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Childhood Obesity and Its Relationship to Sedentary Behavior Patterns vs. Other Independent Risk Factors of Obesity Among Navy Dependent Adolescents

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CHILDHOOD OBESITY AND ITS RELATIONSHIP TO SEDENTARY BEHAVIOR PATTERNS VS. OTHER INDEPENDENT RISK FACTORS OF OBESITY AMONG NAVY DEPENDENT ADOLESCENTS

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ABSTRACT

CHILDHOOD OBESITY AND ITS RELATIONSHIP TO SEDENTARY BEHAVIOR PATTERNS VS. OTHER INDEPENDENT RISK FACTORS OF OBESITY AMONG NAVY DEPENDENT ADOLESCENTS

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Background According to data gathered in the NHANES 1999 survey 14% of American children are now classified as obese, a 60% increase in prevalence from the NHANES II survey in 1976. Multiple research studies have looked at the role of dietary intake, heredity, and physical activity participation as independent risk factors of obesity with mixed results. However, sedentary behavior patterns, which have markedly increased in the past ten years, have not been extensively studied in relation to childhood obesity. The goal of this study was to focus on the relationship between various sedentary behaviors and childhood obesity.

Methods Two descriptive questionnaires and a food frequency questionnaire were used to gather data on 9-12 year old adolescents from Navy families in the Hampton Roads area. The questionnaires gathered data on hours and days spent in physical and sedentary activity, dietary intake, demographics, anthropometric data of both the child and parents, and parental exercise involvement with the child. A 101 total surveys were collected and used for analysis. Data were examined for frequency distributions and percentages as well as bi- and multi-variate relationship analysis of the independent variables to childhood obesity.

Results Using the 95th percentile as a minimum on the new pediatric growth charts, 39.8% of children were categorized as obese based on their BMI. Associations were found between childhood obesity and total time spent on the computer per week day, total time spent watching television per week day, total hours per day in sedentary behavior, maternal BMI, and if both parents are obese. Significant trends with childhood obesity were also shown if a parent was home when the child got home from school and number of hours per week the father exercises with the child. Kappa analysis revealed a strong correlation between parent and child responses in the areas of sedentary behavior patterns, dietary intake, and perception of physical activity level. Using a multi-variate model it was found that the largest independent risk factor of childhood obesity was maternal BMI. Total time spent in sedentary behavior was the second largest risk factor with a strong trend. Father's BMI, total caloric intake, total time spent in physical activity, and demographic data showed no significant relationship with child's body mass index.

Conclusions Childhood obesity is a major problem among adolescents of Navy personnel. The present study shows that the strongest risk factors among these children are maternal body mass index and time spent in sedentary behaviors. Development of educational and intervention programs for this population should therefore focus on parental involvement and methods to decrease sedentary lifestyle habits.

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CHAPTER 1

Introduction

The Healthy People 2010 are goals set forth for the American people by the Office of Disease Prevention and Health Promotion through the US Department of Health and Human Services (Healthy People 2010, 2000). These initiatives were created to set the standards for a healthier American from the beginning of life to the end of life. Many of these goals deal with keeping our nation's children healthy. Healthy people 2010 goals include the following: "reduce the proportion of children and adolescents who are overweight or obese," and "increase the proportion of adolescents who engage in vigorous physical activity that promotes cardiorespiratory fitness 3 or more days per week for 20 or more minutes per occasion." However, despite the government's initiation of this nationwide program originally in 1979, many of the objectives have still not been met (CDC press release, 1999). Of great concern is the goal for children to "reduce the proportion of children and adolescents who are overweight or obese." In 1988, the prevalence of adolescent obesity was 11%, and in 1999 it had risen to 14% of the US adolescent population (CDC press release, 1999). Similar to the obesity trend that is rising steadily among American adults, American children are also getting fatter at an exponential rate.

Statement of Problem

Research has shown that excessive weight in children is the main cause for childhood hypertension. In addition, childhood obesity has been linked to numerous other chronic health related conditions including Type II diabetes mellitus, coronary

artery disease, orthopedic disorders, and respiratory diseases such as asthma, obesity hypoventilation syndrome and sleep apnea, gall bladder disease, and polycystic ovary disease (Gidding, 1996). Aside from the physical complications of childhood obesity, psychological issues like emotional distress, loss of self-esteem, social isolation, and difficulty interacting with family and peers have also been shown to be associated with childhood obesity. Yet, despite the research showing childhood obesity is present, proof that obesity causes undesirable effects both physically and mentally, and the fact that the government has a child's health initiative in place, obesity continues to rise among children.

This increasing weight trend is thought by some experts to be due solely to diet (Tucker et al., 1997) and by others to be due to low levels of physical activity (Delany, 1998). One has to ask, has dietary intake among children really changed over the years or is it more the Nintendo/playstation/computer age and the decrease in physical activity during the school day that has decreased today's children's energy expenditure therefore leading to the increasing weight trend? Data collected from the National Health and Nutrition Examination Surveys (NHANES) during the last three surveys found little variance in energy intake over the last two decades yet an increasing trend in childhood obesity as stated earlier (Bronner, 1996). Within the Commonwealth of Virginia, Virginia Beach is currently deciding whether to cut physical education as a mandatory course in the junior high schools. In order to stop the trend of decreased physical activity and to promote the need for lifestyle education, research needs to be completed to show that sedentary lifestyle is an area of high concern. Therefore, this research addressed the

question: Is childhood obesity more closely related to inactivity as opposed to other factors like dietary consumption and physical fitness?

Hypotheses

For the purpose of this study the following null hypotheses were tested:

1. There will be no statistically significant correlation, at the $p < 0.05$ level, between the dichotomous variable of childhood obesity and the categorical variables of age, gender, and ethnicity.
2. There will be no statistically significant difference, at the $p < 0.05$ level, between children's responses and primary caregiver's responses on the independent variables of dietary intake, sedentary behavior patterns, and physical activity levels.
3. There will be no statistically significant association, at the $p < 0.05$ level, between the continuous variable of body mass index and categorical variables of various sedentary behaviors including television viewing time, time spent on the computer, time spent napping, time spent doing homework, and time spent in other sedentary activities.
4. There will be no statistical significant association, at the $p < 0.05$ level, when comparing total time spent per day in sedentary behavior to the variables of heredity, physical activity levels, and dietary intake that could elicit a confounding influence.
5. There will be no statistical significant association, at the $p < 0.05$ level, between the dichotomous variable of childhood obesity and parental BMI,

hours each parent exercises with the child, and presence of an adult when the child gets home from school.

6. There will be no statistical significance showing independent cause, at the $p < 0.05$ level, between body mass index and all the independent variables of obesity including heredity, sedentary behavior patterns, physical activity levels, and dietary intake.

Assumptions

For the purpose of this research, the following assumptions were made:

1. The random sample sufficiently represents the adolescent (9-12 year old) military population in the Hampton Roads Area.
2. The instruments, Parent Survey and Lifestyle Questionnaire for Adolescents, are appropriate measurements of sedentary behavior patterns and physical activity levels.
3. Dietary instruments, including a modified 24-hour recall and food frequency questionnaire, are appropriate measurements of typical macronutrient intake of adolescents.
4. The subjects answered all the questions completely and candidly.
5. The subject understood and followed the standardized instructions provided to them for completion of the questionnaire.

Delimitations

1. The research measured body mass index, physical activity levels, macronutrient dietary intake, and time spent in common sedentary activities like TV watching and time spent on the computer before and after school hours. The research did not measure time spent inactive in school, which was assumed comparable for all children of similar age groups; nor was micronutrient dietary content analyzed, as adequacy of vitamin and mineral intake was not being measured.
2. Subject participants consisted only of those children (9-12 years old) who present at Naval Medical Center Portsmouth or Boone Clinic for physician appointments during the fall of 2000.
3. Only children currently in the Hampton Roads Military population were chosen. Therefore, the survey does not represent all children in the Hampton Roads Area, yet should still give an adequate cross-section of the area as a whole since the Navy military population makes up 229.524 of the people in the Hampton Roads Area (Public Affairs Division, Commander Navy Region Mid-Atlantic). Per the population designated for the study, results are only generalizable to the specific children studied.
4. Research was conducted during the fall of 2000. By conducting the research in the beginning of the school year, right after summer, body weight may have been slightly lower and outdoor activity levels may have been slightly higher than if the research had been conducted during the winter months.
5. Children were possibly coached by their parents on answers when filling out surveys therefore creating some bias in their results.

Limitations

1. The adolescent activity questionnaire has no established validity or reliability as a whole. Therefore, a panel of educational experts was used to establish content validity. Recommendations of rewording of questions and additional questions needed were taken into consideration and changes were made accordingly. Additionally, a pilot study was completed using a convenience sample of 25 adolescents from the target population who did not participate in the study.
2. The parent questionnaire has no established validity or reliability as a whole. As stated above, experts in the field and a pilot study were utilized.
3. The study was not able to determine a cause-and-effect relationship of childhood obesity since retrospective data of previous weights and heights were not reported as actual numbers but rather limited to a question concerning the parent's perception of the child's weight status over the last five to eight years.
4. Dietary recall provides an estimate of dietary intake as compared to actual intake, as retrospective methods were utilized to collect data. To provide a more accurate assessment of dietary intake, both a modified 24-hour recall and food frequency assessment were collected to provide a crosscheck for the data gathered.

Definitions of Terms

For the purpose of this research the following terms are defined:

1. Body Mass Index (BMI): A well-researched unit of anthropometric measurement that is calculated by measuring mass in kilograms divided by height in meters squared ($kg \cdot m^{-2}$).

2. Obesity: A BMI greater than or equal to the 95th percentile as determined by the new pediatric growth charts (Kuchzmarski, 2000) or greater than or equal to 30 kg $\cdot$ m^{-2} for adults.
3. Modified 24-hour dietary recall: A multiple-choice selection of the number of times each major food category is eaten in the previous day.
4. Recommended Dietary Allowances (RDAs): Nutrient and energy standards for healthy population groups in the United States by age and sex, updated every 4-5 years by expert committees of scientists to reflect current research, and issued by the National Research Council of the National Institutes of Health (Worthington-Roberts, 1996)
5. New Pediatric Growth Charts: Growth curves of an extensive reference population based on BMI for age for children 2-19 years old, recently updated by the National Center for Chronic Disease Prevention and Health Promotion and the National Center for Health Statistics in 2000.
6. Sedentary behavior: Activities that require little to no metabolic effort including television watching, using the computer, doing homework, napping, talking on the phone, playing an instrument.
7. Physical activity: Activity, light or hard, that causes an expenditure of energy above one's resting metabolic rate.
8. Hard exercise: Exercise that causes one to breathe heavy and make the heart beat fast (examples included playing ball, jogging, fast biking).

9. Light exercise: Exercise that is not heavy enough to make the heart beat fast or causes heavy breathing (examples included walking, playing goalie, or slow bike riding).
10. Play outside: Active physical activity not inside the home.

Significance of the Study

Numerous studies have investigated the detrimental effects of childhood obesity as well as such factors associated with childhood obesity like heredity, dietary intake, exercise fitness level, and social environment. However, little research has looked closely at total inactivity level, which also is hypothesized to be closely associated with childhood obesity based on the strong correlation between television viewing time and childhood obesity found by Anderson et al. in 1998, and decreased heart rate and childhood obesity found by Maffeis et al. in 1997. Although research has investigated the association between television viewing time and childhood obesity, the inactive time of Americans today can be related to more than just time spent in front of the television. With the boom of the technology age it has been observed that American adults' sedentary time has increased dramatically. Has technology done the same to our children?

Children of today now have much more than the television to keep them entertained with little energy expenditure. Today is a world of computers, the Internet, real-life video games, and chat lines. It is hypothesized that children have also increased their leisure time to include more sedentary activities, which could then account for the rise in childhood obesity over the last 20 years. Therefore, research supporting this theory

of increased sedentary behavior would help allow for government, school, and various other children program planners know what the issue was leading to this unfortunate phenomenon. Programs could be planned to take into account the media children are spending their leisure time with and use these media to promote physical activity by creating interactive computer programs that force a child to move more than just their fingers in order to make an action happen on the computer screen.

The 1999 National Health and Nutrition Examination Survey conducted by the National Center of Health Statistics, a division of the Centers for Disease Control and Prevention (CDC), initially showed that approximately 13% of children ages 6-11 and 14% of children ages 12-19 years are overweight (BMI values greater than or equal to the 95th percentile) (CDC press release, 1999). This statistic representing the number of overweight children has more than doubled since 30 years ago when the First Nutrition Examination Survey was conducted (See Table 1). This disturbing trend has been related to a variety of factors including poor dietary habits, socioeconomic status, ethnicity, genetic makeup, and family lifestyle.

Table 1: Results of NHANES studies from 1963-1999 on overweight prevalence in children ages 6-19 years by percentage

Age	1963-70	1971-74	1976-80	1988-94	1999
6-11 years	4	4	7	11	13
12-19 years	5	6	5	11	14

Studies into these various factors have shown that obesity is most prevalent among Hispanic, African-American, and American Indian children. Females are plagued with obesity more than males. As seen with adults, children from poorer families seem to experience higher rates of being overweight (Healthy People 2010, 2000). As far as dietary intake is concerned, cross-sectional studies have shown that children's total caloric intake has not changed significantly over the last 20 years despite the increase in fast-food restaurants and convenience foods in the American diet (Gidding, 1996).

However, what is not being stressed in all this research is the role inactivity is playing in this trend. According to the 1996 survey by the CDC and International Life Science Institute, fewer than 25% of children between the ages of 12-21 are vigorously active (Pate, 1996). Participation in physical education classes by high school students has dropped from 42% to 25% (Promoting Life Long Physical Activity, 1997). The American Heart Association reports that children now watch an average of 17 hours of television a week, which does not include the time spent playing video and computer games which are becoming increasingly popular in the youth population (Gidding, 1996). One study reported that a child's odds of being overweight were nearly five times greater if that child watched more than three hours of television per day (Anderson, 1998). As adults become more and more sedentary, that same message is obviously being sent out to our children. Instead of playtime consisting of running around outside after school, children are coming home and logging onto the Internet. Obviously, for this trend to cease, changes in attitudes, education, and parent/child interaction need to take place. Therefore, the purpose of the present study was to investigate the effects of sedentary

behavior vs. other variables associated with childhood obesity to look for associations and multivariate model significance.

CHAPTER 2

Review of the Literature

While extensive research exists on diet, heredity, and physical activity levels leading to childhood and adolescent obesity, the research on sedentary time and its role in this issue is mainly limited to TV viewing time. This review discusses the current literature available on childhood obesity and the factors associated with its cause. Sedentary time and its relation to obesity will be briefly discussed with research available on television watching and childhood obesity. Specific topics addressed include dietary intake as it relates to childhood obesity, heredity and childhood obesity, physical fitness and childhood obesity, and finally sedentary activity and its relationship to childhood obesity.

Dietary Intake and Childhood Obesity

In the adult population, dietary intake is thought to be one of the main culprits for obesity and obesity related illnesses. However, in the pediatric population, numerous studies have shown no such similar association between absolute energy intake and obesity.

In research by Gazzaniga and Burns (1993), 53 white children, 9-11 years old were surveyed with 24-hr recalls concerning diet and activity. Body composition was based on skinfold measurements of the triceps and subscapula as compared to most of the following research that used BMI. In this study, calculated %body fat was determined through a regression equation that included sexual maturation, sex, and race. Initial results showed an absolute difference in caloric intake with obese children consuming

more calories than non-obese children. The coefficient of determination for the model was 26.0%. However, when the data were adjusted for body weight the results reversed, showing non-obese children having a higher energy intake than obese children. This research was consistent with past findings as stated above. However, the research, did note a positive correlation between dietary fat intake and obesity levels and a negative correlation between complex carbohydrate intake and obesity in white American children. This research was limited in population by both numbers of subjects and ethnicity.

A study by Takada et al. (1998) was conducted on the diet of Japanese youth to see if the relationship among Japanese children between dietary intake, dietary composition, and obesity was similar to the findings of Gazzaniga and Burns (1993) in American children. In this study, obesity was defined as a BMI greater than 20 $kg \cdot m^{-2}$. The survey looked at 457 fifth grade boys and the foods they typically ate and the frequency of eating those foods. The children were then divided into groups by serum lipid levels, which showed a positive correlation with total dietary fat intake. In this comparison it was found there was no significant relationship between BMI and total dietary fat intake. Further, it was concluded that the only food frequency that did have a positive correlation with obese children was rice, a complex carbohydrate low in fat. Foods were analyzed by frequency only, therefore, no comparison could be made between caloric intake and BMI. Although this research did pool an adequate subject population, gender and race were limited. This finding is opposite the conclusion of the above study by Gazzaniga and Burns (1993).

A cross-sectional study completed by Tucker et al. (1997) once again looked at diet composition and its relationship to body composition. The study used 262, 9-10 year

olds. Regression analysis was used to determine the associations between various indices of dietary intake with obesity while controlling for the factors of energy expenditure, fitness, gender, and parental BMI. Results showed a significant correlation between the amount of fat and carbohydrates consumed as related to increased adiposity, yet no significance was shown in total caloric intake and adiposity. Results of this study, however, cannot determine that childhood obesity is indeed caused by dietary intake of any kind since this is a cross-sectional study design.

Johnson-Down et al. (1997) found that children who participated in more physical activity actually took in a greater number of kilocalories yet this did not contribute to their obesity status. The study looked at 9-12 year old children from multiethnic, low-income families. Questionnaires were used to assess physical activity levels and 24-hour dietary recalls were used to determine caloric intake. Obesity status was determined by a BMI greater than the 85th percentile on the pediatric growth charts. Results found that activity levels did not differ between weight groups, however, caloric intake was higher in those children who participated in greater hours of physical activity. Johnson-Down also reports underreporting of caloric intake among overweight children, therefore, questioning the validity of the correlation to dietary intake. This finding suggests that neither dietary intake nor activity level were good determinants of childhood obesity.

The combination of these studies shows total caloric intake is not highly associated with childhood obesity if the numbers are looked at in absolute terms. In addition, with the findings by Johnson-Down et al. (1997) about underreporting of caloric intake by obese children, future studies need to focus on validation methods to ensure dietary intake is reported accurately before correlation studies can be completed. With

the varying results in caloric composition being the causation factor of childhood obesity, the question arises if there are other issues, which have a higher relationship than diet.

Heredity vs. Environmental and Childhood Obesity

Much research has investigated the role familial association plays with childhood obesity. In a study by Whitaker et al. (1997), a cross-sectional study was completed on 854 subjects born between 1965 and 1971. BMI was determined for the subjects as well as their parents. Results showed that the risk for obesity at any age was significantly greater if either parent or both parents were obese. However, by only comparing BMI's it is impossible to say this is a genetic issue vs. an environmental issue.

Based on the results of the previous study as well as many others, Francis et al. (1999) looked at body composition, dietary intake, and energy expenditure in non-obese children of obese and non-obese mothers. The study recruited 85 mothers who were of various BMI with 114 children, 6-10 years old, who were in the 10-90th percentile of weight for height. The study used 7-day food diaries, indirect calorimetry, activity questionnaires and interviews, and dual x-ray absorptiometry to collect data. Results of this research showed significantly higher percent abdominal fat in children of obese mothers as compared to children of non-obese mothers. Further analysis of body composition showed a much greater percent lean body mass in children from non-obese mothers. The factors of dietary intake, resting energy expenditure, and physical activity of the children showed no correlation with BMI. This study did not look at sedentary behavior and its casual relationship to the obesity epidemic.

O'Loughlin et al. (1998) looked at the correlation of income levels and ethnicity to obesity among elementary schoolchildren (ages 9-12). Anthropometric data were collected, along with socio-economic data, lifestyle behavior questions on smoking, level of physical activity, and dietary behaviors. BMI was categorized for children and adults as not overweight, overweight, or obese. In the univariate analysis a high BMI among both parents was somewhat associated with obesity among both boys ($p \leq 0.10$) and girls ($p \leq 0.01$). Other factors shown to be statistically related with obesity were tobacco use, infrequent physical activity, and frequent video game playing. Inactivity levels in this study were only measured by number of hours the child watched TV and played video games; therefore, this correlation may have been much higher if all forms of inactivity were looked at.

Whitaker et al. (1997) performed a retrospective study to determine the cause-and-effect relationship between parental BMI and child BMI. The study looked at 854 subjects from a Group Health Cooperative. They were selected based on height and weight available from birth till the age of 21 years, and parental height and weight available. Logistic-regression analysis showed that a child's risk of obesity was much greater if either a child's mother or father was obese. The researchers hypothesized that this trend could be secondary to shared genes or environmental factors. Although the retrospective data showed a more prominent cause-and-effect relationship than previous data, threats to internal validity including accidental sampling questions the validity of this research.

To better assess if obesity is a genetic issue, Heitmann et al. (1997) completed a six-year prospective study on adult monozygotic and same-sex dizygotic twins. BMI was

determined from self-reported weights and heights and leisure time activity was assessed from a questionnaire both pre and post-study. Results found a significantly greater relationship relating to changes in BMI and monozygotic twins as opposed to dizygotic twins, therefore suggesting the genetic component. Heitmann's research also found a "gene-environment" interaction between physical activity level and weight gain that suggested low physical activity (a sedentary lifestyle) could have more of a contributing effect to obesity in men who are already predisposed to obesity genetically. From this study, the researchers do state that the genetic mechanism of obesity is still unknown, and environment does play a role.

Faith et al. (1999) also looked at twins to see if a genetic component existed that influenced body mass index and fat mass. She looked at 41 monozygotic and 25 dizygotic twins with a mean age of 11.0 years. Convenience sampling was used as twins were recruited from an outdoors annual twin fair held in Ohio. Measurements were gathered on height, weight, and percent body fat. BMI and total fat mass were calculated from information gathered. Structural equation modeling was used to see if monozygotic twins had stronger correlation than dizygotic twins, therefore, suggesting a genetic component. Results showed a stronger correlation with monozygotic twins with both BMI and percent body fat and structural equation modeling showed genetic factors accounted for 86% of between-individual variation with the remainder percent being explained by environmental influences.

Perusse and Bouchard (2000) did a meta-analysis on the gene-diet interaction in obesity, summarizing the current literature available on the subject. They discussed the fact that obesity does have a large genetic component based on the phenomenon with

adults regarding dietary sensitivity on lipid and lipoprotein phenotype. Evidence has supported the observation that some adults are insensitive to dietary intervention when it comes to lowering their serum lipid levels while other individuals are very sensitive to dietary changes. Perusse reported this phenomenon in a group of 125, 4-10 year old children after three months of dietary intervention where there was a significant correlation between non-reducible lipid levels and those children with a positive family history of coronary artery disease. Studies on monozygotic, male twins, also support the genetic component to diet induced obesity. Overfeeding protocols showed six times more variance in weight gain between twin pairs than within the pairs. Negative energy balance studies of monozygotic twins showed even more variance (F ratios > 10) with weight loss response. Research in animals have identified over 100 possible genes that have the potential to influence obesity, if this is also true in humans then it could explain why diet intervention works well in some obese individuals and not in others.

By studying sedentary behavior among children and their parents it might be determined that obesity has both social and metabolic components. If this is true it will become important to use both dietary and behavioral intervention in counseling to discover if genetic sensitivities are present to either modality.

Physical Fitness and Childhood Obesity

Since it has been shown that physical activity patterns are established in childhood (Janz et al., 2000) and that physical activity may in fact protect against disease, much research has been conducted on child physical activity levels. Methods originally designed for adults have been modified for children to attempt to accurately assess

physical activity levels in this younger population. Therefore, many methods are available to assess physical activity levels in children including direct observation, motion sensing or heart rate telemetry, and survey. Since most research on the subject of obesity is of a large-scale epidemiological basis, surveys have been found to be the most practical method for assessing this variable (Koo and Rohan, 1999).

The 1990 Youth Risk Behavior Survey was used by Pate et al. (1996) to look at the association between physical activity and its relationship to other health behaviors. The study looked at 11,631 high school students deemed to be a representative sample of adolescents in the United States. The subjects completed surveys that assessed physical activity, diet, substance abuse, and other negative health behaviors. Students were defined as "low active" if they completed fewer than two days of light exercise and no days of hard exercise in the last 14 days. "High active" was defined as six or more days of hard or light exercise in the last 14 days. By using only the outlying data of high activity and very low activity, the researchers hoped to counteract classification error known to be found in self-reporting by children. Results showed 14% of the population was classified as low active and that this classification was positively correlated to poor dietary habits and increased television viewing. The percentage of children who were classified as high active was 22.8%. Since weight was not looked at in this study no comparison with low activity and obesity was observed. However, as the proceeding research will describe, obesity and television watching does seem to be highly correlated.

DeLany completed a meta-analysis on the role of energy expenditure and pediatric obesity (1998). He found that obese children as a group utilize more energy than non-obese children do, however, when values are adjusted for body weight, the numbers are

similar. His review of the literature also shows obese children spent less time in physical activity and more time in sedentary activity and at rest than their non-obese counterparts. In addition, it was observed that obese boys were much more sedentary at home than non-obese boys; however, at school they were equally as active as other children were. He concluded that there are no metabolic defects concerning energy metabolism in obese children, however sedentary activities could precipitate the disease.

In addition to research supporting the theory that obese children could metabolize energy efficiently, Owen and Gutin (1999), in their review of the literature showed that obesity did not inhibit a child from performing maximal exercise testing and could produce similar peak oxygen consumption (VO_2 peak) levels and peak heart rates as non-obese subjects. This was shown with both weight bearing and non-weight bearing exercise tests. This could explain why other research shows no correlation with obesity and physical activity as obese children have no physical barriers in this area.

Sedentary Activity and Childhood Obesity

Although it was hypothesized over 50 years ago that obese children are more sedentary than non-obese children are (Bruch, 1940), this part of child obesity research has not been extensively studied in recent years. With the invention of computers and other games that have increased a child's sedentary time greatly, there is a need to reinvestigate this issue.

In 1998, Anderson et al. looked at the relationship between physical activity and television watching with level of obesity among children. The study gathered data on 8-16 year olds between the years of 1988 and 1994, which does allow for history to be a

threat to internal validity. It was found that children who watched four or more hours of television per day had a significantly higher BMI and skinfold thickness as compared to children who watched less than one hour per day. In a multi-variate model comparison of BMI with the number of bouts of vigorous activity a child completed and television-viewing time, the correlation was shown to more highly associated with television viewing than vigorous activity.

A broader definition of inactivity and its relationship to childhood obesity was studied by Gordon-Larsen et al. (1999). This study looked at television viewing, and playing video and computer games. The study used the 1996 National Longitudinal Study of Adolescent Health which gathered information on more than 14,000 students in grades 7 through 12 in the areas of anthropometry, physical activity, physical inactivity, and ethnicity. Results found inactivity to be highest for African-American males and females and lowest for non-Hispanic white males and females. Males overall were more inactive and watched more TV. Obesity was shown to be highest among African-American females; however, no statistical correlation was done between obesity and inactivity to show a direct relationship.

This relationship was shown in a randomized, controlled intervention study by Robinson (2000). He observed third and fourth-grade students who were given lessons on reducing their television and videotape viewing time and video game usage. Robinson was trying to determine if adiposity gains would be smaller in those children who were encouraged to abstain from these activities, compared to the control group. He also looked at frequency of high-fat meals and physical activity level. Results found significantly smaller BMI gains in the intervention group, showing that by reducing time

spent in sedentary behavior, adiposity could be affected. No significant correlation was seen with decreased television viewing and frequency of high-fat meals or increases in physical activity. This study therefore supports the hypothesis that obesity may be correlated more to sedentary lifestyle habits, not diet or physical activity patterns.

Maffeis et al. (1997) studied the relationship between physical inactivity and adiposity in prepubertal boys. The study looked at 28, nine-year-old males. It measured anthropometic data including weight, height, and triceps and subscapular skinfolds. In addition, the research looked at postabsorptive metabolic rate, energy expenditure, and three-weekdays of heart rate monitoring by a heart rate transmitter. Sedentary activity time was defined as the time spent below the flex heart rate, which was calculated as an average of heart rates during lying, sitting, standing, and light exercise. Using a step-down multiple regression model between BMI and the variables of sedentary activity time, time in non-sedentary activity, energy expressed for activity, and total daily energy expenditure, only sedentary activity time showed a significant relationship with BMI. The coefficient of determination for this model was 46.0%, therefore showing greater than 50% of the relationship to childhood obesity are variables not covered in this research. This study is threatened by overgeneralization to external validity secondary to the small subject population and specific age and gender of all subjects. In addition, accidental sampling was used for both the subject population and the control group, which threatens internal validity. However, the work serves as an excellent pilot to express the need for further research on the subject.

In 1998, Maffeis completed another study on childhood obesity that looked at anthropometrics, physical activity, and parental obesity of 112 eight-year old children and

then re-studied this same population four years later. He found that mother's BMI and television viewing were significantly associated with childhood obesity at the age of eight and the mother's obesity was again correlated with childhood obesity when the child was 12 years old. Maffeis found no significant correlation with child obesity and caloric intake or participation in physical activity.

Multiple research studies have correlated childhood obesity to television watching. The abundance of significant studies in this area would then lead to the hypothesis that if television has such a strong link to childhood obesity, other activities where the child is sedentary would have similar strong relationships. In addition, since children imitate their parents on many aspects and research has shown that obese parents lead to obese children (Maffeis 1998, Whitaker 1997, O'Loughlin 1998, and Francis 1999), research needs to be conducted to examine the association between time spent being sedentary by parents and time spent being sedentary by children as a cause of childhood obesity.

A summary of the current research shows that childhood obesity is a multi-factorial issue that is affected by various aspects of human life. In addition, the area of sedentary behavior has been sparsely studied and needs more in-depth research studies to look for confounding variables to obesity as sedentary hours of Americans continue to increase and obesity of Americans continue to increase. As noted above, conflicting research findings for similar variables, raise the question that causes of childhood obesity could be different based on the subset of the population studied. Based on this assumption, research conducted on childhood obesity should be used specifically on the population studied when creating educational and intervention programs. To date, no

study has examined this issue in child dependents of US Navy personnel. Based on observation in a Naval Hospital and the findings of Moore (1998) and Tiwary and Holguin (1992) showing increased rates of childhood obesity in army dependents, this is an important issue needing further study.

CHAPTER 3

Methodology

A descriptive research approach was selected for the study's design. This was based on the interest of gathering data that described the factors that previous research has recognized as being important determinants of childhood obesity.

Subjects

A cross-sectional convenience sample of 500 children, age's 9-12 years, from Navy families in the Hampton Roads Area were given surveys for this study. A low return rate was expected based on the survey design, however a minimum sample size of 100 surveys returned was set as a goal. The sample size was chosen based on the statistical decision of reliability based on the pilot study results. Localities utilized for the study-included Virginia Beach, Norfolk, Chesapeake, Portsmouth, Suffolk, Hampton, and Newport News. Inclusive parameters were an age range of 9-12 years old, current height and weight measurements available, no reported genetic diseases that cause obesity (for example Prader-Willi Syndrome, Bardet-Biedl and Cohen, hypothyroidism and Cushing's syndrome), and no present history of pregnancy. The result was a useable sample size of n=101 and a response rate of 20.2%.

Treatment/Experimental Design

Before beginning the research, permission was obtained from the Human Subject/Institutional Review Board at Old Dominion University as well as the Internal Review Board at Naval Medical Center Portsmouth. In September of 2000, a

convenience sample of 9-12 year old children who had an appointment at Boone Pediatric Clinic or Portsmouth Naval Hospital and met the inclusive data was obtained. Consent was assumed by the return of the survey. In the cover letter the context of the project was explained and parents and children were asked to fill out the surveys that assessed a variety of factors including dietary intake, physical activity levels, and sedentary behavior. Heredity factors were obtained though parent's height and weight. The combination of the food frequency and 24-hour recall helped to increase the validity of the dietary intake of the child.

Children's BMI were compared to the norms established by the NHANES III expert committee (Dietz, 1998) in an attempt to control for maturation. Statistical significance of children's BMI was analyzed both inclusive and exclusive of outlying scores to test for variance.

Data Collection Procedures

A cross sectional sample of 500 children, age 9-12 years, from Navy families in the Hampton Roads Area was recruited for the study. Every day for one month, parents of children attending Pediatric or Nutrition Clinic at Naval Medical Center Portsmouth or Boone Clinic in Virginia Beach were handed a survey package upon check-in. Included in the survey packet were three survey instruments along with a cover letter (See Appendix A) providing detailed instructions to the parent and child on filling out the survey and the pager number of the primary investigator should the parent or child have any questions while filling out the survey. The cover letter encouraged the parent to only assist his or her child with the survey if needed but not provide answers for the children's

survey in order to prevent bias in the children's answers. The children's survey was a questionnaire, designed from previous validated studies (Heath et al., 1993), and entitled Adolescent Lifestyle Questionnaire (See Appendix B). The questionnaire determined factors related to time spent in vigorous and moderate level activity as well as time spent in sedentary activity. In addition, the questionnaire included a modified 24-hour recall as the last 7 questions. The questionnaire consisted of 17 questions total. Also included in the survey packet was a food frequency questionnaire with standardized instructions on filling the form out (Zeman, 1991) (See Appendix C). A parent questionnaire was also included for the parent or legal guardian who spends the most time with the child to complete (See Appendix D). The parent survey was also modified from previously validated studies (Ross and Gilbert, 1995 and Ross and Pate, 1987). The parent survey was used to verify the children's results on dietary intake and exercise as well as to obtain familial adiposity patterns. A self-addressed, stamped envelope was available at the front desk if the subject wanted to return the surveys at a later date. However, they were encouraged by the front desk staff to return the surveys back to the front desk before leaving for the day. Anonymity of subjects was insured by having no place required to write in name or any identifying number like social security number. A total of 500 surveys were distributed, 101 surveys were computed and returned resulting in a return rate of 20.2%. Since less than 100 surveys were returned in the first month, the recruitment method was continued for another two months until an adequate subject pool of 100 surveys minimum were obtained.

Statistical Analysis

Data analysis was completed using the SPSS-7.0© computer program. Data were examined using frequency distributions and percentages. To determine dietary intake, 24-hour recall and food frequency surveys were calculated by Nutritionist V™ for total kcal/d consumption and macronutrient intake. Survey results were grouped into total time spent in sedentary behavior (number of hours) and total time in active behavior (number of hours and number of days). These values were used as a continuous factor to compare against obesity. Using Kappa analysis, parent surveys were used as a reliability agent for the children survey answers. If answers had differed between the two surveys an average number would have been taken. However, parental and children answers did not differ significantly so this was not done. Parental weight and height were used from the parent survey to factor for heredity, and BMI measurements were calculated from the information provided. Chi square analysis and independent t-tests were utilized for comparison of obesity status in children by various independent variables that preceding research had indicated were linked to obesity including dietary intake, physical activity level, sedentary behavior, and heredity. The children's BMI measurements were collapsed into a dichotomous variable of obese and non-obese based on the 95^{th} percentile or greater on the pediatric growth charts. Linear regression was utilized to factors related to obesity based on the continuous BMI reported by the population. A two-tailed Pearson's correlation model was used to determine association between the main independent variables and childhood obesity. Those differences with a p-value of less than 0.05 were deemed statistically significant.

CHAPTER 4

Results

Description of Population. Section one of the adolescent questionnaire gathered demographic information such as age, sex, and race. Children were asked to circle their age, gender, and race from groups provided. All age groups were fairly evenly represented with 23 9-year olds (23.7%), 25 10-year olds (25.8%), 21 11-year olds (21.6%), and 28 12-year olds (28.9%). Gender was also fairly evenly distributed. Males represented 43 (46.2%) of the children surveyed and females represented 50 (53.8%) of those surveyed. The final demographic variable, race, reported 31 (32.3%) of the children were African-American, 52 (54.2%) were non-Hispanic, Caucasian, 5 (5.2%) were Hispanic, 5 (5.2%) were Asian, and 3 (3.1%) were reported as other. No response for age, gender, and race was reported 4, 8, and 5 times, respectively.

Rating of time spent in physical activity and sedentary activity. Questions one through ten asked children to choose what category best described their time spent during the week and on weekends in physical and sedentary behavior.

Questionnaire item one asked children to check how many times in the past 14 days they had participated in "hard" exercise for at least 20 minutes, defined as exercise that made them breath heavy and their heart beat fast. Seven (7.1%) children reported that they had spent no time in hard exercise, 15 (15.2%) reported 1-2 days of hard exercise, 39 (39.4%) reported 3-5 days of hard exercise, 19 (19.2%) reported 6-8 days of hard exercise, and 19 (19.2%) reported greater than 9 of the last 14 days were spent in

hard exercise for a minimum time of 20 minutes. Two children did not respond to this question.

Questionnaire item two asked the same question as item one but used the variable of light exercise. Light exercise was defined as exercise done for at least 20 minutes that did not make your heart beat fast or make you breath heavy. Ten (10.0%) children reported no light activity in the past 14 days, 24 (24.0%) reported 1-2 days of light activity, 24 (24.0%) reported 3-5 days of light activity, 19 (19.0%) reported 6-8 days of light activity, and 23 (23.0%) reported greater than 9 days of at least 20 minutes of light activity in the last 14 days. One child did not respond to this question. When chi square analysis was used to compare hard and light exercise to childhood obesity no relationship was found with $p = 0.538$ and $p = 0.305$, respectively.

The next four questions assessed hours spent watching TV or playing on the computer daily on both week and weekend days. During the school week 2 (2.0%) children reported not watching any hours of television, 26 (26%) reported watching one hour or less of TV per week day, 43 (43%) reported 2-3 hours of TV, 19 (19%) reported 4-5 hours, and 10 (10%) reported 6 or more hours of television watching per day during the weekday. One child did not respond to the question. During the weekend, 4 (4%) of children reported no TV watching, 36 (36%) reported less than one hour of TV per day, 34 (34%) reported 4-5 hours per day, and 26 (26%) reported greater than 6 hours per day spent watching TV on the weekend. One child did not respond to this question. The mean time spent watching television on the weekday and weekend was 3.36 hours and 4.42 hours per day, respectively.

Time spent on the computer during the week averaged a mean time of 2.40 hours per day. Fourteen (14%) reported no hours spent on the computer per day, 46 (46%) reported one hour or less per day, 28 (28%) reported 2-3 hours per day, 8 (8%) reported 4-5 hours per day and 4 (4%) children reported greater than six hours per day. One child did not respond to this question. Mean weekend hours per day spent on the computer was 2.95 per day with 6 (5.9%) reporting no hours, 36 (35.6%) reporting one hour or less, 37 (36.6%) reporting 2-3 hours, 17 (16.8%) reporting 4-5 hours, and 5 (5%) of children reporting 6 or more hours on the computer per day on the weekend. From these data, the average number of hours per day spent watching television and on the computer were computed for the week by the equation "(wk x 5) + (wkend x 2)/7". Mean average TV time was 3.66 hours/day and mean average computer time was 2.56 hours per day.

Questionnaire item number seven was an activity recall to assess leisure activity, both sedentary and active, engaged in during the week after school (table 2). Sedentary behaviors like television watching and time spent using the computer were repeats of questionnaire numbers 3 and 5 and therefore kappa analysis was used to test for reliability of the responses. Both statistical measures revealed a strong reliability ($p < 0.001$) between television viewing time and computer playtime between the two similar questions. Thus confirming the repetitive accuracy of the children's answers to the questions. From questionnaire number seven the variable "sedentary hours per day" was computed to reflect total number of hours spent in sedentary activity during the school week, after school. Mean sedentary behavior time was 7.00 hours per day with a standard deviation of 2.35 hours.

Table 2: Children's responses to time spent in activity after school both sedentary and active

Leisure Activity	Mean (SD)	N
Watch Television	2.79 hours (1.29)	101
Do Homework	2.22 hours (0.98)	101
Take a Nap	0.19 hours (0.74)	101
Play Video games/on Computer	1.80 hours (1.15)	101
Play Outside	2.07 hours (1.49)	101
Other**	0.70 hours (1.09)	101

**Other was reported of a variety of activities including babysitting, practicing a musical instrument, afterschool sports, go to mall, read, play indoor games, and talk on phone. No one activity was reported a significant number of times to show any relevance to the group category.

Questionnaire item number 8 asked children to report if they took a nap at any point during the week. Seventy-four (73.3%) children reported not taking a nap while 27 (26.7%) of children reported they did take naps either during the week after school or on the weekend.

Questionnaire item number 9 asked children how many days per week they were in physical education class. The mean for this category was 3.53 days per week with 6 (6.0%) reporting no days, 11 (11%) reporting 1 day per week, 14 (14%) reporting 2 days per week, 14 (14%) reporting 3 days per week, 3 (3%) reporting 4 days per week, and 52 (52%) reporting 5 days per week. One child did not respond to this question.

Questionnaire item number 10 asked children to assess their exercise behavior compared with their peers. Eighteen (18%) children said they were a lot more physically active than most other kids, 18 (18%) reported being a little more physically active than other kids, 30 (30%) reported their physical activity level the same as most other kids, 16

(16%) reported being a little less physically active then other kids, and 18 (18%) reported being a lot less physically active than other kids. One child did not respond to this question.

24-hour dietary recall. The final section of the children's questionnaire was reflective of a 24-hour dietary recall. Questions 11-18 assessed how many times "yesterday" the child had eaten fruit, vegetables, juice/soda, hamburgers/fried chicken/hotdogs/sausage/pizza, French-fries/potato chips, baked goods and ice-cream. The final question was a written summary of the previous night's dinner and was later categorized as high fat (> 40% of total calories from fat), low fat (< 20% of total calories from fat), or balanced (20-40% of total calories from fat) based on nutrient analysis by Nutritionist V. Mean fruit intake was one time a day, mean vegetable intake was one time a day, mean soda/juice intake was 2 times a day, mean fast-food intake was one time a day, mean French fry intake was one time a day, mean baked good intake was one time a day, and mean ice-cream intake was 0.5 times per day. In regards to the previous night's dinner, 34 (34.7%) children had a high fat dinner, 5 (5.1%) of children had a low-fat dinner, and 59 (60.2%) children had a balanced dinner the previous night. Three children did not respond to this question. Table 3 summarizes significance shown between childhood obesity and the various food groups studied.

Table 3: Significance of various food groups to obesity from a 24-hour recall

Variable	N	p
Fruit	98	0.159
Vegetable	98	0.378
Juice/Soda	97	0.763
Fast-food*	98	0.053
Fries	98	0.037
Sweets**	98	0.736
Ice cream	98	0.622

*defined as hamburger, fried chicken, hot dog, sausage, or pizza
**defined as candy, cookies, doughnuts, pie, or cake

The parent survey was used mainly to compare the validity of the children's answers by asking the primary care giver similar questions with comparable categories. Kappa analysis revealed the children's answers as highly comparable to the adults' answers in the categories of time spent watching TV ($p < 0.001$), playing on the computer ($p < 0.001$) and perception of time spent in active behavior ($p < 0.001$). The parent survey was also used to determine heredity as factors of obesity by reporting height and weight of both parents and the child in questionnaire item number 11. From these measurements body mass index was determined (BMI) and these numbers were compared against standardized growth charts described previously to determine obesity. The mean BMI for children was 23.2 $kg \cdot m^{-2}$ with a standard deviation of 7.2 $kg \cdot m^{-2}$. Based on the 95th percentile from the new pediatric growth curves, 59 (60.2%) were non-obese and 39 (39.8%) children were obese. Three children did not provide enough information to determine their BMI. The mean BMI for fathers was 27.6 $kg \cdot m^{-2}$ with a standard deviation of 3.40. Based on the NIH clinical guidelines for obesity defined as

being a BMI > 30 kg $\cdot$ m^{-2}, 59 (72.8%) fathers were non-obese and 22 (27.2%) were obese. Twenty surveys did not provide enough information to determine BMI for the father. The mean BMI for mothers was 27.6 kg $\cdot$ m^{-2} with a standard deviation of 6.11. Also based on NIH guidelines of adult obesity, 61 (69.3%) mothers were non-obese and 27 (30.7%) mothers were obese. Thirteen surveys did not provide enough information to determine mothers' BMI. Both parents being obese made up 10.3% of the population studied. Data missing on mother and father's BMI may be due to absence of that parent in the household, however the questionnaire asked no question to determine single vs. dual family homes. The parent survey did ask if the primary caregivers of the child were the biological parents (see Table 4).

Table 4: Determining if Primary Caregivers of Child are the Biological Parents

Biological parent	N	Valid Percent
Mom and dad	75	75
Only mom	19	19
Only dad	4	4
Neither	2	2

The final section to the questionnaire packet was the food frequency. Nutritionist V™ software was used to analyze total calories consumed per day, total grams of protein consumed per day, total grams of carbohydrates consumed per day, and total grams of fat consumed per day. Mean dietary intake was 1828 $\pm$ 486.1 kilocalories/day, 79 $\pm$ 20.6 grams of protein/day, 198 $\pm$ 64.8 grams of carbohydrates/day, and 83 $\pm$ 23.6 grams of

fat/day. When calories per day were compared against the recommended daily allowances as set forth by the FDA for the children's age group (2000-2500 kilocalories/day), 92 (91.1%) children reported eating less than the RDA and 9 (8.9%) children reported eating more than the RDA.

Research Question 1: Does childhood obesity differ relative to gender, race, or age? Chi square analysis was used to compare childhood obesity against the descriptive variables of gender, race, and age (See Table 5). None of the independent variables were found to be significantly related with the dependent variable of obesity as determined by the Center for Disease Control pediatric growth curves.

Table 5: Significance of Childhood Obesity and Demographic Variables

Variable	N	p-value
Age	94	0.138
Race	94	0.703
Gender	91	0.525

Research Question 2: When using a questionnaire, can children's responses in regard to dietary intake, time spent in sedentary behavior, and physical activity level be verified when compared to their primary caregivers answers to the same questions? Analysis of the similar questions between parent and child were compared for reliability of answers using the kappa statistic. A highly significant correlation ($p < 0.001$) was found between

perception of physical activity level as compared to one's peers between adult and children responses. Time spent in sedentary activities also showed a highly significant correlation ($p < 0.001$) when assessing the questions relating to total hours during a week day spent watching television and playing on the computer and total hours during a weekend day spent watching television and playing on the computer. When comparing dietary intake responses between parent and child a significant correlation was seen for how many times per day the children eat candy, cookies, doughnuts, pie, or cake ($p = 0.005$), how many times per day they drink soda ($p = 0.006$), how many times per day they eat fruits and vegetables ($p < 0.001$), and how many times per day they eat hamburgers, fried chicken, hot dogs, sausage, or pizza ($p = 0.001$). However, the response to times per day the child eats salty snacks like french-fries or potato chips had no correlation ($p = 0.838$), with children reporting an average of 0.50 times per day and parents reporting an average of 1.25 times per day.

Research Question 3: Can childhood obesity be associated with time spent in sedentary activities like watching television, playing on the computer, playing Nintendo like games, taking a nap, and doing homework? Analysis of these variables was performed both separately by activity as well as by computed average number of hours per week spent watching television, playing on the computer, and an average of total hours per day in all four sedentary activities. Chi square analysis showed a significant correlation ($p = 0.020$) between childhood obesity and time spent on the computer per weekday. A significant relationship was also found with obesity and television viewing hours per weekday ($p = 0.039$). A trend towards significance was shown with regularity of playing Nintendo like games and childhood obesity ($p = .063$). Using the continuous variable of child's BMI

and Pearson's correlation a strong significant relationship was also found between total hours per day in sedentary behavior and BMI ($p = 0.023$). Obese children spent an average of 9.52 hours per day in sedentary activity, not factoring in time spent in school, while non-obese children spent an average of 8.89 hours in sedentary activity, not factoring in time spent in school. When this same variable was factored without outlying BMI measurements (BMI measurements less than 15 $kg \cdot m^{-2}$ or greater than 36 $kg \cdot m^{-2}$) no significance was found ($p = 0.20$).

Research question 4: When comparing sedentary behavior against other independent factors of obesity like heredity, physical activity level and dietary intake, is there a confounding influence between the variables? Comparison of these variables to each other using chi square analysis showed no significant confounding relationship at the $p < 0.05$ level.

Research question 5: Do parents' BMI, exercise habits with their children, and presence at home have a significant influence on childhood obesity? The mother's obesity status, both as an independent variable relationship as well as an independent risk factor of childhood obesity, showed a highly significant relationship with the child's BMI ($p = 0.004$ and $p < 0.001$ respectively). If both parents were obese there was also a significant association with the child being obese ($p = 0.033$). However, if just the father was obese, no relationship was shown with the child's obesity status ($p = 0.972$). There were significant inverse relationships between childhood obesity and father exercising with the child ($p = 0.018$) as well as the presence of a parent when the child came home from school ($p = 0.011$).

Research question 6: When comparing childhood obesity against all the independent variables of obesity (heredity, physical activity levels, sedentary behavior patterns, and dietary intake), will sedentary behavior patterns show the highest correlation with obesity? Using linear regression, the greatest correlation was actually shown with mother's obesity ($p < 0.001$) with sedentary behavior patterns showing the next strongest trend ($p = 0.096$) (See Table 6). The coefficient of determination for the model was 27.9%, therefore showing that there are other reasons for childhood obesity not studied by this research.

Table 6: Multiple-regression analysis of factors assumed relevant to childhood obesity

Variables	8	SE	P
Constant	-1.588	8.165	.846
total caloric intake	1.10E-05	0.00	0.965
total hours in sedentary behavior	0.814	0.482	0.096
mother's BMI	0.526	0.133	0.00
father's BMI	0.217	0.229	0.347
hours spent in hard physical activity	-0.950	0.661	0.155

Discussion

Regarding the demographics of this study, males and females were fairly evenly represented, 46.2% and 53.8%, respectively. Using chi square goodness of fit test and information provided by the Bureau of Naval Personnel on the demographic make-up of active duty personnel as of December 31, 2000 (www.bupers.navy.mil), the ethnic demographics did not show a significant similarity. The survey sample was more representative of the local demographics (www.census.gov) which has a higher African

American population than the national Navy demographics. The main dependent variable of childhood obesity was reported as 39.8% of the population surveyed, which is significantly higher than the 14% reported by the NHANES 1999 survey of overweight children. However, the findings of this survey should be compared with the findings of the national survey with caution, as the present survey used a much smaller sample size and encompassed a population that differed greatly by socioeconomic status and ethnic diversity. More comparable studies would include one by Moore (1998) of adolescent army dependent females and the study by Tiwary and Holguin (1992) of army dependents ranging in age from one and older. These two studies found 40% and 33.3%, respectively, of children were considered above normal weight. The Virginia Department of Health reports regional obesity to be about 33% according to studies they have done in the area, which included military families. However, percentages can still not be compared exactly, as these three studies used the old pediatric growth charts that were based on the National Center for Health Statistics in 1979, while this study used the newly revised pediatric growth charts based on measurements of BMI as stated earlier. In addition, this study may be limited by a sampling effect since it surveyed only those children who presented at the pediatrician's office and did not question the reason for their visit. It could be assumed that sick children are more likely to be obese than non-obese children; however, to the researcher's knowledge this has not been studied. What can be hypothesized based on this study and the studies by Moore (1998) and Tiwary and Holguin (1992) is that the military population does have a greater issue with childhood obesity than the civilian population. The remainder of this discussion will focus on explanations of the main independent variables analyzed in this study.

No differences were found when comparing race, gender, and age against the variable of childhood obesity. This is in support of findings by Johnson-Down et al. (1997) who studied 9-12 year olds from multiethnic, low income families, yet differs from findings of Gordon-Larsen et al. (1999), MMWR (1998), and O'Loughlin et al. (1998), who all reported a larger prevalence of obesity among African-American youths. Explanations for this could lie in the fact that the previous three studies also showed a variation in socioeconomic status between African-Americans and Non-Hispanic whites. Although socioeconomic status was not looked at in this research, by pulling from a military population that is 100% employed either as enlisted members or officers of the US Navy and given that even low rank enlisted personnel make salaries above the poverty line, a direct comparison may not be applicable based on race alone.

Total caloric intake also showed no significant relationship with obesity in this population. When total caloric intake was collapsed into a dichotomous variable of 2500 kilocalories per day intake (the RDA for this age group), 92% of the population reported not even meeting this level regardless of weight status. This may be explained by the fact that throughout the research completed on this subject, underreporting of caloric intake by children has been consistently noted especially among obese children (Johnson-Down et al., 1997). However, since it appears evident in this study that underreporting of nutrient intake was done by both obese and non-obese children, and given that parent records correlated among most food groups with their children's answers at a high significance level, we can assume the numbers for dietary intake in this study are at least representative of actual caloric and macronutrient intake across the population as a whole.

Total caloric intake also correlated significantly with reported caloric intake of subjects in the research by Tucker et al. (1997).

Physical activity levels also showed no significant relationship with obesity status, which supports findings by O'Loughlin et al (1998), Francis et al. (1999), and Johnson-Down et al. (1997). The method for data collection of physical activity patterns was based on the research by Pate et al. (1996) as an interval level variable that allowed the children to rate their participation in light and hard exercise by numbers of days per week participated in during the last 14 days. However, since sedentary patterns in this research were classified as number of hours per day in various activities, future research in this area would more accurately benefit from a physical activity recall as a more continuous variable that can then be directly compared to the activity recall the child survey used to calculate sedentary behaviors. This method was not employed in this research based on the findings by Johnson-Down et al. (1997) that activity recalls are limited in the child population because of their decreased cognitive ability to accurately record type, duration, and intensity of physical activity. However, since kappa analysis showed a very high correlation between parent and children responses in the areas of dietary intake and sedentary behavior patterns, it is assumed that the same correlation would have been seen if a physical activity recall was used in the population studied.

Parental BMI as a contributing factor of child obesity has also been supported in the literature that have utilized the same age group (O'Louglin et al., 1998, and Whitaker et al.,1997) as well as younger children (Francis et al., 1999). However, the three researchers stated above found childhood obesity highly correlated if either the child's mother or father were obese or if both parents were obese. This research found the

strongest correlation with maternal obesity but also a significant association with both parents being obese. No independent relationship was found with father's BMI and the child's BMI. As stated in the demographic data, these results may be dependent on the fact that the population studied in this research were all military dependents. If one relies on the logic that most of the military personnel are male, and the mother would spend much more of her time in the home with the child serving as the primary caregiver, it is therefore not surprising that a child's obesity would have higher correlation to the mother's BMI.

As stated in studies by O'Loughlin et al. (1998) and Anderson et al. (1998), excessive television viewing time has a relationship to childhood obesity. However, this research expanded the concept of sedentary behavior time to other inactive aspects of children's lives like computer time, time spent doing homework, napping, and other activities like talking on the phone and practicing an instrument. The research found that, in addition to television viewing, total time spent in sedentary behavior correlated with obesity. This is in support of the research by Maffeis et al. (1997) who did not look at specific activities but did look at the comparison between metabolic rate and energy expenditure and its effects on obesity. As stated earlier this significant relationship did take into account outlying BMI measurements; however, use of these numbers is supported by research by Johnson-Down et al. (1997) and O'Loughlin et al. (1998) who also utilized BMI measurements greater than 36 $kg \cdot m^{-2}$ and less than 9 $kg \cdot m^{-2}$. It therefore can be stated that a group of morbidly obese children are a real population of society that need to be included in research on childhood obesity as they require immediate intervention and also pose the highest risk to poor outcomes in terms of health

and well being. Researchers like Janz et al. (2000) have found that activity patterns established in childhood lead to the activity patterns maintained in adolescence and that these patterns are carried into adult life. Therefore, it is important to establish obesity education programs that target children from a very young age instead of programs that just focus on a child's obesity once it is already out of control and behavior patterns related to diet and exercise have already been established.

CHAPTER 5

Summary and Conclusions

Childhood obesity, which is a growing problem in this country, has been related to a variety of factors. These factors include dietary intake, socioeconomic status, ethnic background, genetic makeup, and lifestyle behavior patterns. Although obesity is definitely a multi-factorial problem, trying to pinpoint the main causative agents that correlate with obesity in children could help government officials, educational planners, and caregivers construct more effective child obesity programs to attempt to decrease the morbidity of this epidemic.

The purpose of this study was to evaluate the different factors related to childhood obesity and to specifically focus on sedentary behavior activities and analyze their effect both as independent activities as well as a grouped variable on obesity.

Using two modified questionnaires and a food frequency questionnaire, data were gathered concerning the factors deemed important in contributing to childhood obesity. Data were examined using frequency distribution, percentages, chi square analysis, Pearson's correlation, independent t-tests, kappa analysis, and linear regression. Frequencies were used to determine demographic data, time spent in sedentary and active leisure activity, and caloric intake as compared to the RDA. Kappa analysis was used to check for reliability of answers in sections of the questionnaire where similar questions were asked. This was tested between the child and the primary caregiver in reporting of time spent in sedentary and physical activity and dietary intake, and within the child questionnaire in reporting leisure weekday activities.

Results of this study revealed that the strongest independent variable that was correlated to childhood obesity was mother's BMI, while total time spent in sedentary behavior also showed a significant relationship with childhood obesity. Father's BMI, dietary intake, time spent doing physical activity, and demographics showed no significant correlation with child obesity. Significant relationships were also found between childhood obesity and the variables of TV viewing time, time spent on the computer after school, Nintendo usage, high fat snack consumption, time the father spent exercising with the child, and if a parent is home when the child got home from school. Demographics of this study showed a large obese population among Navy dependents in Hampton Roads, in that 39.8% of children had BMI's that were greater than or equal to the 95th percentile based on the pediatric growth charts. This alone illustrates a major problem in the population studied that warrants need for corrective intervention. In addition, sedentary activities appear to be a major risk factor for childhood obesity. As the world becomes more and more technologically based, sedentary activities are only likely to intensify.

Planners of childhood obesity programs may wish to consider the statistically significant findings and even the highly correlated findings when designing a program for 9-12 year old adolescents. Program development which takes into account the factors that make up a child's lifestyle in the 21st century may not only provide more positive outcomes but could also allow for new media to be discovered that could assist in halting or at least decreasing the increasing trend in childhood obesity.

Conclusions

The following conclusions are based on the results of this study:

1. Childhood obesity among 9-12 year olds is a large problem in the Navy population that is not segregated by sex, race or age.
2. Childhood obesity is highly correlated with mother's BMI, therefore lending credence to the fact that educational programs need to not only be focused on the child's habits but also the mother's.
3. Childhood obesity shows a significant relationship with total time spent in sedentary behavior and independently with time spent watching television, playing Nintendo, and time spent using the computer after school.
4. There is no significant difference in the total dietary intake of obese vs. non-obese children on a macronutrient level.
5. Childhood obesity is affected by the parental environment as shown through correlation with mother's weight, time spent exercising with the child, and presence of an adult in the home when the child gets home from school.

Considering the results of this study, the following recommendations for future study are made:

1. Establishment of the validity and reliability of the data collection instruments, *Lifestyle Questionnaire for Adolescents* and *Parent Survey.*
2. Replication of this study with a larger sample, including children not limited to dependents of Navy personnel, to verify the findings of the study.

3. Investigate whether military rank of the active duty family member has any effect on the obesity of the child.
4. Replicate the investigation with a modification of the questionnaires that more closely explores parental exercise and eating habits to see if there is a correlation with child eating and exercise habits.
5. Investigate if total time spent in sedentary activity has changed over the last thirty year in both children and adults.

In conclusion, the findings of this study suggest that childhood obesity is a multi-factorial issue with a strong correlation with the obesity status of the maternal household member and time that the child spends in inactive behavior patterns. In addition, this study lends credence to the fact that 9-12 year old children can accurately depict their lifestyle patterns both from a dietary and activity standpoint and that parents of this age group realistically see their children's current activity level and obesity status. Planners of childhood obesity programs should keep these factors in mind when developing programs for obese children and make sure that these programs incorporate not only a child component but an adult component too. Programs that take all relevant variables into consideration will hopefully not only show a higher success rate in decreasing the prevalence of childhood obesity but also help to decrease the trend of adult obesity.

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Dear Parent,

We are currently conducting research on the daily activity patterns and dietary intake of children age's 9-12 years old. To assist in the understanding of the physical fitness level of your child, we would appreciate you and your child taking about five minutes to answer the following surveys. The **adolescent survey and food frequency questionnaires** are for your child to complete and the **parent survey** is for you to complete. You may assist your child with questions he/she does not understand; however, we would like the responses on the adolescent survey to reflect the way the child sees itself. You and your child are not required to answer every question, but doing so will help to provide a more complete picture of Navy children's daily activity and dietary patterns as a whole. However, please do not force your child to answer the questions if they really don't want to.

This survey is completely private; therefore, please do not sign your or your child's name. Please return the surveys before you leave today **in their original envelope** in the marked "**Return Survey**" box at the check-in desk. If you feel you could better answer the questions if you took the survey home, the check-in desk has pre-addressed envelopes you may take with you to mail the surveys at a later date. Please mail back all surveys back within one week. Your return of this survey is your consent that we may use the results in our research.

As a thank you for your time and as a benefit for your child, we have included educational material for you child on dietary intake and exercise for a healthy lifestyle. In addition, specialized pediatric dietitians are always available to you and your child on an outpatient basis by calling 554-6219.

If you do have any questions about the surveys while you are filling them out, the check-in desk has the pager number of a pediatric dietitian who can assist you.

- Listed below are a couple of questions that if answered **yes** would exclude your child from this study. If you answer yes to any of the questions below we can not include your child in this study but would like to thank you for your time.

  Has your child been diagnosed by a doctor with any of the following?

  1. Pradder Willis
  2. Bardet-Biedl and Cohen
  3. Hypothyroidism
  4. Cushing's Syndrome
  5. Current pregnancy

- Please look in your child's medical record and record their **height and weight** for the past two years (if available). Include today's height and weight.

  Date: Height: Weight:
  Date: Height: Weight:

APPENDIX B

ADOLESCENT LIFESTYLE QUESTIONNAIRE

Lifestyle Questionnaire for Adolescents

Circle the appropriate answer:

Age: 9 10 11 12 **Sex:** male female

Race: black
white(non-Hispanic)
Hispanic
Asian
other

Please check or write in the answer that best describes you

1. How many times in the **past 14 days** have you done at least 20 minutes of exercise **hard** enough to make you breath heavily and make your heart beat fast? (Hard exercise includes playing ball, jogging, fast biking-include time you spent in PE class)

- ☐ **None**
- ☐ **1-2 days**
- ☐ **3-5 days**
- ☐ **6-8 days**
- ☐ **9 or more days**

2. How many times in the **past 14 days** have you done at least 20 minutes of **light** exercise that was not heavy enough to make your heart beat fast or breath heavy? (Light exercise includes playing ball, walking or slow bike riding-include time spent in PE class)

- ☐ **None**
- ☐ **1-2 days**
- ☐ **3-5 days**
- ☐ **6-8 days**
- ☐ **9 or more days**

3. During the **school week** how many hours a day do you typically watch television, videos, or movies (include time before and after school)?

- ☐ **None**
- ☐ **1 hour or less**
- ☐ **2 to 3 hours**
- ☐ **4 to 5 hours**
- ☐ **6 or more hours**

4. During the **weekend** how many hours a day do you typically watch TV, videos, or movies?

- ❑ **None**
- ❑ **1 hour or less**
- ❑ **2 to 3 hours**
- ❑ **4 to 5 hours**
- ❑ **6 or more hours**

5. During the **school week** how many hours a day do you play/work on the computer and/or video games before and after school?

- ❑ **None**
- ❑ **1 hour or less**
- ❑ **2 to 3 hours**
- ❑ **4 to 5 hours**
- ❑ **6 or more hours**

6. During the **weekend** how many hours a day do you play/work on the computer and/or video games before and after school?

- ❑ **None**
- ❑ **1 hour or less**
- ❑ **2 to 3 hours**
- ❑ **4 to 5 hours**
- ❑ **6 or more hours**

7. After school what do you usually do? How many hours do you spend doing each?

Activity	**6 or more hours**	**4-5 hours**	**2-3 hours**	**1 hour or less**	**none**
Watch TV					
Do homework					
Take a nap					
Play outside					
Play sports					
Other (write in)					

8. After school or during the day on the weekend do you ever take a nap?

- ☐ **Yes**
- ☐ **No**

9. How many days per week are you in physical education class?

- ❑ **I am not in physical education class**
- ❑ **1 day per week**
- ❑ **2 days per week**
- ❑ **3 days per week**
- ❑ **4 days per week**
- ❑ **5 days per week**

10. Some children play more sports and get more exercise than others, compared to other children do you think you do things that make you breath hard and make you sweat:

- ❑ **A lot more than most other kids**
- ❑ **A little more than most other kids**
- ❑ **A little less than most other kids**
- ❑ **A lot less than most other kids**
- ❑ **The same as most other kids**

11. Yesterday, how many times did you eat fruit?

- ❑ **3 or more times**
- ❑ **2 times**
- ❑ **1 time**
- ❑ **None**

12. Yesterday, how many times did you eat a salad or vegetable?

- ❑ **3 or more times**
- ❑ **2 times**
- ❑ **1 time**
- ❑ **None**

13. Yesterday, how many times did you drink juice or soda (do not count diet soda)?

- ❑ **3 or more times**
- ❑ **2 times**
- ❑ **1 time**
- ❑ **None**

14. Yesterday, how many times did you eat a hamburger, hot dog, sausage, or pizza?

- ❑ **3 or more times**
- ❑ **2 times**
- ❑ **1 time**
- ❑ **None**

15. Yesterday, how many times did you eat French fries or potato chips?

- ❑ **3 or more times**
- ❑ **2 times**
- ❑ **1 time**
- ❑ **None**

16. Yesterday, how many times did you eat cookies, doughnuts, pie, or cake?

- ❑ **3 or more times**
- ❑ **2 times**
- ❑ **1 time**
- ❑ **None**

17. Yesterday, how many times did you eat ice cream?

- ❑ **3 or more times**
- ❑ **2 times**
- ❑ **1 time**
- ❑ **None**

APPENDIX C

FOOD FREQUENCY QUESTIONNAIRE

Food Frequency Questionnaire

How Often Do You Eat the Foods Listed Below?

(Please only check one box for each food)

	More than once a day (always)	Every day (always)	3-4 times times a week (often)	Every 2-3 weeks (sometimes)	Don't eat (never)
Dairy					
Milk, whole					
Milk, 2%					
Milk, skim					
Cottage Cheese					
Cream Cheese					
Other Cheeses					
Yogurt					
Ice Cream					
Frozen Yogurt					
Pudding					
Margarine					
Butter					
Meats					
Beef, Hamburger					
Chicken, fried					
Chicken, baked					
Pork, Ham					
Bacon, Sausage					
Hotdogs					
Pizza					
Frozen Meals					
Fish					
Tuna Salad					
Breaded Fish					
Other Fish					

How Often Do You Eat the Foods Listed Below?

(Please only check one box for each food)

	More than once a day (always)	Every day (always)	3-4 times times a week (often)	Every 2-3 weeks (sometimes)	Don't eat (never)
Eggs					
Egg salad					
Whole eggs					
Grains					
Bread					
Rolls, Biscuits					
Muffins, Donuts					
Pancakes, Waffles					
Bagels					
Pasta, Spaghetti					
Mac and cheese					
Rice					
Crackers					
Crackers & Cheese					
Crackers & Peanutbutter					
Poptarts					
Cereal					
Sugar coated					
Non-sugar coated					
Granola					
Beverages					
Fruit juice					
Fruit drinks, Hi-C					
Regular soda					
Diet soda					
Snacks & sweets					
Chips					
Pretzels					
Popcorn					
French-fries					
Cookies					
Cake, pie					
Pastries					
Candy					
Fast-food					

Parent Survey:

To assist in the understanding of the physical fitness of your child, we would appreciate you taking a couple of minutes to answer the following questions. You are not required to answer every question, but doing so will help to provide a more complete picture. Answers will be kept strictly confidential. Please return this survey along with your child's in the envelope provided. Thank you.

1. Compared to other children of the same age/sex, is your child: **CHECK ONE.**
   - ❑ A lot more physically active than most
   - ❑ A little more physically active than most
   - ❑ A little less physically active than most
   - ❑ A lot less physically active than most
   - ❑ Average-about the same as most

2. How much television does your child typically watch on the typical **SCHOOL DAY**:
   - ❑ None
   - ❑ 1 hour or less
   - ❑ 2 to 3 hours
   - ❑ 4 to 5 hours
   - ❑ 6 or more hours

3. How much television does your child typically watch on the typical **WEEKEND DAY**:
   - ❑ None
   - ❑ 1 hour or less
   - ❑ 2 to 3 hours
   - ❑ 4 to 5 hours
   - ❑ 6 or more hours

4. If you have a computer in the home, how much time does your child typically play on the computer on a typical **SCHOOL DAY**:
   - ❑ None
   - ❑ 1 hour or less
   - ❑ 2 to 3 hours
   - ❑ 4 to 5 hours
   - ❑ 6 or more hours

5. If you have a computer in the home, how much time does your child typically play on the computer on the typical **WEEKEND DAY**:
   - ❑ None
   - ❑ 1 hour or less
   - ❑ 2 to 3 hours
   - ❑ 4 to 5 hours
   - ❑ 6 or more hours

6. Does your child play games like Nintendo, Sony Play Station, or other low activity indoor games:
   - ❑ Every day
   - ❑ Every weekend only
   - ❑ Once or twice a week
   - ❑ Never

7. Are you or another adult home when your child gets home from school?
   - ❑ Yes
   - ❑ No

8. Do you feel it is safe for your child to play outdoors in the neighborhood if you are not home?
   - ❑ Yes
   - ❑ No

9. In a typical week, does your child get exercise or physical activity that would make them **sweat or breath heavily** (including school sports teams but not including physical education class during school):
   - ❑ One time a week or less
   - ❑ Three times a week
   - ❑ Five times a week
   - ❑ More than five times a week

10. In the typical week, on how many days do the child's parents or guardians (who ever the child lives with) **exercise with the child** for 20 minutes or more? List number of days per week for each parent.

Mother or Female Adult:	Father or Male Adult:

11. What is the **current** height and weight of the child's Parent or Legal Guardian (who ever the child lives with)?

List for each parent and circle relationship.

Mother or Female Adult: **Ht:** **Wt:**
Father or Male Adult: **Ht:** **Wt:**

12. Are you the biological parent of your child?
    - ❑ Yes
    - ❑ No

13. Looking at your child over the last 5-8 years, has your child, compared to others of the same age/sex:
    - ❑ Been of an average weight
    - ❑ Been too thin
    - ❑ Been a little heavy set
    - ❑ Been overweight

14. How would you describe your child's eating habits (next to each food item write how many times they would eat this per day):

Salty snacks like chips/French fries :
Sweets like cookies/doughnuts/pies/cake/ice-cream :
Soda (not including diet) :
Hamburgers/hotdogs/sausage/pizza :
Fruits/vegetables :

APPENDIX E

FREQUENCY SCORES OF ADOLESCENT QUESTIONNAIRE ITEMS

age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	9	23	22.8	23.7	23.7
	10	25	24.8	25.8	49.5
	11	21	20.8	21.6	71.1
	12	28	27.7	28.9	100.0
	Total	97	96.0	100.0	
Missing	System Missing	4	4.0		
	Total	4	4.0		
Total		101	100.0		

sex

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	43	42.6	46.2	46.2
	female	50	49.5	53.8	100.0
	Total	93	92.1	100.0	
Missing	System Missing	8	7.9		
	Total	8	7.9		
Total		101	100.0		

race

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	african-american	31	30.7	32.3	32.3
	white (non-hispanic)	52	51.5	54.2	86.5
	hispanic	5	5.0	5.2	91.7
	asian	5	5.0	5.2	96.9
	other	3	3.0	3.1	100.0
	Total	96	95.0	100.0	
Missing	System Missing	5	5.0		
	Total	5	5.0		
Total		101	100.0		

Question 1:

hard exercise

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	none	7	6.9	7.1	7.1
	1-2 days	15	14.9	15.2	22.2
	3-5 days	39	38.6	39.4	61.6
	6-8 days	19	18.8	19.2	80.8
	9 or more days	19	18.8	19.2	100.0
	Total	99	98.0	100.0	
Missing	System Missing	2	2.0		
	Total	2	2.0		
Total		101	100.0		

Question 2:

LTEXERCI

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	none	10	9.9	10.0	10.0
	1-2 days	24	23.8	24.0	34.0
	3-5 days	24	23.8	24.0	58.0
	6-8 days	19	18.8	19.0	77.0
	9 or more days	23	22.8	23.0	100.0
	Total	100	99.0	100.0	
Missing	System Missing	1	1.0		
	Total	1	1.0		
Total		101	100.0		

Question 3:

TVWK

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	none	2	2.0	2.0	2.0
	1 hour or less	26	25.7	26.0	28.0
	2-3 hours	43	42.6	43.0	71.0
	4-5 hours	19	18.8	19.0	90.0
	6 or more hours	10	9.9	10.0	100.0
	Total	100	99.0	100.0	
Missing	System Missing	1	1.0		
	Total	1	1.0		
Total		101	100.0		

Question 4:

TVWKND

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 hour or less	4	4.0	4.0	4.0
	2-3 hours	36	35.6	36.0	40.0
	4-5 hours	34	33.7	34.0	74.0
	6 or more hours	26	25.7	26.0	100.0
	Total	100	99.0	100.0	
Missing	System Missing	1	1.0		
	Total	1	1.0		
Total		101	100.0		

Question 5:

COMWEEK

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	none	14	13.9	14.0	14.0
	1 hour or less	46	45.5	46.0	60.0
	2-3 hours	28	27.7	28.0	88.0
	4-5 hours	8	7.9	8.0	96.0
	6 or more hours	4	4.0	4.0	100.0
	Total	100	99.0	100.0	
Missing	System Missing	1	1.0		
	Total	1	1.0		
Total		101	100.0		

Question 6:

COMWKND

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	none	6	5.9	5.9	5.9
	1 hour or less	36	35.6	35.6	41.6
	2-3 hours	37	36.6	36.6	78.2
	4-5 hours	17	16.8	16.8	95.0
	6 or more hours	5	5.0	5.0	100.0
	Total	101	100.0	100.0	
Total		101	100.0		

Question 7:

TV

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	none	4	4.0	4.0	4.0
	1 hour or less	46	45.5	45.5	49.5
	2-3 hours	35	34.7	34.7	84.2
	4-5 hours	11	10.9	10.9	95.0
	6 or more hours	5	5.0	5.0	100.0
	Total	101	100.0	100.0	
Total		101	100.0		

homework

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	none	7	6.9	6.9	6.9
	1 hour or less	68	67.3	67.3	74.3
	2-3 hours	22	21.8	21.8	96.0
	4-5 hours	2	2.0	2.0	98.0
	6 or more hours	2	2.0	2.0	100.0
	Total	101	100.0	100.0	
Total		101	100.0		

naptime

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	none	94	93.1	93.1	93.1
	1 hour or less	4	4.0	4.0	97.0
	2-3 hours	2	2.0	2.0	99.0
	4-5 hours	1	1.0	1.0	100.0
	Total	101	100.0	100.0	
Total		101	100.0		

computer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	none	22	21.8	21.8	21.8
	1 hour or less	62	61.4	61.4	83.2
	2-3 hours	14	13.9	13.9	97.0
	4-5 hours	2	2.0	2.0	99.0
	6 or more hours	1	1.0	1.0	100.0
	Total	101	100.0	100.0	
Total		101	100.0		

play outside

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	none	23	22.8	22.8	22.8
	1 hour or less	47	46.5	46.5	69.3
	2-3 hours	22	21.8	21.8	91.1
	4-5 hours	5	5.0	5.0	96.0
	6 or more hours	4	4.0	4.0	100.0
	Total	101	100.0	100.0	
Total		101	100.0		

misc

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	none	70	69.3	69.3	69.3
	1 hour or less	22	21.8	21.8	91.1
	2-3 hours	9	8.9	8.9	100.0
	Total	101	100.0	100.0	
Total		101	100.0		

Question 8:

PE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	none	6	5.9	6.0	6.0
	1 day per week	11	10.9	11.0	17.0
	2 days per week	14	13.9	14.0	31.0
	3 days per week	14	13.9	14.0	45.0
	4 days per week	3	3.0	3.0	48.0
	5 days per week	52	51.5	52.0	100.0
	Total	100	99.0	100.0	
Missing	System Missing	1	1.0		
	Total	1	1.0		
Total		101	100.0		

Question 9:

NAP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	74	73.3	73.3	73.3
	yes	27	26.7	26.7	100.0
	Total	101	100.0	100.0	
Total		101	100.0		

Question 10:

child perception of their exercise compared to others

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	a lot more	18	17.8	18.0	18.0
	a little more	18	17.8	18.0	36.0
	a little less	16	15.8	16.0	52.0
	a lot less	18	17.8	18.0	70.0
	same	30	29.7	30.0	100.0
	Total	100	99.0	100.0	
Missing	System Missing	1	1.0		
	Total	1	1.0		
Total		101	100.0		

Question 11:

FRUIT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	37	36.6	36.6	36.6
	3 or more times	36	35.6	35.6	72.3
	2 times	21	20.8	20.8	93.1
	1 time	7	6.9	6.9	100.0
	Total	101	100.0	100.0	
Total		101	100.0		

Question 12:

VEG

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	27	26.7	26.7	26.7
	3 or more times	46	45.5	45.5	72.3
	2 times	23	22.8	22.8	95.0
	1 time	5	5.0	5.0	100.0
	Total	101	100.0	100.0	
Total		101	100.0		

Question 13:

SODA

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	18	17.8	18.0	18.0
	3 or more times	28	27.7	28.0	46.0
	2 times	31	30.7	31.0	77.0
	1 time	23	22.8	23.0	100.0
	Total	100	99.0	100.0	
Missing	System Missing	1	1.0		
	Total	1	1.0		
Total		101	100.0		

Question 14:

FASTFOOD

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	38	37.6	37.6	37.6
	3 or more times	52	51.5	51.5	89.1
	2 times	10	9.9	9.9	99.0
	1 time	1	1.0	1.0	100.0
	Total	101	100.0	100.0	
Total		101	100.0		

Question 15:

FRIES

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	59	58.4	58.4	58.4
	3 or more times	34	33.7	33.7	92.1
	2 times	7	6.9	6.9	99.0
	1 time	1	1.0	1.0	100.0
	Total	101	100.0	100.0	
Total		101	100.0		

Question 16:

CANDY

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	42	41.6	41.6	41.6
	3 or more times	44	43.6	43.6	85.1
	2 times	10	9.9	9.9	95.0
	1 time	5	5.0	5.0	100.0
	Total	101	100.0	100.0	
Total		101	100.0		

Question 17:

ICECREAM

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 times	3	3.0	3.0	3.0
	1 time	31	30.7	30.7	33.7
	none	67	66.3	66.3	100.0
	Total	101	100.0	100.0	
Total		101	100.0		

Question 18:

dinner

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	high fat	34	33.7	34.7	34.7
	low fat	5	5.0	5.1	39.8
	balanced	59	58.4	60.2	100.0
	Total	98	97.0	100.0	
Missing	System Missing	3	3.0		
	Total	3	3.0		
Total		101	100.0		

APPENDIX F

FREQUENCY SCORES OF PARENT QUESTIONNAIRE ITEMS

Question 1:

parents perception of child's exercise habits

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	a lot more physically active	10	9.9	9.9	9.9
	a little more physically active	20	19.8	19.8	29.7
	a little less physically active	16	15.8	15.8	45.5
	a lot less physically active	19	18.8	18.8	64.4
	average	36	35.6	35.6	100.0
	Total	101	100.0	100.0	
Total		101	100.0		

Question 7:

parent home when child gets home from school

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	12	11.9	11.9	11.9
	yes	89	88.1	88.1	100.0
	Total	101	100.0	100.0	
Total		101	100.0		

Question 8:

safety of playing outdoors in neighborhood

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	70	69.3	69.3	69.3
	yes	31	30.7	30.7	100.0
	Total	101	100.0	100.0	
Total		101	100.0		

Question 10:

number of days dad execises with child

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	67	66.3	67.0	67.0
	1	6	5.9	6.0	73.0
	2	15	14.9	15.0	88.0
	3	8	7.9	8.0	96.0
	4	3	3.0	3.0	99.0
	5	1	1.0	1.0	100.0
	Total	100	99.0	100.0	
Missing	System Missing	1	1.0		
	Total	1	1.0		
Total		101	100.0		

number of hours mom exercises with child

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	62	61.4	61.4	61.4
	1	15	14.9	14.9	76.2
	2	12	11.9	11.9	88.1
	3	11	10.9	10.9	99.0
	5	1	1.0	1.0	100.0
	Total	101	100.0	100.0	
Total		101	100.0		

Question 11:

mobese

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	61	60.4	69.3	69.3
	1	27	26.7	30.7	100.0
	Total	88	87.1	100.0	
Missing	System Missing	13	12.9		
	Total	13	12.9		
Total		101	100.0		

DOBESE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	59	58.4	72.8	72.8
	1	22	21.8	27.2	100.0
	Total	81	80.2	100.0	
Missing	System Missing	20	19.8		
	Total	20	19.8		
Total		101	100.0		

Question 12:

biological parent

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	mom and dad	75	74.3	75.0	75.0
	only mom	19	18.8	19.0	94.0
	only dad	4	4.0	4.0	98.0
	neither	2	2.0	2.0	100.0
	Total	100	99.0	100.0	
Missing	System Missing	1	1.0		
	Total	1	1.0		
Total		101	100.0		

Question 13:

parent's perception of child's weight

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	average wt	54	53.5	54.0	54.0
	too thin	8	7.9	8.0	62.0
	little heavy set	22	21.8	22.0	84.0
	obese	16	15.8	16.0	100.0
	Total	100	99.0	100.0	
Missing	System Missing	1	1.0		
	Total	1	1.0		
Total		101	100.0		

APPENDIX G

PEDIATRIC GROWTH CHARTS FOR BODY MASS INDEX

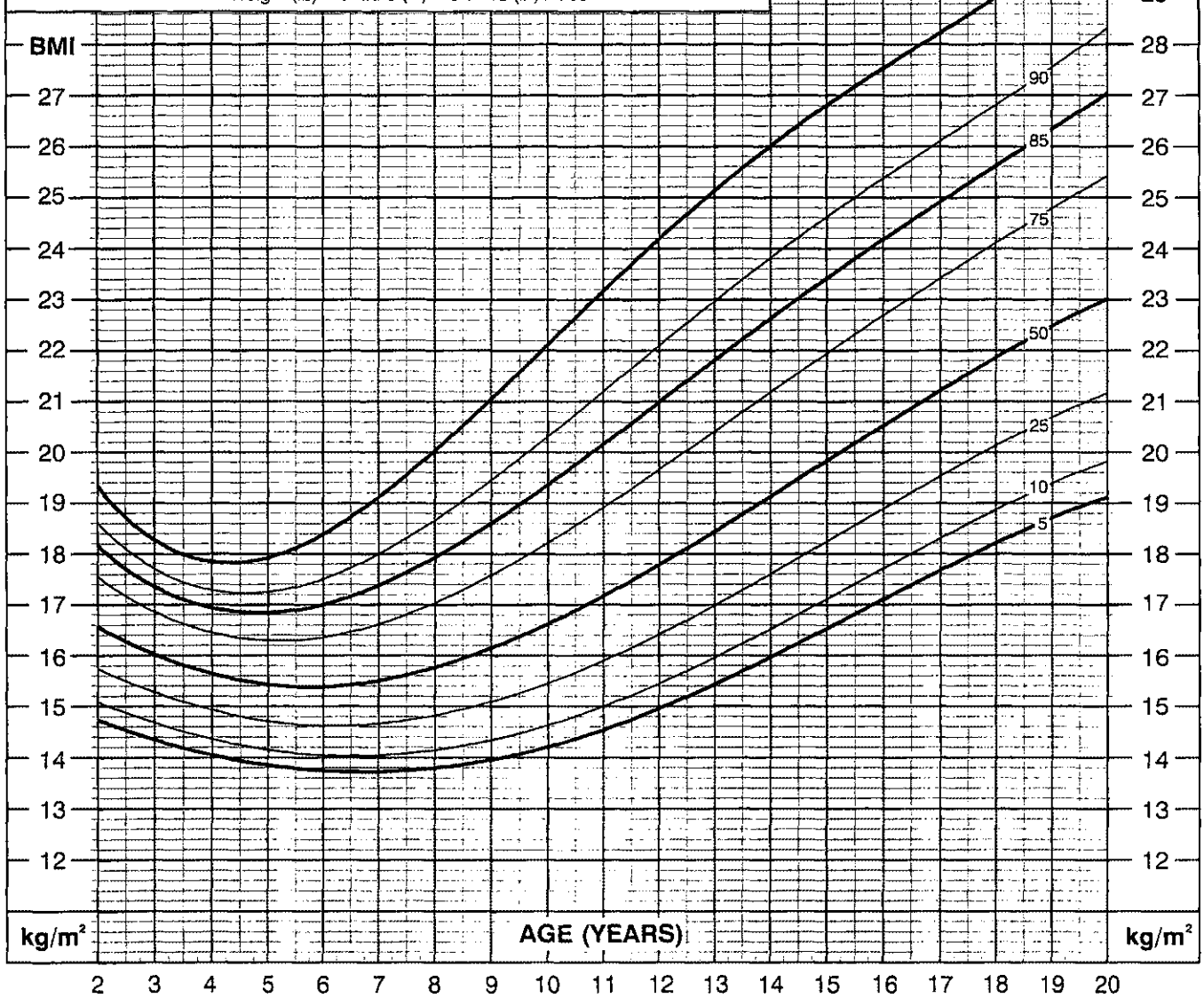
2 to 20 years: Boys
Body mass index-for-age percentiles

NAME _____

RECORD # _____

Date	Age	Weight	Stature	BMI*	Comments

***To Calculate BMI:** Weight (kg) ÷ Stature (cm) ÷ Stature (cm) x 10,000
or Weight (lb) ÷ Stature (in) ÷ Stature (in) x 703



SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

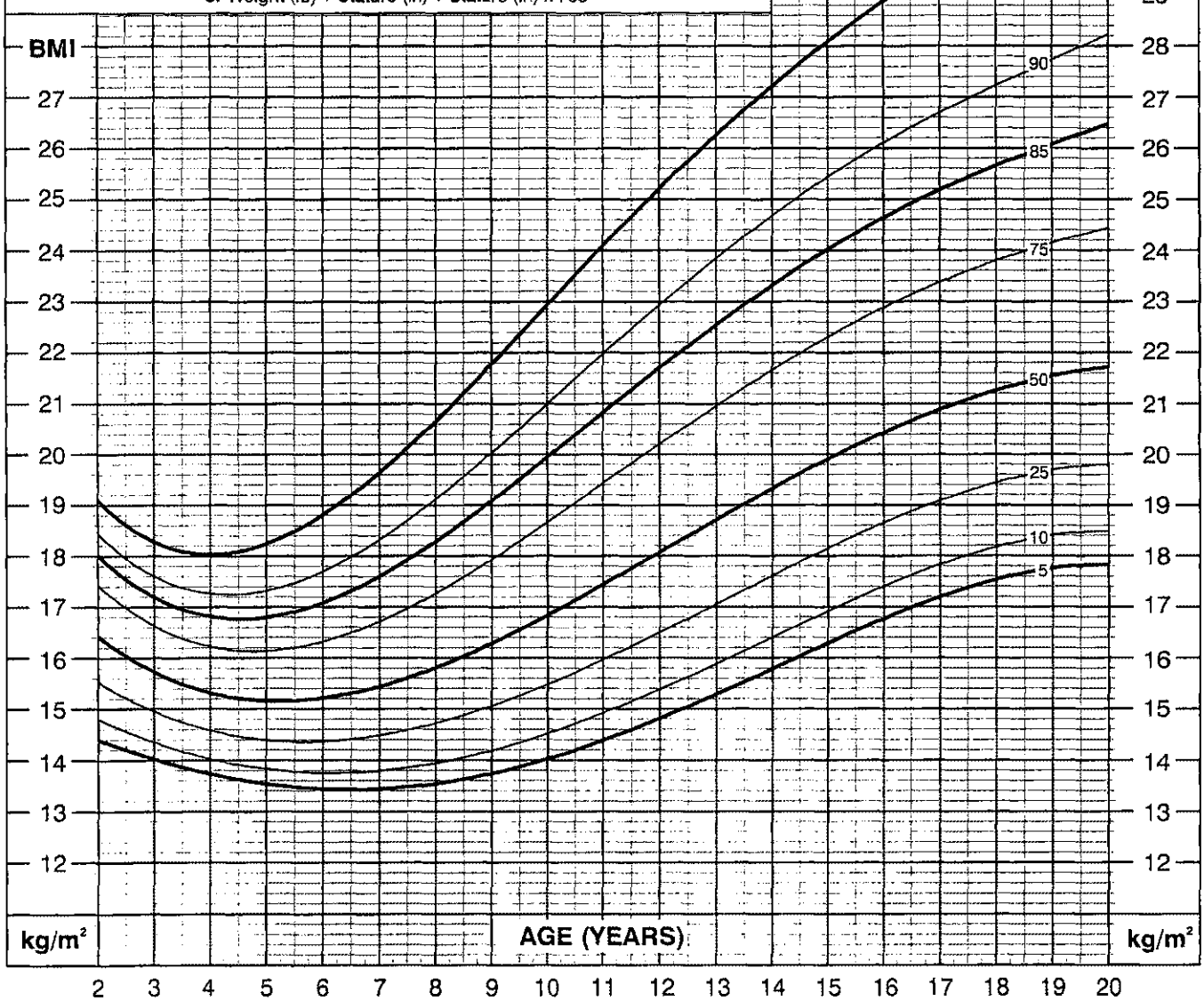
2 to 20 years: Girls
Body mass index-for-age percentiles

NAME _____

RECORD # _____

Date	Age	Weight	Stature	BMI*	Comments

***To Calculate BMI:** Weight (kg) ÷ Stature (cm) ÷ Stature (cm) x 10,000
or Weight (lb) ÷ Stature (in) ÷ Stature (in) x 703



SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

VITA

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EDUCATION

B.S. Cornell University, Ithaca, NY 1994
Hotel and Restaurant Management
Concentration: Food Service Management in the Health Industry
Dietetic Internship Medical College of Virginia Hospital of Virginia Commonwealth University, Richmond, VA 1998
M.S. Old Dominion University, Norfolk, VA
Exercise Physiology, expected degree date 2001

WORK EXPERIENCE

Pediatric Dietitian, Naval Medical Center, Portsmouth
Portsmouth, VA September 1999- present
In-patient pediatric dietitian covering the Neonatal Intensive Care Unit as well as the pediatric floors. Created pediatric nutrition support manual. Working to develop, implement, and teach a pediatric obesity class. Provide continuous lectures and education to house staff.

Relief Dietitian, Sentara Southside Hospitals
Norfolk, VA January 1999- September 1999
Rotate through all floors at Norfolk General, Bayside, and Lee Hospital including ICU's, medicine and surgery floors, rehab, and high-risk nursery. Proficient in nutrition support, diet education, intake analysis, and screenings. Helping to rewrite nutrition support manual and provided pediatric competency to hospital dietitians.

Food Service Director, ARAMARK, James River Corporation and Progressive Insurance
Richmond, VA November 1995-July 1996
Created daily menus, directed all financial aspects, yearly budgeting, increased sales by 133%, sanitation maintenance, all personnel management, initiated ARAMARK's Treat Yourself Right Program, remerchandising of various locations.

PROFESSIONAL ORGANIZATIONS, PRESENTATIONS, PUBLICATIONS, AND AWARDS

American Dietetics Association
American College of Sports Medicine
Pediatric Professional Practice Group
Publication of Pediatric and Neonatal Nutrition Support Manual, NMCP 2001
Case Study publication on Bronchopulmonary Displasia and Nutritional Implications, PPG 2001
Presentation on Infant and Neonatal Nutrition, NMCP physicians and NNP's
Presentation on Childhood Obesity at NMCP 17th Annual Research Competition
Research in Wellness Award, NMCP 2001