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Problem Solving Skill and Obesity in Children

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Abstract:

Introduction: Childhood obesity is a problem that leads to many serious health effects including early maturation, decreased quality of life and increased risk for cardiovascular disease. In 2012, over one third of children were considered obese (Childhood Obesity Facts 2015). Efforts have been made to reduce this number but they have not been fully successful (Nutrition Standards for School Meals 2015, Prevalence of Childhood obesity in the United States 2011-2012 2015). What other factors are causing kids to choose foods that lead to weight gain.

Literature Review: In research regarding psychological motivations of overeating, there has been a correlation between decreased executive function and overeating in a population of middle aged women (Manasse et al. 2014). It was also shown that when asked to complete a complex mental task, a person is more likely to choose an unhealthy food option (Truong and Sterm 2015). The body reacts similarly to the sight of food as it does to substances like cocaine (Cohen 2008, Executive Functions Profile 2012, Imaging Dopamine Transmission in Cocaine Dependence 2011). What makes certain individuals more susceptible to giving in to this urge?

Purpose: The purpose of this study is to examine how a child's ability to make decisions may correlate with their weight status.

H_0: There is no statistically significant correlation between problem solving scores, as tested using "Word Generation" and "Animal Sorting, to BMI in 3rd grade children.

Methodology: The population was 3rd grade students at Pea Ridge Elementary School. Problem Solving skill was evaluated using the "Animal Sorting" and "Word Generation" sections of the NEPSY II assessment. These results were compared to Body Mass Index.

Results: Out of the 19 students in the final population, 3 were considered overweight, 3 underweight and 13 healthy weight. For the Animal Sorting Test, 3 students scored below average, 12 students scored average, and 3 students scored above average. Data was not recorded for two participants. For the Word Generation Semantic Test 4 students scored below average, 12 students scored average, and 2 students scored above average. For the Word Generation Initial Letter, 1 student scored below average, 12 students scored average and 5 students scored above average.

Analysis: Results were analyzed using a one-way ANOVA test. The results were not significant. The null hypothesis could not be accepted or rejected.

Conclusion: Because of limitations in population size, additional research would be beneficial to gain further knowledge about the association between problem-solving skill and BMI. Using a different tool for analysis may also provide more conclusive results.

Problem Solving Skill and Obesity in Children

Introduction:

Childhood obesity is a topic that has constantly surrounded by media in the last several years. This attention is very much justified. In the last 30 years it has more than doubled (Adolescent and School Health- Childhood Obesity Facts 2015). There are multiple initiatives around the country striving to bring this epidemic to an end. Becoming obese or overweight earlier in life also increases the chance of being obese as an adult and experiencing the significant health consequences (Adolescent and School Health- Childhood Obesity Facts 2015). In addition, obesity in childhood years leads to early maturation in physical development such as increased height growth and early onset of menarche. (Dietz 1998). The quality of life for obese children is also significantly impacted. Obese children report their quality of life lower than children with healthy weights (Williams 2005).

In the past, obesity has been thought of as a condition completely under conscious control (Caballero 2004). Food advertisements often target children and encourage them to fine relief from their stresses by eating their products. For example, in its advertisement, Reece's Puffs™ claims "Amazing things can happen when you taste Reece's puffs" (Hayden Menard. Also, if you're feeling down, the Kool-Aid™ man can come to the rescue (Kool-Aid Commercials 1950's-1990's, 2008). Decreasing exposure to TV food advertisements has proven to decrease food consumption (Veerman et al. 2009).

The tool used to determine obesity in children has been body mass index (BMI) (BMI Percentile Calculator). In pediatric patients the BMI is calculated using the child's age, sex, height, and weight. A child is considered underweight if they are between the 1st and 5th percentile, healthy weight if they are between the 6^{th} and 85^{th} percentile, and overweight if they are above the 85^{th} percentile (About Child and Adolescent BMI).

Continued research and emphasis on this national problem continues to be an important research agenda. Because of initiatives from activists, schools are now offering healthier options (Nutrition Standards for School Meals 2015). Because of these incentives, the rates of childhood obesity have actually improved in the last few years for 2-5 year olds. The rate of obesity for this age group dropped from 13.9% to 8.4% from 2003-2012. (Prevalence of Childhood Obesity in the United States 2011-2012, 2015). However, despite this improvement, a major problem is still present. In 2012, over one third of children were considered overweight or obese (Childhood Obesity Facts 2015). This creates the question, “why are kids continuing to choose foods that lead to weight gain?

Literature Review:

The majority of obesity research has focused on the psychological motivations of overeating or unhealthy eating behaviors. Research has demonstrated a correlation between individuals with less education and obesity. (Shiv and Fedorikhin 1999, Weight Gain Trends Across Sociodemographic Groups, 2005). However, there are individuals who are highly educated on the effects of obesity, such as healthcare providers, who are overweight (Cohen 2008). This evidence leads investigators to believe that there is more to this complex problem than simply knowing that certain foods are unhealthy and promote obesity. Brain function has been examined to learn more about why we eat the way we do. Our brains secrete dopamine at the sight of food (Cohen 2008). This euphoria is mediated chemically similar to a drug high (Executive Functions Profile 2012, Imaging Dopamine Transmission in Cocaine Dependence 2011). Overreacting to this compulsion to consume food may indicate a problem within the dopaminergic circuits that increases the value of food and decreases the importance of regulation and control (Fagundo et al 2012). The instinct to follow this urge has been shown to become more intense when a person’s brain is operating at a higher level of processing. One study examined the effect of completing a strenuous mental task on participant’s dietary choices. The patients with the easier task were more likely to choose the healthy snack option (Truong and Sterm 2005).

The brain’s executive function refers to a wide range of mental processes related to the management of different portions of one’s life such as planning, decision making, and time management. Executive function problems tend to become evident in early elementary years (What is Executive Function). Moreover, decision making ability has been shown to be impaired in people with extreme weight conditions including obesity and anorexia. This impaired function in the obese individuals may be related to an increased impulsiveness. This characteristic creates more of an emphasis on instant gratification causing people have difficulty choosing something that is better in the long run verses something that fulfills an urge at the moment (Fagundo et al.2012). Research has also demonstrated that executive function is correlated with weight related issues in other populations such as adult women. Verbal intelligence, self-regulatory control, and other domains of executive function were tested in women. Researchers noted that executive function is lower in overweight participants who experienced loss of control eating. This association is highest with low scores on self-regulatory control (Manasse et al. 2014). Examination of executive function problem solving in children and its relationship with BMI may provide important data that impacts the developmental period influencing the children’s health in their adult years.

Decision making is an important portion of development for many reasons. Just as we address deficits in performance at school, it is also important to address health issues and how effective decision making impacts their future life choices. Problem solving can be broken down into five steps. Identification of the problem, brainstorming ideas for a solution, logical evaluation of ideas and choosing most appropriate, implementation of solution, and evaluation (The 5 Step Problem Solving Method). If a child has poor skills in completing this process, it may be more difficult for them to make proper choices in diet and exercise. The instinctual cravings of the body for fat filled food may overpower any thoughts of health as the inborn desire becomes easier than the evaluation of the consequences of the choice (Cohen 2008). This research project examines the relationship between weight and executive function in a sample of school age children and the correlate it to their weight status.

The NEPSY II assessment is used to quantify executive function. “Word Generation” and “Animal Sorting” portions of the assessment, create a value for the child’s level of skill in making a decision. The surveys assess if the child is able to make a decision rather than how well the child follows through with the decision. “Word Generation” tests verbal productivity and ability to identify words that are within a specific category. It contains two portions- Semantic and Initial Letter. This test examines the brainstorming process of decision making. The second test, “Animal Sorting,” examines the logic process of decision making. This test evaluates the child’s ability to develop a basic idea and then act on the idea (Gioia et al. 2000, Schmitt and Wodrich 2004).

Aims:

The purpose of this study is to examine how a child’s ability to make decisions may correlate with their weight status.

H_0: There is no statistically significant correlation between problem solving scores, as tested using “Word Generation” and “Animal Sorting, to BMI in 3rd grade children.

Methodology:

Prior approval by the University of Arkansas Institutional Review Board and approval from the Pea Ridge Elementary School system were obtained.

Sample. The sample for this study consisted of a convenience sample of 20 third grade students attending the Pea Ridge Elementary School in Pea Ridge, Arkansas. Students excluded those that receive Special Education.

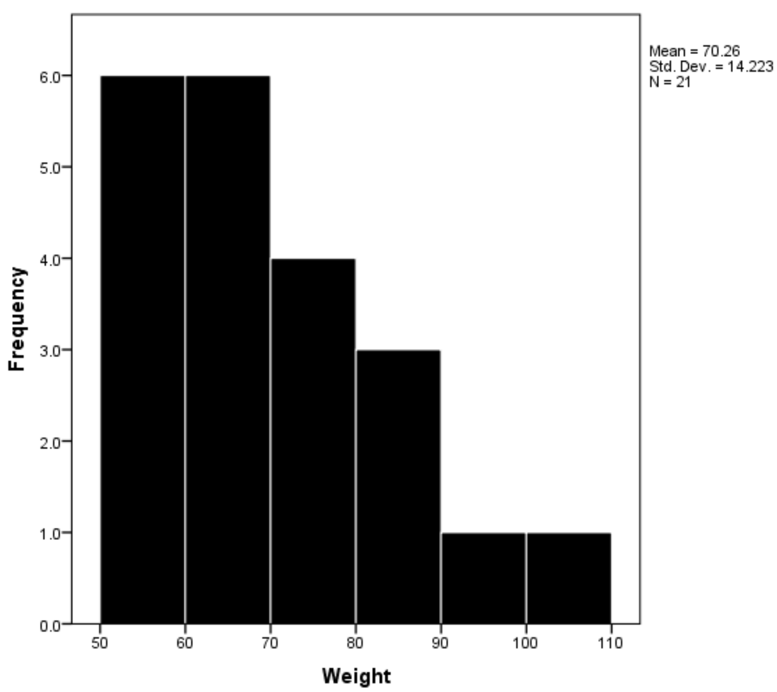
Design. A correlational study design was used for this research project to determine if a correlation between tests for problem solving ("Word Generation" and "Animal Sorting) and Body Mass Index exists. All student information was de-identified in accordance with the Health Insurance Portability and Accountability Act (HIPAA) guidelines. Each student participating in the study was assigned a case number. All data was reported in the aggregate and was stored on a password protected computer. Information related to executive functioning of the child will be obtained using the "Word Generation" and "Animal Sorting" portions of the NEPSY II assessment (Schmitt and Wodrich 2004). The semantic portion of the "Word Generation" requires the child to list as many words that fit into a certain category as they can in one minute. For example, if the category was colors, the child might say "pink, blue, green, orange, etc." The Initial Letter portion requires the same task except instead of a general category, the child receives a letter that all the words should start with. For example, "ant, alphabet, apple, etc." For the "Animal Sorting test," the child receives 8 cards with a different animal on each. The child sorts the animals into as many groups as they can and explains the grouping rationale. The children received instructions for each test and 3 examples for each category. These examples were not recorded as acceptable answers from the child. They were then asked to verbally validate that they understood what they were being asked to do. Once the child stated that they were ready, a timer was started using a cell phone timer application.

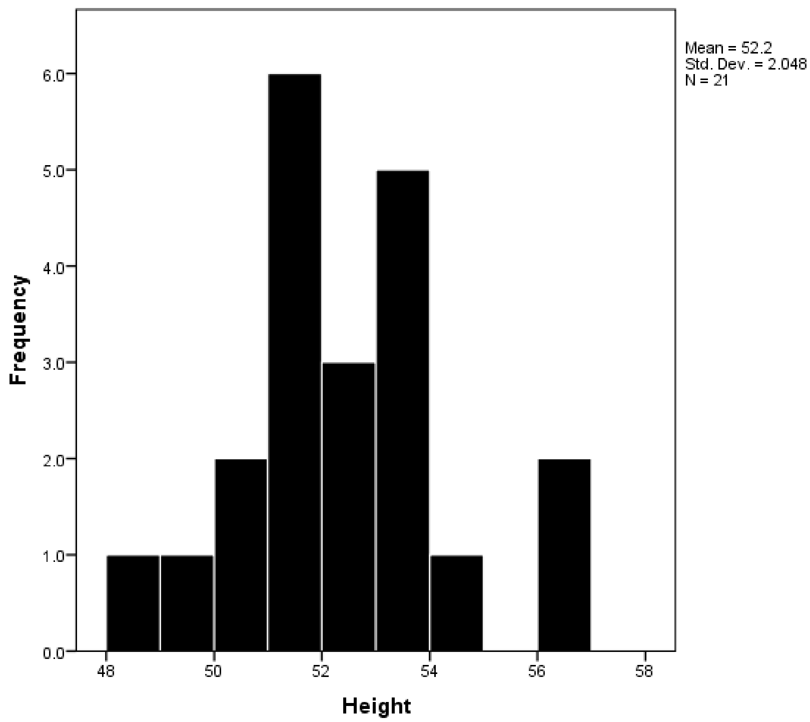
For the Body Mass Index Portion of the data collection, students' heights were measured using a tape measure against a wall. Their weights were measured using a floor scale.

Results:

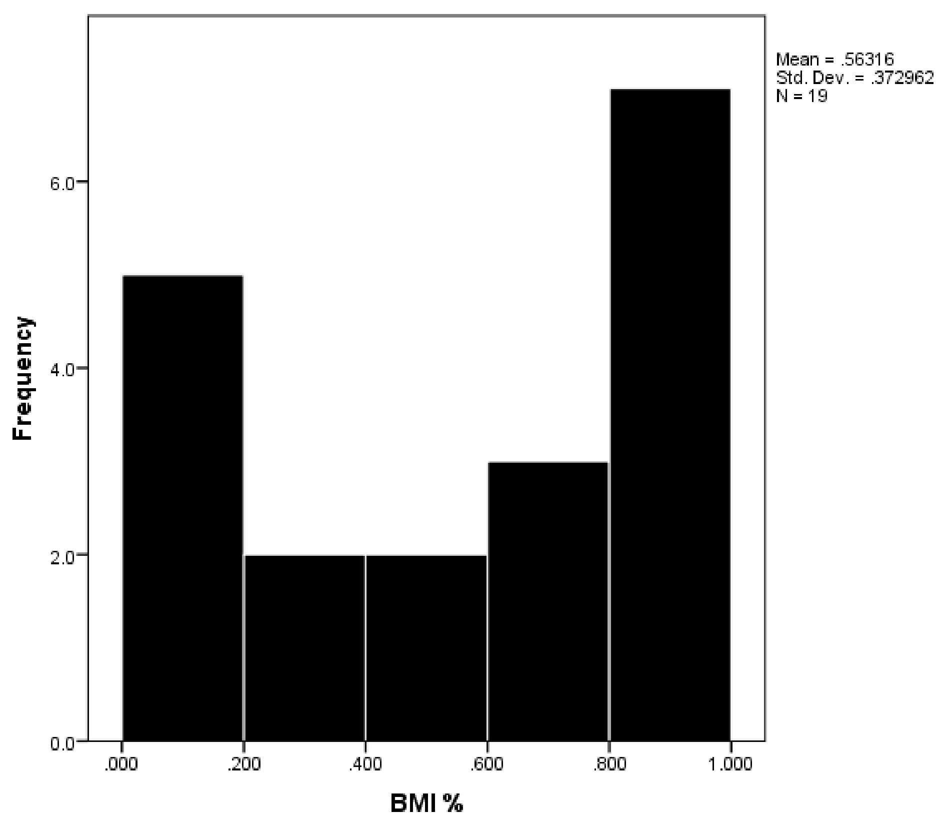
After completion of data collection, the population consisted of 11 (43%) males, 9 females (59%), and one unidentified gender (4.8%) for a total of 21 students. All students were between the age of 8 and 9. Each student was measured and weighed and then completed the Animal Sorting test and initial and first letter portions of the Word Generation test. Because of one missing gender, and one missing birth date, 2 of the students were excluded from analysis.

Within this population, heights between 49 and 57 inches were recorded as well as weights between 50 and 98 pounds. These were calculated into BMI's between 14 and 26. These BMI's were split into 3 groups- overweight (above 95%), healthy (5-95%), and underweight (below 5%). There were 3 students that were underweight. 13 within the healthy category and 3 students that were overweight. The students' BMI's were also charted according to the percentile they fell into within the population. The students ranged from the 4th to 95th percentiles with the majority of students falling between the 80th and 99th percentile.





Mean = 52.2
Std. Dev. = 2.048
N = 21
Frequency
6.0
5.0
4.0
3.0
2.0
1.0
0.0
48
50
52
54
56
58
Height



Mean = .56316
Std. Dev. = .372962
N = 19
Frequency
6.0
4.0
2.0
0.0
.000
.200
.400
.600
.800
1.000
BMI %

The Word Generation, Animal Sorting Semantic, and Animal Sorting Initial Letter results were also scored using below average, average, and above average. For the Animal Sorting Test, 3 students scored below average, 12 students scored average, and 3 students scored above average. Data was not recorded for two participants. For the Word Generation Semantic Test 4 students scored below average, 12 students scored average, and 2 students scored above average. For the Word Generation Initial Letter, 1 student scored below average, 12 students scored average and 5 students scored above average.

Animal Sorting

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	above average	3	14.3	15.8	15.8
	average	13	61.9	68.4	84.2
	below average	3	14.3	15.8	100.0
	Total	19	90.5	100.0	
Missing	System	2	9.5		
Total		21	100.0		

Word Generation Semantic

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	above average	4	19.0	21.1	21.1
	average	13	61.9	68.4	89.5
	below average	2	9.5	10.5	100.0
	Total	19	90.5	100.0	
Missing	System	2	9.5		
Total		21	100.0		

Word Generation Initial Letter

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	above average	1	4.8	5.3	5.3
	average	13	61.9	68.4	73.7
	below average	5	23.8	26.3	100.0
	Total	19	90.5	100.0	
Missing	System	2	9.5		
Total		21	100.0		

Analysis:

An ANOVA was conducted to determine if executive function; specifically, problem solving; was different for groups with different Body Mass Index's. Participants were classified into three groups: below average (*n* = 5), average (*n* = 13), and above average BMI (*n* = 1). There were no outliers, as assessed by boxplot; data was normally distributed for each group, as assessed by Shapiro-Wilk test ($p >$ .05); and there was homogeneity of variances, as assessed by Levene's test of homogeneity of variances ($p = .120$). Data is presented as mean ± standard deviation. CWWS score was not statistically significantly different between different BMI groups, F (2,18) =.434, p< 0.005.

ANOVA

BMIPERCENT

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.129	2	.064	.434	.655
Within Groups	2.375	16	.148		
Total	2.504	18			

ANOVA

BMIPERCENT

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.061	2	.031	.201	.820
Within Groups	2.442	16	.153		
Total	2.504	18			

Levene Statistic	df1	df2	Sig.
.476[a]	1	16	.500

Conclusion:

No statistical significance was found during analysis of this study. The null hypothesis cannot be proved or disproved because of the high margin of error associated with this study. The small population was highly limited in finding relationships between data. The participant groups of below average, average, and above average BMI were not equal in participant number. In addition, the numbers were very small overall with one group containing a single participant. A smaller number of students agreed to participate than expected and missing data further limited the population size. This population was a convenience sample with no efforts made to represent the pediatric population equally.

Although we were unable to find any correlation in this study, further research may be beneficial. Another study with a larger number of participants and more equal Body Mass Index based groups would be able to provide more comprehensive results regarding whether problem solving skill is correlated with Body Mass Index. Using a different tool to analyze problem solving may also be beneficial in finding more conclusive results.

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