were created by the researcher, regarding the behaviors, habits, roles, and diet of the children. The same questions were asked in both interviews. Each

interview took no longer than 30 minutes. The responses to the interview questions were then written down, and analyzed after the interview process. The behaviors and habits of the children were compared to common sensory seeking behaviors, in order to identify any possible relationship between obesity and sensory processing disorder.

Results

The first participant stated their child was a female who was 5 feet, 5 inches tall. The child was 12 years of age, weighing about 140lbs. Around the age of 10, the doctor discussed with the parents about their child being overweight, and suggested they work as a team to help the child lose weight. Results show that the child preferred any foods that were sweet. The child did notice when her face or hands were dirty and did wipe them off after noticing. The child enjoyed moderately spicy foods, however not too hot. A typical breakfast for the child included a bowl of cereal such as Life, some eggs and bacon, or a breakfast drink. The parent noticed that the child does get tired easily when participating in activities, such as soccer. The parent reported that the child has a tough time falling asleep at night when she plays sports all day or eats a lot of sugar shortly before bed. When the child does eat a lot of sugar, the first participant stated that her daughter does get overly wild and over-active. The participant also mentioned that her child watches a lot of television in a given day, on average approximately 5-6 hours.

The second interview was conducted over the phone as well. The parent of the child explained that the child is a 10 year old female, 5 feet, 3 inches and weighs 157 pounds. The child is in 5th grade, and was told this past year that she was at least 15 pounds overweight. The family doctor prescribed a blood test to check for cholesterol, and found that her cholesterol was over 200. The participant then went on to mention that her child avoids certain foods such as fruits and vegetables, particularly tomatoes and green beans. One texture she avoids is anything

mushy. The parent reported that the child has always enjoyed eating spicy food since she was a little girl. When asked the child's typical meal for breakfast, the parent said the child eats about two big bowls of cereal a day, usually cheerios. When asked about the child's interest in physical activities, the participant mentioned that the child enjoys playing soccer; however, the child usually sits out after halftime due to tiredness and shortness of breath. The parent mentioned that the child never has a problem sleeping at night, no matter what she eats that day, and also never takes naps. Lastly, the participant was asked about the amount of television that the child watches per day, and the parent noted that on weekends she spends approximately three hours watching TV each day and sometimes more on weekends.

Both interviews resulted in some similarities that were acknowledged between the two participant's' answers. Both participants mentioned their child overeats and overstuffs their mouths with food. Both children avoid some food textures they do not prefer. Another similarity was that both children enjoy eating very spicy foods, and at times struggle sleeping at night. All the similarities between the two interviews were also similar behaviors to typical sensory-seeking behaviors.

Discussion

After analyzing the results and past research that has been conducted, there are in fact similarities between sensory seeking behaviors and actions of children who are obese and overweight. Common sensory seeking behaviors that many children who have sensory processing disorders may perform, include: chewing on inedible objects, fidgeting, watching a lot of TV/Video games, loving loud noises, problems sleeping, preferring spicy and hot foods, craving/avoiding certain textures, overstuffing mouth when eating or overeats, and loves playing sports and physical activities. Behaviors and actions of the overweight/obese children whose

parents were interviewed include: over eating & overstuffing mouth with food or sometimes inedible objects, tiring easily during physical activity, sometimes having high blood pressure and cholesterol, lacking exercise, avoiding certain textures and foods, enjoying spicy foods, may struggle sleeping at night, and watching a lot of TV at one time. The results of the interviews were noted, reviewed, and assessed, and many similarities were found between sensory seeking behaviors and behaviors of overweight/obese children. For example, both groups of children may eat and overstuff their mouth with food. Also, both groups at times avoid food textures that they do not enjoy or prefer. Both sensory seekers and children who are obese/overweight were found to often times enjoy spicy and hot foods, and may also struggle sleeping at night. Sensory seeking children often times enjoy stimulating screens and watching television as well, which was a similarity with the child of Participant 2. However, since there were only 2 participants in the study, both with high BMI's, the variation of the research in this case, is small. Therefore, other children may exhibit these behaviors as well. However, both children displayed more than five common behaviors which define sensory processing disorders. With the variety of common behaviors and the frequency in which the behaviors are performed, researchers can conclude that these overweight children may potentially have a sensory processing disorder.

The results allow the researcher to understand that there are similarities between sensory seeking behaviors and behaviors of children who are obese. For example, as stated in the literature obese, children lack the satiety signal therefore try to feel satisfied by increasing the amount of food they pick up, bring to their mouth, and eat. Many children partake in binge eating, where they eat a large amount of food over a short period of time (Cohen, 2014). Similar to children, who are obese, sensory seeking children react to sensory input, especially when relating to food or the act of eating. Behaviors may include stuffing one's mouth with food or

chewing nonedible objects (Lashno, 2010). Literature also found that foods higher in fat and sugar content are typically perceived as highly palatable, such as chocolate or other sugary treats that are both high in fat and sugar (Asmaro, D., Jaspers-Fayer, F., Sramko, V., Taake, I., Carolan, P., & Liotti, M, 2012). The high sugar and fat content was found to cause sensory sensitive individuals to have a higher perception of senses for this highly palatable food. Food consumption can increase as one's palatability increases, so it can be assumed by these results that if sensory sensitive participants perceive palatability while eating chocolate or other indulging foods, they are more likely to eat more. It may be that people who are sensory sensitive deal with their mood with strategies such as overeating, which can cause obesity (Asmaro, D., Jaspers-Fayer, F., Sramko, V., Taake, I., Carolan, P., & Liotti, M., 2012).

Similar to this literary finding, relating to sensory processing individuals, there has been studies that support the idea that the gustatory system or "taste" receptors specifically sense fatty acids, particularly affecting people that are obese (Mattes, 2010) (Mizushige, Inoue, & Fushiki, 2007). Often times, fatty foods signal an intrinsic reward within the nervous system when they are consumed, which influences a child's eating routine and lifestyle. In Weltens, Zhao, and Oudenhove's study, the comfort from comfort foods and the mechanisms that link fat signaling to reward and emotion were studied, helping understand the purpose of the large consumption of food eaten by individuals who are obese (2014). The search for the feeling of comfort and satiety is felt by those who are sensory seekers, which may cause them to overeat and sense fatty foods, eventually leading to obesity.

It has been noted that sensory seekers tend to have a disruption in attention or being able to focus. Hill et al.(2013), conducted a study which found that BMI of younger children negatively correlated with the amplitude towards food stimuli when visualizing food, which

suggests that children with higher BMI percentages process foods higher in fat and calories using less attention (Hill et al., 2013). The lack of attention of the overweight children while eating may be related to a possible sensitivity to sensory processing. Past literature also found that a common sensory seeking behavior includes watching a lot of television. All of the sensory seeking children that watch countless hours of television constantly see commercials advertising for sugary and fattening foods, which causes them to 'want' to eat these foods. The results found in this study show that overweight and obese children often watch countless hours of television as well, which may indicate a potential relationship between sensory seeking behaviors and childhood obesity.

As the results of this study illustrated, there are similarities between children who are obese, and sensory seeking behaviors. However, with further analysis, it should be noted that there were even more similarities between the behaviors of the two participants and the behaviors of children with hypo-sensitivity processing disorders. Hyposensitivity is when a child has lower than normal sensitivity to stimuli. Children with hyposensitive processing disorder need constant touch and feeling as well, and have higher tolerance to touch, smell, and pain. For example, some symptoms of hyposensitivity includes as followed: constantly need to touch people or textures, clumsy and uncoordinated movements, frequently chews on objects or food, eats quickly, insists on watching TV, and prefers sedentary lifestyles. All the participants mentioned that their child over eats and overstuffs their mouth with food, enjoys watching television, constantly touches food and other objects, and both have relatively sedentary lifestyles. This may lead to the idea that children who are obese and overweight may be diagnosed as hyposensitive rather than sensory seekers. Future research is needed to determine if there is a stronger relationship between hypo-responsiveness and children who are overweight.

There were a few weaknesses to the research, which could have been different and increased the reliability and validity of the study. For example, the children of the participants were not officially diagnosed as obese. It can be concluded that sensory seeking behaviors may be similar to those who are obese or overweight, however not just diagnosed as obese unless further research is presented. In future studies, the participants could have children who are officially diagnosed as obese. Also, the number of participants was low which decreases the validity of the research. With a greater number of participants, the research results could be more dependable and reliable as well. Something that could be changed to better the results of the study is to conduct the interview in person. This will allow the researcher to understand and grasp the emotions and facial features of the participants as they ask them questions, which can impact the results. The last change that could have been used is a standardized assessment which would diagnose the children as having a form of a sensory processing disorder. This would allow the results to be more conclusive and definitive in finding a relationship between children diagnosed with a Sensory Processing Disorder, and children who are diagnosed as obese.

The research conducted and the results that were found can help benefit the professional health care field. For example, knowing there are various similarities between children with sensory processing disorders and children who are obese and overweight can increase the knowledge of Occupational and Physical Therapists who work with pediatrics, as well as nutritionists, in order to conduct and implement the most beneficial and successful intervention plan for the child. Also, this research study can increase the awareness of families who have children that are overweight and obese, and can use the results to better understand how their child works and the reasons behind their behaviors. Further research can only benefit the health field and family members of children battling such health impairments.

Research shows there are similarities that lead to the belief of a relationship between sensory processing disorders and children who are obese. With further research, this association can be further studied in more detail including more participants. For example, future research could include the administration of the Short Form of the Sensory Profile to a variety of children who are diagnosed as obese. After the administration of the assessment, the investigator can collect all the completed Sensory Profile assessments, score each of the assessments, and draw conclusions. These conclusions would be more concrete on the association between sensory seekers and children who are obese. The validity of the study will increase and the future results will be more reliable with the use of a standardized assessment, focusing on the sensory processing of the child rather than a nutritional or dietary intervention. This will allow health professionals in the future to understand and better treat their pediatric clients using more of a client-centered and holistic approach in order to maximize the child's occupational performance in all their activities of daily living.

TABLE 1:

Interview Questions:

- **1st Child: 5'5-140 lbs**
 - **Female: 12 years old**
 - **About 10 years old doctor talked to parents about being overweight**
 - **Plays Soccer/volleyball-all exercise, enjoys playing sports and being active**
 - **2nd Child: 5'3-157 lbs**
 - **Female: 10 years old**
 - **This year, while in 5th grade, doctor asked for blood test. Found out cholesterol was above 200. Was told overweight by at least 15 pounds**
1. Does your child avoid any certain tastes or foods?
 - a. If so, what food?
 - i. 1st child: Preferred, All about sweets
 - ii. 2nd child: Avoided most fruits and vegetables. Did not like the texture of tomatoes, peas, green beans
 2. After eating, does your child ever not seem to notice when their face or hands are messy?
 - a. 1st Child: Yes she'll wipe it off
 - b. 2nd Child: No, never had a problem with that
 3. Does your child enjoy spicy and hot foods?
 - a. 1st Child: Moderately spicy. Not too spicy
 - b. 2nd Child: Yes, hotness never bothered her. Always did
 4. Explain what your child's typical breakfast may look like...
 - a. 1st Child: Bowl of cereal- life, Eggs, bacon, Breakfast drink
 - b. 2nd Child: Bowl of cereal- about 2 bowls of cereal (cheerios, frosted shredded wheat)
 5. Does your child enjoy eating all different textures of food? If not, what texture do they dislike the most?
 - a. For example, do they enjoy eating: mashed potatoes, Jell-O, potato chips?
 - i. 1st Child: Nothing noticed
 - ii. 2nd Child: Doesn't enjoy some mushy foods (oatmeal/cream of wheat)
 6. When playing and participating in activities, does your child seem to tire easily?
 - a. Do they have poor endurance?
 - i. 1st Child: When they began talking about weight, she would do things but get tired easily. She would play soccer, she got older and hit puberty, she got tired quickly and got down on herself and quit because she got really tired

- ii. 2nd Child: Yes; when playing soccer, was out of breathe and tired after about half a game
- 7. Does your child ever become overly silly, unsafe, over-active, or inattentive, especially when taking part in an activity?
 - a. 1st Child: If she eats a lot of sugar, she gets a little bit crazy and overly wild
 - b. 2nd Child: No, never had a problem
- 8. Does your child ever have any trouble sleeping at night?
 - i. 1st Child: If she plays sports all day, she sleeps hard; a regular day, it takes a while to fall asleep
 - ii. 2nd Child: No, always sleeps through the night. Very heavy sleeper
 - b. Do they take naps during the day, and if so, for how long?
 - i. 1st Child: Sometimes on the weekend, an hour or so
 - ii. 2nd Child: Never takes naps
- 9. Does your child or has your child ever licked or tasted inedible objects?
 - a. 1st Child: Nothing that is noticeable
 - b. 2nd Child: Nothing that is noticeable
- 10. Does your child play videogames and watch TV constantly or for very long periods of time?
 - a. Approximately how many hours a day?
 - i. 1st Child: Watches a lot of TV (first punishment when in trouble)-can watch for like 5-6 hours usually weekly
 - ii. 2nd Child: Never watches too much TV, only lets child watch no more than an hour and a half of TV
- 11. Does your child every have difficulty sitting still? If so, please name some examples of places and situations where this is difficult for them.
 - a. 1st Child: No attention deficit, she has moments but not continuous
 - b. 2nd Child: Never noticed any trouble sitting still

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