THE RELATIONSHIPS BETWEEN CHILDREN'S AND PARENTAL RISK FACTORS, DIETARY PATTERNS AND WEIGHT STATUS IN CHILDREN WITH INTELLECTUAL DISABILITIES IN SOUTH KOREA

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A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the School of Nursing.

Chapel Hill
2010

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ABSTRACT

YEONGMI HA: The Relationships between Children's and Parental Risk Factors, Dietary Patterns and Weight Status in Children with Intellectual Disabilities in South Korea
(Under the direction of Julie Jacobson Vann, PhD, RN)

Increasing trends of overweight have been found in children with intellectual disabilities (ID) as well as in typically developing children worldwide. Most evidence has shown that overweight is more prevalent in children with ID than in typically developing children. Identifying overweight risk factors is critical for understanding the development of overweight during childhood. Therefore, the purpose of this study was to identify relationships between children's and parental risk factors, dietary patterns and weight status in children with ID aged 7 to 11 years driven by the modified Vulnerable Populations Model.

From December 2009 to January 2010, a convenience sample of 88 parents of children with ID aged 7 to 11 years was recruited from four special schools in South Korea. Parents of children were asked to complete a survey and 3-day food records. The collected data were analyzed using SAS (version 9.2). Exploratory factor analysis was used to identify children's dietary patterns. Correlation coefficients were used to examine the relationships between children's and parental risk factors and dietary pattern scores. The relationships between children's and parental risk factors and children's weight status were assessed using Chi-square with Fisher's exact test and ANOVA. To test the hypothesis that multiple risk factors were associated with weight status in children, logistic regression analysis was performed.

Two thirds of children were normal weight and 19% of children were overweight or obese. More than half of the children had moderate intellectual disabilities; and 36% of children had severe intellectual disabilities. This study found that both severity of disability and parental education were significant factors of overweight in children. Mild or moderate ID was associated with being overweight in children. Lower parental education was associated with overweight in the children. Two dietary patterns, Korean dietary pattern and Westernized dietary pattern, were identified: low scores on the Korean dietary pattern were associated with increased risk of overweight in children. Overall, these findings provide a basis for future studies of the risk factors and causes of overweight in children with ID aged 7 to 11 years, as well as for effective overweight prevention programs.

DEDICATION

To my parents, Euung Ha and Muim Kim, whose supports and prayers made this possible

To my younger brothers and sister-in-law, Jin Ha, Byeongjin Ha, and Hyokyeong Kim, who gave endless love

ACKNOWLEDGEMENTS

Writing a dissertation provides a great lesson to me beyond those about how to conduct research. I would like to acknowledge my sincere appreciation to my committee members, colleagues, and friends for their big support throughout the process. I could not have finished this dissertation without these important people: 1) Dr. Julie Jacobson Vann, chair and advisor of my dissertation committee. She is a great mentor and supporter for sharing all of her extensive knowledge and for continuing her encouragement throughout my dissertation. As the first doctoral student to her, her mentorship has positively impacted my personal and professional growth. 2) Dr. Jean Goeppinger, a member of my dissertation committee and my previous mentor before she retired. Dr. Goeppinger always inspired me to continue this study since the first year of doctoral program and kept me going to write this dissertation in the darker moments of the process. 3) Dr. Jennifer Piersma D'Auria, a member of my dissertation committee. She provided clear direction and important discussions, which she made for my dissertation. 4) Dr. Ka He from the school of public health, a member of my dissertation committee and wonderful faculty. I appreciate his interest in my topic and willingness to give critical, helpful advice about how to improve my research, specifically for nutrition areas. 5) Dr. Jamie Crandell from the Research Support Center (RSC), a member of my dissertation committee. She was a great statistical professor and gave her big support for my data analysis and interpretations.

I would like to sincere appreciation to my senior colleagues, Eunsook Choi, who lead this study in Korea as a co-investigator. She provided endless supports with warmth since the beginning of the dissertation and gave big help for the survey of schools to collect data. And, I would like to express my appreciation for my fellow Ph.D. students in the school of nursing and close friends. Thank to Jeongok Logan for her continuous caring like a older sister during the last four years whenever I discouraged. Thanks to Seungjin Lee and Hyunkyung Choi for constant encouragements and their support throughout the PhD program. Thanks to Hutch Allen for her countless hours of editing my paper and for her great encouragement of my progress. Thank to Hyunju Park for her valuable input into my dissertation. And, thanks to Bomin Shim, Jahyun Kang, Jeongok Park, Jinhee Park and Mihyun Park for their warm supports. Finally, I would like to extend my deep appreciation to close friends Hyejin Lee and Bongsoon Lee for their endless supports during many stressful times in my PhD program.

Many parents and teachers in Korean special schools have helped me to arrive at the completion of the dissertation. Special thanks to the four special schools participating in this survey: Bomyung special school, Dukhee special school, Jungae special school, and Sunmyung special school. Without their support I would never have made it. They deserve to have my sincere appreciation.

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ABBREVIATIONS

AAIDD	American Association on Intellectual and Developmental Disabilities
APA	American Psychiatric Association
BMI	Body Mass Index
CDC	Centers for Disease Control and Prevention
CI	Confidence interval
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders IV
FFQ	Food Frequency Questionnaire
ID	Intellectual Disability
IQ	Intelligence Quotient
IRB	Institutional Review Board
IOM	Institute of Medicine
KCDC	Korea Centers for Disease Control and Prevention
KFDA	Korean Food and Drug Administration
NHANES	National Health and Nutritional Examination Survey
OR	Odds Ratio
PSI-SF	Parenting Stress Index-Short Form
PWS	Prader-Willi syndrome
SES	Socioeconomic Status
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

Identification of the Problem

The term “intellectual disability” has changed over time; and various terms are formally used to refer to “intellectual disability” (Harris, 2005, p. 3). The term “intellectual disability” is interchangeably used with current terms such as “mental retardation,” “learning disability,” “developmental disability,” and “cognitive impairment,” which vary according to cultural and political preference (Goodey & Stainton, 2001; Harris, 2005, p. 3; Schalock, 2002). The term “mental retardation” is generally accepted in the United States and other Anglophone countries. However, there is currently debate among professionals regarding the terminology of “mental retardation” because of negative beliefs and attitudes associated with the label of “mentally retarded” (Kanaya, Scullin, & Ceci, 2003; Taylor, 2002). The general consensus among researchers is that a new term is needed. Emerging new terms to replace mental retardation have included “intellectual disability” (Gelb, 2002; Schalock, 2002) and “developmental disability” (Smith, 2002).

The prevalence of childhood overweight and obesity has increased throughout the world since the 1980s (Janssen et al., 2005) and has become a major health problem worldwide (Davison & Birch, 2001a; Lobstein, Baur, & Uauy, 2004). The rates of childhood overweight and obesity have more than doubled for pre-school children and adolescents and more than tripled for children 6 to 11 years of age in the United States (U.S.)

over the past three decades (Institute of Medicine [IOM], 2005). In the U.S., an estimated 62% of children and adolescents, ages 6 through 11 years, were classified as either overweight or obese with a body mass index (BMI) at or above the 85th percentile using 2003 to 2006 data (Ogden, Carroll, & Flegal, 2008). Although the prevalence of overweight and obesity in children in Asian countries is reported to be lower than in the U.S., Asian countries have also experienced dramatic increases in overweight and obesity (Lobstein et al., 2004). In Korean children aged 7 to 12 years, the rates of childhood overweight and obesity have almost doubled from 1997 (12.3%) to 2005 (20.9%) (Oh et al., 2008). During this period, the prevalence of overweight for male children increased from 12.3% to 21.9%, and the prevalence for girls increased from 12.4% to 19.8% (Oh et al., 2008).

Such increasing trends of overweight have been shown in children with disabilities as well as in typically developing children. Many researchers have hypothesized that children with intellectual disabilities (ID) might be at higher risk for overweight compared with typically developing children because children with ID often have additional predisposing factors, such as metabolic complications related to particular genetic syndromes or practical issues related to inappropriate eating and/or physical inactivity (De, Small, & Baur, 2008; Lobstein et al., 2004). Most evidence has shown that overweight in children with ID is more prevalent than in typically developing children (Bandini, Curtin, Hamad, Tybor, & Must, 2005; De et al., 2008; Ells et al., 2008; Lin, Yen, Li, & Wu, 2005; Marshall, McConkey, & Moore, 2003; Stewart et al., 2009; Takeuchi, 1994). Using data from the National Health and Nutrition Examination Survey (NHANES) 1999-2002 it has been estimated that the prevalence of overweight and obesity among American children with learning disabilities was 1.2 times higher than children without learning disabilities; and the

prevalence in children with physical disabilities was 1.7 times higher than children without physical disabilities (Bandini et al., 2005). In one study in Taiwan the average BMI for children and adolescents ages 4 to 18 years with ID was higher than the BMI of typically developing children (Lin et al., 2005). A study of children with ID aged 10 to 19 years in Ireland also confirmed higher levels of overweight and obesity in children with ID (37%) compared with typically developing adolescents (17%) (Marshall et al., 2003). Similar to the higher prevalence of overweight problem in children with ID across other countries, in South Korea 34.1% of children with ID were overweight compared with 18.8% of typically developing children (Ha & Yun, 2005).

For children with ID, the prevalence of overweight is significantly higher than in typically developing children (Bandini et al., 2005; De et al., 2008; Ells et al., 2008; Lin et al., 2005; Marshall et al., 2003; Stewart et al., 2009; Takeuchi, 1994). However, it is unclear why the prevalence of overweight in children with ID is higher and which risk factors, including children's and parental risk factors and children's dietary intakes, are contributing to the higher rate of their overweight problems. Identifying which risk factors are associated with overweight in children with ID is critical to understanding the developmental trajectory of overweight during childhood. Effective overweight prevention and treatment programs can be developed using identified risk factors of childhood overweight.

Risk factors related to childhood overweight are known to be complex. Individual, family, school, social, and cultural factors are all related to dietary intake and physical activity (IOM, 2005). Until recently, the majority of published studies have only focused on the relationships among children's age, sex, and overweight in children with ID (Bandini et al., 2005; De et al., 2008; Ells et al., 2008; Lin et al., 2005; Marshall et al., 2003; Stewart

et al., 2009; Takeuchi, 1994), and have not focused on an interrelationship between multiple risk factors including parental factors and dietary intakes and children's weight status. Without scientific knowledge about the interrelationship between multiple risk factors, including children's and parental risk factors and children's dietary intakes, it is difficult to explain why the rate of overweight in children with ID is much greater than in typically developing children.

Overweight and dietary intake are inextricably linked because overweight is caused by an energy imbalance of more calories consumed than used (IOM, 2005). There is no doubt that weight gain occurs when energy intake exceeds energy expenditure. It is significant that anthropometric studies of traditional hunting populations report no obesity; whereas modernized or Westernized societies report rapid increases in the prevalence of overweight and obesity (Brown, 1991). One primary cause for the link between Westernization and overweight or obesity is changes in diet (Brown & Konner, 1987; Kim, Moon, & Popkin, 2000; Popkin, 2001). Specifically, Westernization of traditional diets generally involves decreased intake of vegetables and increased intake of fats and sugary foods. Therefore, a decrease in traditional healthy dietary patterns and an increase in Westernized dietary patterns may result in childhood overweight and adult obesity.

The Korean nutrition environment is rapidly changing with accelerated economic growth (Kim et al., 2000). Over the past three decades, consumption of cereals and grain products, which were the major contributors to food intake of South Koreans, has significantly decreased (Kim et al., 2000). The intake of all animal food products and fast foods has greatly increased, while vegetable intake has not significantly changed over this time period (Kim et al., 2000; Korean Food and Drug Administration [KFDA], 2003). A

rapid replacement of traditional Korean dietary patterns with Westernized dietary patterns has occurred in Korea as well as other developing countries (Kim et al., 2000; Rivera, Barquera, Campirano, Campos, Safdie, & Tovar, 2002). Such nutritional transition has resulted in increased body mass index, especially among Korean children (Kim et al., 2000). Specifically, Westernized dietary patterns, including increased consumption of meats, potatoes, and sweetened foods in typically developing children, have led to childhood overweight (Kant, 2004; Tseng & De Villis, 2001). These foods tend to be high in fats and processed sugar and low in vegetables and fiber (Kant, 2004).

Dysfunctional eating is a common problem in persons with ID (Gravestock, 2000; Hove, 2004, 2007; O'Brien & Whitehouse, 1990; Schreck, Williams, & Smith, 2004; Thommessen, Heiberg, Kase, Larsen, & Riis, 1991). Dysfunctional eating in persons with ID includes overeating, avoidance of certain foods, collection of food in one's mouth, food selectivity, compulsive eating, and eating too fast (Hove, 2007). More than 60% of persons with ID have several dysfunctional eating problems such as overeating and eating too fast (Hove, 2007; O'Brien & Whitehouse, 1990). There is a need to pay attention to eating problems in persons with ID because problems such as overeating, avoidance of certain foods, and food selectivity can be related to weight gain and nutritional issues (Hove, 2004; Morgan et al., 2002; Schreck et al., 2004). Although most studies that have explored dysfunctional eating problems among persons with ID have focused on adults, it is assumed that dysfunctional eating problems in adults with ID may be developed during childhood. Therefore, the characteristics of dysfunctional eating may offer some explanations for higher prevalence of overweight in children with ID. Finally, assessment of children's specific

dietary patterns that contribute to excess energy intake is critical for understanding the cause of higher rates of overweight in children with ID.

Childhood overweight tends to run in families (IOM, 2005; Davison & Birch, 2001a, 2002, 2005). The role of parents is significant in developing children's health behaviors, including diet and exercise (Binns & Ariza, 2004; Davison & Birch, 2001b, 2002; Golan & Crow, 2004; Welk, 2003). Numerous studies have reported that parents play an important role in developing children's eating patterns and physical activity (Binns & Ariza, 2004; Davison & Birch, 2001b, 2002; Golan & Crow, 2004; Welk, 2003). It is generally accepted that children's eating and exercise behaviors are largely due to the family environment (IOM, 2005) where parents play a significant role in developing children's health behaviors. Parents support the acquisition and maintenance of regular physical activities, and provide the primary social learning environment for children's physical activity behaviors (Lindsay et al., 2006).

The family environment of children with ID may have an even greater influence on dietary patterns and physical activity because of children's low cognitive ability; parents therefore have the potential for more of a direct influence on these children's eating patterns and physical activity (Rimmer, Riley, Wang, Rauworth, & Jurkowski, 2004). As a result, family environments can have lasting effects on children's weight trajectories as children's health habits are highly dependent on parents' actions and attitudes regarding eating and exercise (Davison & Birch, 2001a). To date, most published studies of overweight children with ID focused on only a single risk factor such as child's age, sex, types or severity of disabilities (Bandini et al., 2005; De et al., 2008; Ells et al., 2008; Lin et al., 2005; Marshall

et al., 2003; Stewart et al., 2009; Takeuchi, 1994). Less is known about the interplay of multiple risk factors for overweight in children with ID.

Conceptual Framework to Explain Risk Factors of Overweight in Children with ID

Recent research on childhood overweight has profited from incorporating aspects of social ecology theory and obesity causal web (Kumanyika & Brownson, 2007, p. 97). These frameworks have greatly influenced research related to the development of childhood overweight and adult obesity. The social ecology theory has been applied to obesity problems by Swinburn and colleagues (1999). This framework is appropriate for identifying and prioritizing interventions to understand the obesogenic environment because it emphasizes the importance of the social and environmental contexts in which individuals live and make choices (IOM, 2005). However, the use of the ecological framework can be challenging because this framework is not easy to apply in clinical contexts. It does not give specific guidance on certain variables within each domain (IOM, 2005; Swinburn, Egger, & Raza, 1999).

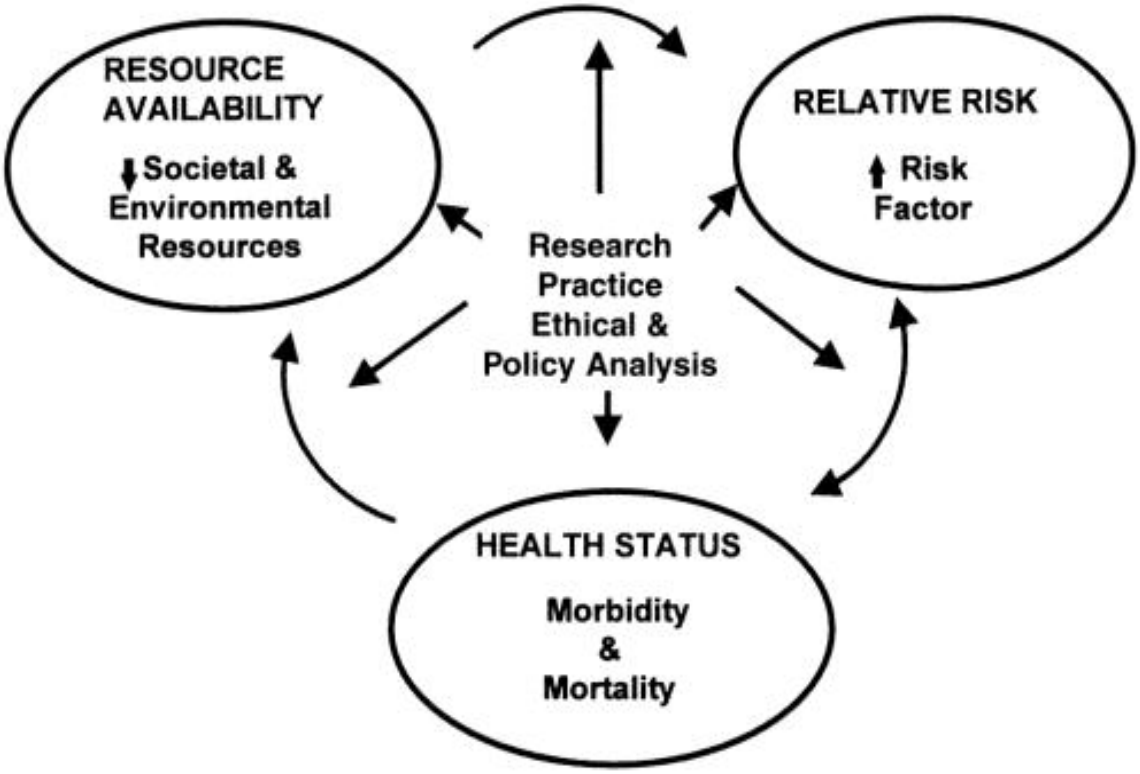
The concept of vulnerability relates to characteristics which increase the probability that the children will suffer negative developmental outcomes (Greenbaum & Auerbach, 1992, p. 11). Such conceptualization of vulnerability seems to be similar to the concept of "risk factors" (Solnit, 1980), which is defined as an increased chance of developing a disease or other outcome (CDC, 2007). Vulnerable populations are defined as social groups who have an increased relative risk or susceptibility to adverse health outcomes (Flaskerud & Winslow, 1998). Usually, vulnerable populations are at risk for poor physical, psychological, or social health due to limitations in physical, environmental, personal and biopsychosocial resources (Aday, 2001, p. 4; Flaskerud & Winslow, 1998). Families of

children with ID are particularly susceptible to physical or environmental risks because they often experience limited access to physical, environmental, personal and biopsychosocial resources (Greenbaum & Auerbach, 1998, p. 590). These multiple cumulative risks can result in adverse health outcomes for children with ID.

Research on vulnerable populations has been enhanced by incorporating aspects of Aday's model (2001) and the Vulnerable Populations Model developed by Flaskerud and Winslow (1998) (Sebastian, 2004, p. 753). Applying the Vulnerable Populations Model to families of children with ID can be helpful in identifying particular risk factors and in obtaining needed resources. This model states that vulnerability results from the combined effects of limited resources, poor health, and high levels of risk factors (Falskerud & Winslow, 1998).

The Vulnerable Populations Model may provide insight into maintaining health status in children with ID (Figure 1.1). The first relationship in the model emphasizes the relationship between resource availability and relative risk of health outcomes. It proposes that a lack of resources increases the relative risk of negative health outcomes. The second relationship in the model specifies that increased exposure to risk factors is likely to lead to increased morbidity and mortality in a population group. The final relationship in the model proposes that morbidity and mortality may feed back into resource availability and further deplete the availability of resources (Flaskerud & Winslow, 1998).

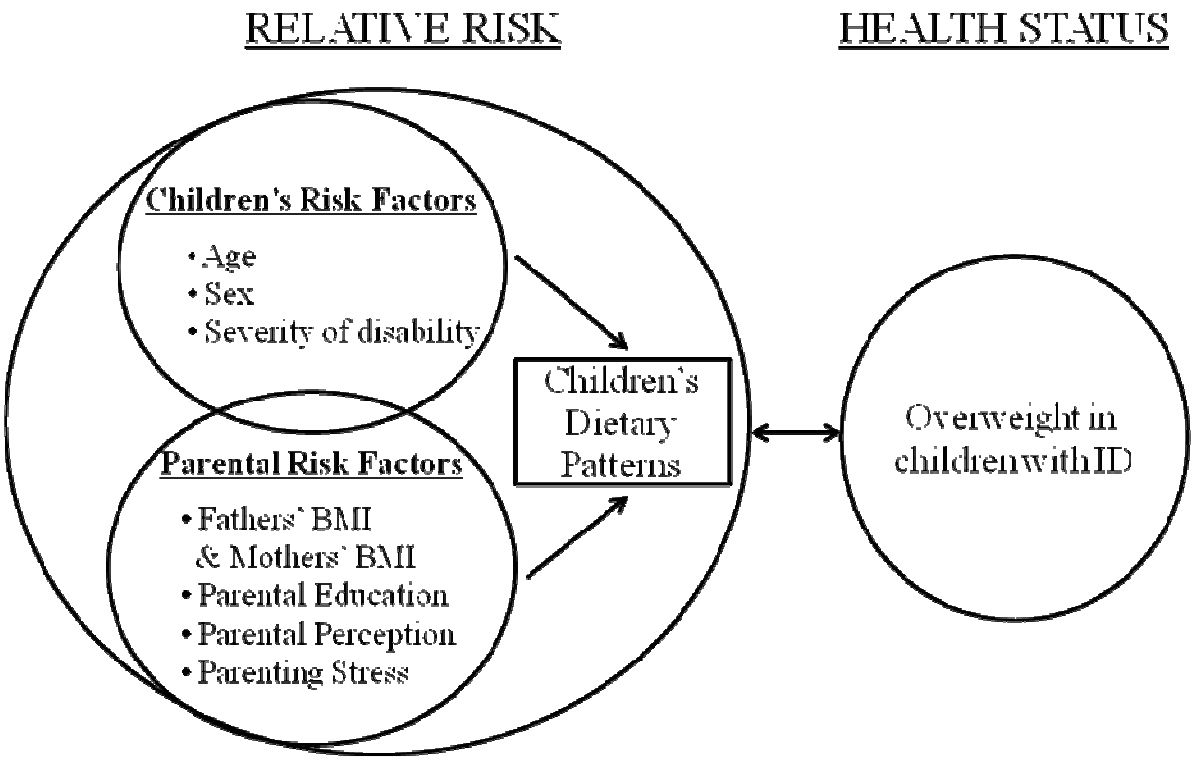
Figure 1.1 Vulnerable Populations Model for Nursing Research and Practice.



The Vulnerable Populations Model (Flaskerud & Winslow, 1998) can help to explain why children with ID are more susceptible to childhood overweight than typically developing children through a cycle of vulnerability. A conceptual model for this study has been derived from the literature, depicting the risk factors of overweight in children with ID (Figure 1.2). The original framework was designed for nursing interventions of vulnerable populations focusing on helping them acquire the resources needed for better health and reduction of health risks (Sebastian, 2004, p. 754). In the revised model for this study, two main concepts are operationalized using the Vulnerable Populations Model. Because this study focuses on identifying risk factors of childhood overweight in children with ID rather than providing overweight management programs, the concept of resource availability may not fit. "Resource availability" includes many things and is not limited to weight management programs.

This revised model focuses on the relationships between multiple risk factors including dietary patterns, both Korean dietary patterns and Westernized dietary patterns, children's and parental risk factors, and weight status in children with ID. First, "health status" is the outcome of vulnerability, which may be negative or positive. The concept of health status is operationalized as overweight status in children with ID.

Figure 1.2 Conceptual Model of This Study Derived from the Vulnerable Populations Model.



Second, "relative risk" estimates the magnitude of an association between exposure and outcome and indicates the likelihood of developing the outcomes in the exposed group relative to those who are not exposed. The exposures may include environmental hazards such as lead-based paint, social hazards such as violence, personal behaviors such as eating habits and physical activity, and biological or genetic makeup such as a genetic syndrome (Sebastian, 2004, p. 758). Vulnerable populations experience multiple risks and are particularly sensitive to the effects of those risks. For this study, relative risk is operationalized as the ratio of the risk of overweight in children with ID who are exposed to multiple risk factors for overweight compared with children with ID who are not exposed to these risk factors. Risk factors of overweight in children with ID can be classified two ways: (1) children's risk factors including children's age, sex, severity of disability, and children's dietary pattern; and (2) parental risk factors including fathers' and mothers' BMI, parental education, parental perception about their children's weight status, and parenting stress. Finally, two concepts of the Vulnerable Populations Model, relative risks and health status as outcomes of vulnerability, create a cycle of vulnerability in which health outcomes reinforce the predisposing factors, which may potentially lead to negative health outcomes.

Gaps and Significance of Study

Many studies have examined the relationship between childhood overweight and dietary intake. In an integrative review of the literature on dietary intakes and obesity, the majority of studies focused on food components such as trans-fatty acids and folate or macronutrients such as fat and carbohydrates, not the overall dietary patterns in children (Ritchie, Ivey, Masch, Woodward-Lopez, Ikeda, & Crawford, 2001). Splitting the food items into food components, such as macronutrients, may ignore the possible chemical

interactions between different compounds within specific food items (Halkjaer, Tjonneland, Overvad, & Sorensen, 2006). Recently, diet and disease literature has found that the study of food groups may account for interactions between different components of a food, and effects of physical characteristics and unknown components (Dam, 2005; Kant, 2004). Several studies have focused on identifying children's dietary patterns related to childhood overweight (Johnson, Mander, Jones, Emmett, & Jebb, 2008; Knol, Haughton, & Fitzhugh, 2005; Li, Paik, & Joung, 2006; Ritchie et al., 2007; Shin et al., 2007; Song, Park, Paik, & Joung, 2009). However, the trends described in published peer-reviewed literature are limited to typically developing children. No peer-reviewed published studies have been identified that scientifically describe the relationship between dietary patterns and overweight in children with ID.

To date, risk factors influencing the weight status of children with ID are limited to children's characteristics such as children's age (Bandini et al., 2005; De et al., 2008; Ells et al., 2008; Lin et al., 2005; Stewart et al., 2009; Takeuchi, 1994), sex (Bandini et al., 2005; De et al., 2008; Ells et al., 2008; Lin et al., 2005; Stewart et al., 2009; Takeuchi, 1994) and types of disability (Bandini et al., 2005) or severity of disability (De et al., 2008; Takeuchi, 1994). In contrast, other risk factors, including parental risk factors and dietary patterns, have not yet been supported by scientific literature. The previous studies of children with ID and risk factors of overweight have generally focused on a single risk factor, even though the overweight phenomenon is not fully explained by one or two single factors (Rimmer, Rowland, & Yamaki, 2007). To better understand the higher rate of overweight among children with ID, it is clear that we need to comprehensively look at children's risk factors, parental risk factors, and eating that may influence the development of overweight among

children because multiple determinants of overweight are closely correlated (IOM, 2005; Kumanyika & Brownson, 2007, p. 105). Without understanding multiple risk factors of overweight in children with ID, overweight prevention or treatment programs for this vulnerable population are not likely to be effective (Rimmer et al., 2007). Identifying risk factors that influence weight status in children with ID is an important first step before designing interventions.

Purpose of the Study

The purpose of this study is to identify the relationships between children's and parental risk factors, dietary patterns and weight status among Korean children with ID aged 7 to 11 years. This is accomplished by examining the relationships between multiple risk factors and weight status in children with ID. The risk factors to be examined are: (1) children's risk factors, including the children's age, sex and severity of disability; (2) parental risk factors, including fathers' and mothers' BMI, parental education, parental perception about their children's weight, and parenting stress; and (3) children's dietary patterns.

Research Questions and Hypotheses

The specific research questions and hypotheses are listed below:

Study Aim 1: The relationships between dietary pattern scores and children's and parental risk factors:

1. What are the relationships between Korean dietary pattern scores or Westernized dietary pattern scores and children's risk factors of age, sex, and severity of disability in children with ID aged 7 to 11 years?

2. What are the relationships between Korean dietary pattern scores or Westernized dietary pattern scores and the following parental risk factors: fathers' and mothers' BMI, parental education, parental perception about their children's weight, and parenting stress in children with ID aged 7 to 11 years?

Null Hypothesis for Study Aim 1:

H1: There are no relationships between Korean dietary pattern scores or Westernized dietary pattern scores and children's risk factors of age, sex, and severity of disability in children with ID aged 7 to 11 years.

H2: There are no relationships between Korean dietary pattern scores or Westernized dietary pattern scores and parental risk factors of fathers' and mothers' BMI, parental education, parental perception about their children's weight, and parenting stress in children with ID aged 7 to 11 years.

Study Aim 2: The relationships between weight status in children with ID and children's and parental risk factors:

3. What are the relationships between children's weight status and risk factors of age, sex, and severity of disability in children with ID aged 7 to 11 years?
4. What are the relationships between children's weight status and parental risk factors of fathers' and mothers' BMI, parental education, parental perception about their children's weight, and parenting stress in children with ID aged 7 to 11 years?

Null Hypothesis for Study Aim 2:

H3: There are no differences between children's weight status and risk factors of age, sex, and severity of disability in children with ID aged 7 to 11 years

H4: There are no differences between children's weight status and parental risk factors of fathers' and mothers' BMI, parental education, parental perception about their children's weight, and parenting stress in children with ID aged 7 to 11 years.

Study Aim 3: The relationships between dietary patterns and weight status in children with ID:

5. What are the relationships between Korean dietary pattern scores and weight status in children with ID aged 7 to 11 years when controlling for children's and parental risk factors?
6. What are the relationships between Westernized dietary pattern scores and weight status in children with ID aged 7 to 11 years when controlling for children's and parental risk factors?

Null Hypothesis for Study Aim 3:

H5: There are no relationships between Korean dietary pattern scores and children's weight status in children with ID aged 7 to 11 years when controlling for children's and parental risk factors.

H6: There are no relationships between Westernized dietary pattern scores and children's weight status in children with ID aged 7 to 11 years when controlling for children's and parental risk factors.

Definition of Key Terms

Intellectual Disability. It is defined as an intelligence quotient less than 70 with onset before 18 years of age and additional support needs in at least two domains, which include communication, self-care, home living, social/ interpersonal skills, use of community resources, self-direction, functional academic skills, work, leisure, health and safety

(American Psychiatric Association, 2000; Korea Ministry of Health, Welfare and Family Affairs, 2009).

Typically Developing Children. It is defined as children who do not have any disability and whose development is following a normal trajectory (Lewis, 2005, p. 4). Sometimes, children without any disability are referred to as normal children. However, use of the term normal implies that children with disabilities are not normal; when, in reality, many aspects of their development may be very similar to children without a disability (Lewis, 2005, p. 4).

Risk Factor. It is defined as any variable that is associated with an increased chance of developing a disease or an infection (CDC, 2007).

Severity of Disabilities. It is defined as a classification of intellectual disability. In Korea, psychiatric doctors' diagnoses of disability status and levels were used to establish the presence of a disability and severity of disability. It is classified into three categories based on intelligence Quotient (IQ) scores in South Korea: (1) mild intellectual disability refers to an IQ of 50 to approximately 70; (2) moderate intellectual disability refers to an IQ ranging from 35 to 49; and (3) severe intellectual disability refers to an IQ at or below 34 (Korea Ministry of Health, Welfare and Family Affairs, 2009).

Body Mass Index (BMI). It is defined as weight in kilograms divided by height in meters squared (weight/height^2; kg/m^2). It is the preferred measure for evaluating overweight and obesity among children aged 2 to 19 years and adults due to its convenience and inexpensiveness (CDC, 2009a; Krebs, Himes, Jacobson, Nicklas, Guilday, & Styne, 2007; World Health Organization [WHO], 2000). For children, the BMI for each child is calculated using Korean age- and sex-specific percentiles for BMI by Korea Centers for

Disease Control and Prevention (KCDC, 2007) because the BMI percentile values vary by age and sex (CDC, 2009a).

Overweight or Obesity. It is defined as abnormal or excessive fat accumulation that may impair health (WHO, 2006). For children, there are four weight status groups: *obese* was defined as at or greater than the 95th percentile (≥95th percentile); *overweight* was defined as at or greater than the 85th percentile but less than the 95th percentile (85th ≤ BMI < 95th percentile); *normal weight* was defined as at or greater than the 5th percentile but less than the 85th percentile (5th ≤ BMI < 85th percentile); *underweight* was defined as less than 5th percentile (< 5th percentile) of the BMI for age- and sex- growth chart for Korean children ages 2 to 18 years. For adults, weight status can be classified into four groups according to the KCDC (2007) categories as: *obesity* (BMI ≥25), *overweight* (23 ≤ BMI < 25), *normal weight* (18.5 ≤ BMI < 23), and *underweight* (BMI < 18.5).

Weight Perception. It is defined as the recognition of acquiring and interpreting the heaviness of weight status (U. S. National Library of Medicine, 2010).

Parenting Stress. It is defined as an adverse psychological reaction to the demands of being a parent (Deater-Deckard, 1998).

Socioeconomic status (SES). It is defined as a total measure of an individual's or family's economic and social position relative to others (National Center for Educational Statistics, 2008). It includes education level, occupational class, family income, composite SES, and neighborhood SES (Shrewsbury & Wardle, 2008). In the U.K., SES is traditionally measured by occupation, while education and income are widely used in the U.S. and Europe (Graham, 2005). A systematic review of studies from 1990-2005, identifying the relationships between SES and childhood overweight, found that parental education level

is the most reliable measure used to represent SES to date (Shrewsbury & Wardle, 2008). However, the concept of SES and its relationship with health is complex and extends beyond the scope of this study. Parental education is used as an indicator of SES in this study.

Dietary Pattern. It is defined, in this study, as interactions and synergistic effects of combined foods or food groups on health rather than discrete foods or ingredients using either a factor analysis or cluster analysis (Dam, 2005; Newby & Tucker, 2004). Specifically, Western dietary pattern is characterized as increased consumption of meats, eggs, potatoes, refined grains, and sweetened foods which may be associated with the risk of obesity or chronic heart disease (Kant, 2004; Tseng & De Villis, 2001). Korean dietary pattern is characterized by increased consumption of vegetables and fruits, kimchi (Korean traditional spicy raw vegetables), seaweeds, and fishes (Shin et al., 2007; Song et al., 2009).

CHAPTER 2

REVIEW OF LITERATURE

Korean Children with ID and Their Families

Definition of Intellectual Disability

Definitions of intellectual disabilities have varied widely by the source of the definition, such as the Diagnostic and Statistical Manual of Mental Disorders IV TR (DSM-IV TR) published by the American Psychiatric Association (APA) (2000) and the American Association on Intellectual and Developmental Disabilities (AAIDD) (2009). The DSM-IV defines ID as an intelligence quotient less than 70 with onset before 18 years of age and additional support needs in at least two domains, which include communication, self-care, home living, social/ interpersonal skills, use of community resources, self-direction, functional academic skills, work, leisure, health and safety (APA, 2000). The AAIDD's (2009) recommended definition of "intellectual disability" is one type of "developmental disability" which affects the way individuals who have it adapt to and cope with various environments (Beirne-Smith, Patton, & Kim, 2006, p. 40). It is characterized by significant limitations both in intellectual functioning and adaptive behaviors as expressed by conceptual, social, and practical skills (AAIDD, 2009; Luckasson et al., 2002).

Classification of Intellectual Disability

Four systems of classification of intellectual disability are used (Harris, 2005, p. 46): (1) the International Classification of Diseases-10 (WHO, 1992); (2) the DSM-IV TR (APA,

2000); (3) the AAIDD Definition, Classification, and Systems of Supports (Luckasson et al., 2002); and (4) the International Classification of Functioning, Disability, and Health (WHO, 2001). A traditional method of classification places people into four levels based on their Intelligence Quotient (IQ) scores and the DSM-IV TR Diagnostic criteria system of intellectual disability (APA, 2000). The severity of disability is classified as follows: (1) mild intellectual disability, an IQ score ranging from 50-55 to approximately 70; (2) moderate intellectual disability, an IQ score ranging from 35-40 to 50-55; (3) severe intellectual disability, an IQ score ranging from 20-25 to 35-40; and (4) profound intellectual disability an IQ score below 20 or 25. In Korea, a similar classification system of intellectual disability based on IQ scores is used, but it is classified into three categories: (1) mild intellectual disability, an IQ score ranging from 50 to approximately 70; (2) moderate intellectual disability, an IQ score ranging from 35 to 49; and (3) severe intellectual disability, an IQ score below 34 (Korea Ministry of Health, Welfare and Family Affairs, 2009). Recently, the AAIDD suggested that the ID classification methods be based on the levels of needed support across adaptive areas rather than on IQ scores (AAIDD, 2009). This classification system consists of four intensity levels of needed support: (1) intermittent ("as-needed basis"); (2) limited (consistent over time, time-limited); (3) extensive (regular involvement); and (4) pervasive (constant, high intensity, provision across settings) (Beirne-Smith et al., 2006, p. 69). Even though this new classification system shows promise as a potentially better method for categorizing disabilities, the traditional classification systems based on IQ scores are still widely used.

The incidence of intellectual disabilities is highest between the ages of 5 to 18 years, with much lower frequencies at preschool levels (Drew & Hardman, 2007, p. 25). Children

at the preschool level are less likely to be identified as having an intellectual disability because they possess social skills similar to typically developing children. However, once children enter the formal school environment, they encounter an emphasis on the acquisition of academic skills and thus their limitations become more visible (Drew & Hardman, 2007, p. 25). Children with ID can therefore be more easily identified in formal school environments.

Causes of Intellectual Disability

In children with ID, boys with intellectual disabilities are more prevalent than girls (Larson, Lakin, Anderson, Kwak, Lee, & Anderson, 2000; Murphy, Boyle, Schendel, Decoufle, & Yeargin-Allsopp, 1998). The reasons for this phenomenon include greater role expectations placed on males in some cultures; aggressive behaviors more often exhibited by males, potentially leading to referral and subsequent labeling; a higher probability of gender-linked biological factors in male children; and gender bias in the diagnostic process. These factors may disproportionately affect the number of males categorized with an intellectual disability (Beirne-Smith et al., 2006, p. 262).

Efforts to identify the causes of ID in children are important because they may help to improve the recognition of associated health issues (Beirne-Smith et al., 2006, p. 182). Identified causes of intellectual disabilities are divided into biological causes from prenatal-genetic disorders, postnatal causes, and environmental causes (Beirne-Smith et al., 2006, p. 182; Harris, 2005, p. 109). Biological causes of intellectual disability include chromosomal disorders such as Prader-Will syndrome and Angelman's syndrome, phenylketonuria, and developmental disorders of brain formation such as hydrocephalus (Harris, 2005, p. 105). While many prenatal-genetic disorders may not be preventable, identifying environmental

causes of intellectual disability may offer an opportunity for preventive interventions. Environmental causes include intra-uterine malnutrition, toxic exposures such as gestational substance abuse, prenatal maternal diseases such as HIV infection, problems of delivery, irradiation during pregnancy, and poverty (Harris, 2005, p. 116). The causes of severe to profound ID have been identified in approximately 70-80% of children, whereas the causes of mild ID are generally unknown (Beirne-Smith et al., 2006, p. 182; Harris, 2005, p. 102; McLaren & Bryson, 1987). It has long been assumed that mild ID is the result of a complex interaction involving genetic predisposition, developmental vulnerability, and multiple environmental events such as sociocultural factors including poverty and chronic social deprivation (Moser, 2000; Harris, 2005, p. 100).

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In the Korean culture, people often believe that disability can be caused by supernatural agents, such as punishment from God or the curse of the devil for their sins, even though Korean people recognize actual causes of their children's disability as genetic defects or diseases (Kim-Rupnow, 2005, p. 119). When their children are diagnosed with disabilities, Korean mothers tend to experience self-blame and depression because they believe that prenatal practices and attitudes influence the health and intelligence of their babies (Kim-Rupnow, 2005, p. 119). Generally, Korean parents attribute the causes of their child's disability to their own misbehaviors, such as poor prenatal practices, mistakes in early parenting, and failure to follow prescribed dietary and nutritional practices (Cho, Singer, & Brenner, 2000).

In Korea, dependency of young children, old grandparents, and sick family members is accepted because interdependence among family members is expected (Kim-Rupnow,

2005, p. 123). Many Korean parents devote most of their time to child care. The degree of parenting and devotion to their children with disabilities is considerable. Due to feelings of guilt about their children's disability, they are likely to sacrifice their entire life to parenting their children with disabilities (Cho et al., 2000).

Korean families who have children with ID are often socially isolated because of the characteristics of their children, and may feel stigmatized by society (Kim-Rupnow, 2005). The concept of stigma is related to the devaluing characteristic which is so powerful and overshadows other traits in many chronic diseases and disabilities (Goffman, 1963, p. 3). A study examining the stigmatizing effects of the use of the label of intellectual disability has shown the label of disability produces a negative response from society, and excludes people with disabilities from social interaction (Dudley, 1983). The stigma related to ID profoundly impacts the families of children with disabilities (Goffman, 1963, p. 3). Korean families of children with ID tend to isolate themselves from fear of public reaction and often limit their activities to their home environment.

Definition of Childhood Overweight

According to the World Health Organization (WHO, 2006), overweight or obesity is defined as abnormal or excessive fat accumulation that may impair health. Researchers have identified several methods for assessing body composition and fat accumulation to determine childhood overweight. Anthropometric measurements are used as indicators of adiposity for practical reasons of cost, simplicity, and safety (Lobstein et al., 2004). The body mass index (BMI: weight/height^2; kg/m^2) is the preferred measure for evaluating overweight and obesity among children and adolescents 2 to 19 years due to its convenience and inexpensiveness (CDC, 2009a; Krebs et al., 2007; WHO, 2000). It has long been

recognized that BMI can be used as a reliable indicator of body fat with a moderate to high correlation between obesity and percent of body fat (Barlow et al., 2007; Krebs et al., 2007; Kumanyika & Brownson, 2007, p. 27).

Childhood overweight has been more difficult to define operationally when compared with adults (Lobstein et al., 2004). Overweight and obesity in adults are defined operationally as fixed BMI values regardless of age and sex; but age- and sex- specific BMI percentiles are used to identify possible weight problems for children (CDC, 2009a). After the BMI is calculated for children, the value is plotted on the BMI-for-age growth charts to obtain a percentile ranking. BMI percentiles are the most common values used to classify children as overweight; the BMI percentile compares children's weights and heights to appropriate reference populations and indicates the relative position of a child's BMI among children of the same sex and age (CDC, 2009a; Kumanyika & Brownson, 2007, p. 35).

For children, BMI percentile values vary by age and sex because the amount of body fat differs between girls and boys and also varies with age (CDC, 2009a). Percentiles rank the position of an individual by indicating what percent of the reference population the individual would equal or exceed. Each country has developed its own age- and sex-specific BMI-for-age growth charts for ages 2 to 20 years to assess childhood overweight. In the U.S., growth charts are age and sex specific, and include nine major percentile curves ranging from the 5^{th} to 95^{th} or the 3^{rd} to 97^{th} percentiles (CDC, 2009a). In Korea, the sex- and age-specific growth curves were developed by the Korean Centers for Disease Control and Prevention (KCDC, 2007) based on large national surveys of Korean children measured for height and weight (Appendix A).

The labels for childhood overweight and obesity have changed over time and may vary in use. Some researchers define overweight as BMI ranging from the 85th percentile to less than the 95th percentile and obese as the 95th percentile or greater (Ells et al., 2008; Oh et al., 2008; Stewart et al., 2009). Others classify the 85th percentile to less than the 95th percentile as at-risk-for overweight and overweight as a BMI of at least the 95th percentile (Bandini et al., 2005; Ogden, Carroll, Curtin, McDowell, Tabak, & Flegal, 2006). Prior to 2005, an expert committee on childhood overweight deliberately avoided the term obese in its guidelines because of the inference of adiposity and body composition in the term "obese", as well as the inability of height and weight data and BMI to measure total body fat specifically (Krebs, Himes, Jacobson, Nicklas, Guilday, & Styne, 2007). The CDC has historically recommended use of the term overweight rather than obese for children. It was believed that children who appear to be overweight at one point in time may subsequently achieve a body weight that is appropriate for height with a BMI in the normal range.

The terminology used to classify childhood overweight has changed since the Institute of Medicine (2005) defined children with a BMI of $\geq$ 95th percentile as "obese" rather than "overweight" due to concerns about negative health outcomes of childhood obesity. An expert committee on childhood overweight endorsed the position of the Institute of Medicine (IOM) report. The IOM committee recommended use of the terms "overweight (85th $\leq$ BMI < 95th percentile)" and "obese (BMI of $\geq$ 95th percentile)" for children (Krebs et al., 2007). Until recently, however, overweight has often been used interchangeably with obesity, a term which has been defined as excess adipose tissue or excess body fat beyond a threshold for what is considered a norm or a reference value (Kumanyika & Brownson, 2007, p. 25). In Korea, both the terms overweight and obesity

are used interchangeably among researchers, even though the Korean Centers for Disease Control and Prevention (KCDC, 2007) has terminology similar to the U.S. and other western countries as overweight ($85^{th} \leq$ BMI $< 95^{th}$ percentile) and obese or obesity (BMI $\geq 95^{th}$ percentile).

Development of Childhood Overweight

The concept of energy balance is important for understanding the development of the childhood overweight and obesity phenomenon (Kumanyika & Brownson, 2007, p. 6). Energy not needed for metabolism, digestion of foods, and physical activity is deposited as fat (WHO, 2000). Overweight and obesity develop as a consequence of deposition of excess calories, and it is called "positive energy balance" (Kumanyika & Brownson, 2007, p. 6). For example, children are likely to become overweight when food and beverage consumption have increased and physical activity has decreased. In an ecological model for explaining the trajectory of childhood overweight and obesity, energy balance is mediated by energy intake, and energy expenditure is moderated by physiological adjustments such as metabolism (Swinburn, Egger, & Raza, 1999). In this model, energy intake and expenditure are the result of individual behaviors, which are influenced by personal characteristics, including age, sex and environmental characteristics. Prevention of childhood overweight and obesity is needed to acquire energy balance; and treatment of obesity is required to have negative energy balance by decreasing dietary intakes and increasing physical activity levels. Therefore, assessment of children's specific dietary intake and energy expenditure patterns, and identification of factors that contribute to excess caloric intake or insufficient energy intake, is a necessary first step for understanding the developmental trajectory of obesity during childhood.

Childhood overweight results from an interaction between genetic and environmental factors, and from a chronic energy imbalance with energy intake exceeding expenditure (Marti, Martinez-Gonzalez, & Martinez, 2008). Genetic factors may contribute to childhood overweight; however, the relative influence of genetic factors on the dramatically increasing rates of childhood overweight, across countries and over decades, in typically developing children is unclear (IOM, 2005; Marti et al., 2008). Evidence suggests that environmental factors, such as overeating and physical inactivity, may explain the increasing trends of childhood overweight by interacting with genetic susceptibility (Davison, Francis, & Birch, 2005; Ritchie, Welk, Styne, Gerstein, & Crawford, 2005). Parental eating habits and family diet patterns play an important role in the development of a child's food preferences , which may in turn affect their body weight (Birch & Fisher, 2000; Fisher, Mitchell, Smiciklas-Wright, & Birch, 2002; Maffeis, 2000). Finally, the concepts of gene-environment interaction may be critical to the synergistic relationship between gene and environment (Agurs-Collins & Bouchard, 2008).

Dramatically increasing trends of childhood overweight can be explained within an obesogenic environment (Davison et al., 2005; Davison & Birch, 2002). This relationship was examined in a longitudinal study of girls and their parents to determine whether distinct obesogenic and non-obesogenic family clusters could predict changes in their daughters' BMI based on family dietary patterns. For obesogenic families, mothers and fathers who have poor dietary patterns and obesity history have shown significantly higher levels of total energy and dietary fat intake (Davison & Birch, 2002; Davison et al., 2005). These results indicate that parents are very influential in the creation of an obesogenic environment, and can accelerate weight gain for themselves as well as their children. This is naturally

explained by the fact that family members show similarities in behavioral risk factors associated with overweight including diet patterns and physical activity level (Burke, Beilin, & Dunbar, 2001; Davison & Birch, 2002; Davison et al., 2005). Additionally, parents serve as role models for children's eating habits (Kosti et al., 2008; Davison et al., 2005). Finally, an obesogenic environment of overeating and physical inactivity is the major factor in the obesity epidemic (Davison & Birch, 2002; Davison et al., 2005; Dietz & Gortmaker, 2001; Hill, Wyatt, Reed, & Peters, 2003).

Consequences of Childhood Overweight

Physical & Psychological Health Outcomes

Trends in childhood overweight are of concern due to the negative health outcomes both during and beyond childhood. Although obesity-related diseases occur in adulthood and childhood, negative health outcomes and diseases associated with overweight occur in childhood and adolescence (Dietz, 1998). The physical health outcomes of childhood overweight include chronic illnesses such as hypertension, type 2 diabetes, orthopedic disorders, cardiovascular disease, and premature death (IOM, 2005; Kumanyika & Brownson, 2007, p. 5). Childhood overweight is also a powerful risk factor for adult obesity (Parsons, Powers, Logan, & Summerbell, 1999; Whitaker, Wright, Pepe, Seidel, & Dietz, 1997). Poor psychological health and social stigma can be associated with childhood overweight due to rejection by their peers and teachers who may stereotype them as lazy (Chen & Brown, 2005; Davison & Birch, 2001a).

Adult obesity has been associated with many types of chronic diseases such as type 2 diabetes, hypertension, coronary heart disease, sleep apnea, and depression (Davison & Birch, 2001a). For adults with ID, obesity also makes a significant contribution to the morbidity

or mortality of chronic diseases (Janicki et al., 2002). For example, mortality among adults with ID is approximately three times higher than that of adults without disabilities (Patja et al., 2000; Tyrer, Smith, & McGrother, 2007). High mortality rates and shortened life expectancies of persons with ID can be explained by genetic problems, life style related health risk factors, and barriers to accessing health care services (Emerson & Hatton, 2007; Robertson, Emerson, Gregory, Hatton, Turner, Kessissoglou et al., 2000; Stanish et al., 2006). Of the lifestyle related health risk factors, adults with ID generally have significantly low levels of physical activity and poor diet, especially women (Robertson et al., 2000). Rates of cardiovascular disease and cardiovascular disease-related deaths are disproportionately high among adults with ID (Draheim, 2006).

Overweight children with ID are more likely to become obese adults (Parsons et al., 1999; Whitaker et al., 1997). There is the added risk of developing various obesity-related secondary conditions such as fatigue, pain, social isolation, difficulty performing activities of daily living, and significant personal and economic hardship on the children and family (Rimmer et al., 2007). Life threatening obesity levels in adults with ID are a strong indicator of the importance of studying overweight in children with ID. However, the relationships between childhood overweight and morbidity and mortality in children with ID have not been fully explained (Janicki et al., 2002).

Economic Burden of Childhood Overweight

Physical and psychological health outcomes of overweight are associated with economic burden affecting individuals, their families and society (Field et al., 2001; IOM, 2005; Wang & Dietz, 2002). The cost of obesity-related health problems in children and adolescents has dramatically increased during the past decades (Wang & Dietz, 2002). The

cost of obesity-related hospitalizations has more than tripled in children age 6 to 17 years during 1979-1999, and obesity-associated annual costs increased more than threefold from $35 million during 1979-1981 to $127 million during 1997-1999 (Wang & Dietz, 2002).

The public health impact of obesity is increasing in Korea as the prevalence of overweight and obesity in Korean children and adults is increasing (Baek et al., 2002; Park et al., 2006). Obesity-related medical expenses accounted for 0.91-1.88% of total national health expenditures in 1998 (Baek et al., 2002); whereas medical expenses accounted for 9.1 percent of total U.S. medical expenditures in 1998 (CDC, 2009b; Finkelstein, Fiebelkorn, & Wang, 2003). The socioeconomic burden associated with overweight and obesity is higher in Western countries, accounting for 2-9% of total national health expenditures (WHO, 1997). Although medical expenses in Korea are lower than those in Western countries, obesity-related medical expenses should not be ignored considering the increasing trend of overweight and obesity in Korea.

Children's Risk Factors Influencing Overweight in Children with ID

There are several risk factors influencing overweight in children with ID. Risk factors for overweight and obesity in children with ID include age (De et al., 2008; Ells et al., 2008; Fox, Hartney, Rotatori, & Kurpiers, 1985; Lin et al., 2005; Marshall et al., 2003; Stewart et al., 2009; Takeuchi, 1994), sex (De et al., 2008; Fox et al., 1985; Ha et al., 2005; Lin et al., 2005; Stewart et al., 2009; Takeuchi, 1994), type of disability (Bandini et al., 2005; Ells et al., 2008; Takeuchi, 1994), severity of disability (De et al., 2008; Lin et al., 2005), and medication induced obesity such as anti-epileptics or anti-psychotics (Ells et al., 2008; Lin et al., 2003; Lobstein et al., 2004).

Age & Childhood Overweight

Studies focusing on the relationship between age and overweight in children with ID have reported conflicting results (De et al., 2008; Ells et al., 2008; Fox et al., 1985; Lin et al., 2005; Marshall et al., 2003; Stewart et al., 2009; Takeuchi, 1994). The trend of increasing BMI levels in children with ID aged 4 to 18 years is supported by several studies (Fox et al., 1985; Lin et al., 2005; Takeuchi, 1994). The prevalence of overweight in children with ID has been observed to increase with age in previous studies (Fox et al., 1985; Lin et al., 2005; Takeuchi, 1994). Overweight was observed more in older girls than younger girls in one study (Fox et al., 1985). Girls with ID in junior high school were approximately 1.5 times more likely to be overweight than girls with ID in elementary school (Takeuchi, 1994). In addition, the prevalence of overweight in boys with ID was 12% in children aged 4 to 6 years and 25% in children aged 7 to 12 years (Lin et al., 2005). However, other studies have not supported a relationship between increasing age and overweight children with ID (De et al., 2008; Ells et al., 2008; Marshall et al., 2003; Stewart et al., 20009).

Sex & Childhood Overweight

Men and women differ in the patterns of fat deposition and fat utilization in metabolism, and these sex differences may be reflected in body fat (Power & Schulkin, 2008). The relationship between sex and body fat composition in adults is distinct in that women tend to be more obese than men due to women's evolutionary characteristics to store excess fat for reproduction and lactation (Lovejoy, Sainsbury, and the Stock Conference 2008 working group, 2009). Consequently, women with ID are at greater risk of overweight and obesity compared with men with ID (Hove, 2004; Melville, Hamilton, Hankey, Miller, & Boyle, 2007; Robertson et al., 2000; Yamaki, 2005). However, less is understood about

sex-specific body fat composition during the childhood period ranging from ages 2 through 19 years (Bogin, 1999).

Generally, sex differences in the proportion of body fat begin early in life, but are further strengthened during puberty (Power & Schulkin, 2008). Pubertal maturation is known to impact obesity development (Jasik & Lustig, 2008; Kimm, Barton, Obarzanek, McMahon, Kronsberg, Waclawiw, et al., 2002). When female adolescents enter puberty earlier than male adolescents during pubertal maturation, sex differences become greater as body fat composition is generally higher in female adolescents than in male adolescents (Wells, 2006). Female children and adolescents aged 8 to 18 years tend to increase their fat mass continually; whereas male children tend to maintain similar body fat composition throughout childhood (Bogin, 1999, p. 34). During the childhood period of 2 to 10 years of age, the reported differences in stature and body fat composition between the sexes, however, have generally been smalll (Bogin, 1999; Wells, 2006).

Several studies have explored the relationship between sex and overweight in children with ID (De et al., 2008; Fox et al., 1985; Ha et al., 2005; Lin et al., 2005; Stewart et al., 2009; Takeuchi, 1994). Although the prevalence of overweight has increased in both boys and girls over time, there are mixed findings about the relationship between sex and overweight in children with ID. Most studies have found that there is no significant difference between sex and overweight in children with ID aged 7 to 12 years, although female children with ID have a tendency to be slightly more overweight when compared to male children (De et al., 2008; Ha et al., 2005; Lin et al., 2005; Stewart et al., 2009; Takeuchi, 1994). In one study that examined the relationship between overweight and sex in children with ID aged 5 to 10 years, the prevalence of overweight in girls was significantly higher

than in boys (Fox et al., 1985). These conflicting results may be explained by sex-specific body fat composition during the middle childhood period, similar to what has been described for typically developing children.

There are generally sex differences in food consumption. Male adults are less likely to consume vegetables and fruits (Forshee & Storey, 2006; Wardle, Haase, Steptoe, Nillapun, Jonwutiwes, & Bellisle, 2004), whereas female adults tend to be more concerned about their weight, and thus frequently select vegetables or fruits to control their weight (Reba-Harrelson, Von Holle, Hamer, Swann, Reyes, & Bulik, 2009). As a result, these differences of attitudes might explain sex differences in food choices. While there have been no published, peer-reviewed studies examining the relationships between sex and food choices to identify dietary patterns, previous studies on sex differences in food choices of adults and adolescents could be applied to the case of children with ID.

Severity of Disability & Childhood Overweight

For adults with ID, a relationship between overweight and severity of intellectual disability has been consistently reported. Studies suggest that the prevalence of obesity is higher in adults with mild to moderate intellectual disabilities than in adults with severe intellectual disabilities in U.S. (Fox & Rotatori, 1982; Kelly, Rimmer, & Ness, 1986; Moran, Drane, McDermott, Dasari, Scurry, & Platt, 2005; Robertson et al., 2000) and Norway (Hove, 2004). However, in three previous studies of children with ID, no significant relationship was found between the severity of disabilities and overweight (De et al., 2008; Fox et al., 1985; Lin et al., 2005). Using data from 98 Australian children with ID and developmental delay aged 2 to 18 years, severity of disability was classified into three levels; mild, moderate and severe or profound. There was no difference in the prevalence of overweight in

children with ID and severity of disability (De et al., 2008). In a Taiwanese study using a representative sample of 279 children with ID aged 4 to 18 years, four levels of disability were used, and no significant relationship was found between obesity and severity of disability (Lin et al., 2005). There was little information about diagnosing and classifying the severity of disability for children with ID in the two studies (Fox et al., 1985).

The severity of disability may influence children's dietary intake through dysfunctional eating behaviors such as overeating and food selection (Hove, 2004, 2007; Morgan et al., 2002). Parents of children with disabilities may frequently give foods to their children, which may be triggered by feelings of guilt related to the disability of their children or a fear of being perceived as uncaring (Leibold, 1994). In addition, food may be given to children with ID to pacify their emotions (Leibold, 1994). Therefore, the severity of intellectual disability in children is expected to increase the risk of childhood overweight by dysfunctional eating problems (Rimmer et al., 2007).

Parental Risk Factors Influencing Overweight in Children with ID

Childhood overweight tends to run in families because of shared genes and shared environments (IOM, 2005). It is generally accepted that children's eating and exercise behaviors are largely influenced by their family environment (IOM, 2005). Parents play a significant role in developing children's health behaviors concerning eating and physical activities (Binns & Ariza, 2004; Davison & Birch, 2001b; Davison & Birch, 2002; Golan & Crow, 2004; Welk, 2003). Parents support the acquisition of eating habits, and provide the primary social learning environment for children (Lindsay et al., 2006). Because children's health habits are highly dependent on parents' actions and attitudes toward eating and

exercise, the home environment can have a lasting effect on children's weight trajectories (Davison & Birch, 2001a).

Parents of children with disabilities can strongly influence their children's eating and activities through modeling, food preferences, and perceptions about food and child's weight, because children with ID spend most of their time at home and are dependent upon family members for care (Rimmer et al., 2007). Therefore, having a better understanding of parental beliefs and attitudes, including parental perceptions about their child's weight, parenting of their child with ID, and parental BMI can guide the process for answering questions regarding the high overweight rate among children with ID.

Parental BMI & Childhood Overweight

A number of studies have found that parental BMI was significantly correlated to their children's BMI (Burke et al., 2001; Danielzik, Langnase, Czerwinski-Mast, Spethmann, & Muller, 2002; Davison & Birch, 2002, 2005; Fiore, Travis, Whalen, Auinger, & Ryan, 2006; Kosti et al., 2008). Parental obesity has been identified as one of the most potent risk factors of childhood overweight; and the most powerful identified risk factor for becoming obese is having obese parents (Agras, Hammer, McNicholas, & Kraemer, 2004; Agras & Mascola, 2005; Blair et al., 2007; Burke et al., 2001; Danielzik et al., 2002; Davison & Birch, 2002, 2005; Fiore et al., 2006; Kosti et al., 2008; Whitaker et al., 1997; Wu & Suzuki, 2006). One early study of the relationship between parental obesity and childhood overweight (Whitaker et al., 1997) reported that overweight and non-overweight children younger than 10 years of age are more than twice as likely to be overweight or obese in adulthood if their parents are obese. In one 10-year longitudinal study seeking to identify risk factors for

overweight children, five independent risk factors for childhood overweight were identified; the strongest direct factor was parental overweight (Agras et al., 2004).

Most studies suggest that there is a positive relationship between children's BMI and both fathers' and mothers' BMI (Burke et al., 2001; Fiore et al., 2006; Reilly et al., 2005), although some have reported that children's BMI is more closely associated with maternal BMI than with paternal BMI (Danielzik et al., 2002). In a study of identifying risk factors of overweight in children of either obese families or non-obese families, using the third National Health and Nutrition Examination Survey (NHANES III), the strongest risk factor was the obesity history of fathers and mothers (Fiore et al., 2006).

Poverty, Parental Education and Relationships to ID

Poverty is strongly associated with various disabilities (Fujiura & Yamaki, 2000). The prevalence of disability in children and adults is higher in persons with lower incomes (Emerson & Hatton, 2007a; Fujiura & Yamaki, 2000; Leonard & Wen, 2002). In Western Australia, 10% of the most socioeconomically disadvantaged families had more than five times the risk of having children with mild to moderate ID, compared with 10% of those in the least disadvantaged (Leonard & Wen, 2002). The association between poverty and intellectual disability is also evident in the U.S. (Emerson & Hatton, 2007b; Fujiura & Yamaki, 2000). Approximately 30% of U.S. children with disabilities are reported to live below the federal poverty level, compared with 16% of typically developing children (Fujiura & Yamaki, 2000). In the U.K., 39% of disabled children were reported to live below the official poverty level, compared with 32% of nondisabled children (Emerson & Hatton, 2007b). Poverty and the circumstances associated with poverty such as poor nutrition, poor housing conditions, and limited access to appropriate health care services may

be significant factors contributing to both poor health outcomes and disability.

Pathways between poverty and families of children with disabilities are well supported. First, families of children with disabilities are often faced with high health care costs and labor intensive daily care routines (Dobson, Middleton, & Beardsworth, 2001; Emerson, 2007; Lukemeyer, Meyers, & Smeeding, 2000). Direct costs of supporting children with ID include specific transportation, special equipment, and child care arrangements. These costs may have an impact on family poverty level. Second, poverty is frequently associated with increased exposure to socio-environmental risk factors associated with poverty, environmental toxins, accidents, infections, less than optimal parenting, poor schooling, and a range of adverse life events (Bradshaw, 2001; Leonard & Wen, 2002). For example, poverty is a risk factor for preterm delivery and low birth weight, both of which are significant risk factors for intellectual disability (Leonard & Wen, 2002). Third, based on data related to children with special health care needs enrolled in the State Children's Health Insurance Program (SCHIP), nearly 50% of children with special health care needs are from single-parent households compared with 17% of typically developing children (U.S. Census Bureau, 2003). Single parent families are more likely to live in poverty than two-parent families (Lutenbacher, 2002).

Adverse health outcomes have been shown to be associated with poverty (Adler, Boyce, Chesney, Folkman, & Syme, 1993), especially among children with ID (Emerson, 2007; Emerson & Hatton, 2007a, 2007b; Fujiura & Yamaki, 2000; Graham, 2005; Leonard & Wen, 2002). Poverty in children with ID has been associated with increased risk of exposure to physical and psychosocial hazards, such as poor nutrition and housing, environmental toxins, and a range of adverse life events (Emerson, 2007). The accumulated

exposure to such risks over a lifetime is likely to represent a significant threat to future health and well-being (Graham, 2005).

The relationship between SES and overweight in children with ID is not well identified, although the importance of the pathways of SES and poor health outcomes has been well documented (Emerson, 2007; Emerson & Hatton, 2007a, 2007b; Graham, 2005). Low SES has been shown to be associated with increased risk of overweight in typically developing children (Cooke, Wardle, Gibson, Sapochnik, Sheiham, & Lawson, 2004; Johnson et al., 2008; North & the Avon Longitudinal Study of Pregnancy and Childhood Study Team, 2000; van der Horst et al., 2007). The strength of the relationship between SES and overweight in typically developing children is expected to be stronger in children with ID (Emerson, Hatton, Llewellyn, Blacker, & Graham, 2006). In the first attempt to examine the association between SES and overweight in Korean children with ID, however, there was no observed significant relationship using two measures of SES indicators, mothers' education levels and family income levels (Ha et al., 2010). Using data from 206 mothers of Korean children with ID aged 8-19 years in six special schools, lower SES measured by family income level, did not significantly predict the development of overweight in children with ID.

Several scientists have hypothesized that low SES may be related to diet quality; palatable and energy dense foods, such as fats and sugars, are inexpensive compared with healthier foods such as fruits and vegetables (Drewnowski & Specter, 2004; Forshee & Storey, 2006). In addition, children in families with low SES may have limited access to activity programs and facilities that may promote better health outcomes (Obrusnikova, Valkova, & Block, 2003). Using data from the Continuing Survey of Food Intake by

Individuals 1994-1998, family income has independent positive associations with healthy dietary patterns high in fruits and vegetables (Forshee & Storey, 2006).

Parental Perception about Children's Weight Status & Childhood Overweight

The attitude that fatness is desirable and a sign of health may stem from the long-held belief that a degree of fatness helps to increase one's survival rate through greater resistance to disease (Parizkova & Hills, 2005). In this situation, parents often believe that their overweight children will naturally grow up being healthy children, and as a result, they frequently fail to perceive their obese children as overweight during early childhood (Jain, Sherman, Chamberlin, Carter, Powers, & Whitaker, 2001). Some mothers also misclassify their children as being of a normal weight out of a reluctance to admit that their children have weight problems (Maynard, Galuska, Blanck, & Serdula, 2003). Parents' accurate perception of overweight children is important because obese children are more likely to become obese adolescents and adults (Baughcum, Chamberlin, Deeks, Powers, & Whitaker, 2000), and an inaccurate parental perception of children's weight status can lead to an ineffective overweight prevention and management program (Baughcum et al., 2000).

Accurate parental perceptions of children's weight status are associated with parental readiness to help children modify diet and physical activity behaviors (Rhee, DeLago, Arscott-Mills, Mehta, & Davis, 2005). Accurate parental perceptions of weight can also be a key factor in solving the problem of significantly increased rates of childhood overweight. If parents fail to accurately perceive their children as overweight, they may not seek out or accept counseling on nutrition and physical activity behavior changes to assist children with weight reduction measures (Doolen, Alpert, & Miller, 2009; Eckstein et al., 2006). To achieve active parental engagement in overweight prevention programs for children, parents

should have an accurate perception of their children's body weight and be aware of poor health outcomes attributable to being overweight.

In previous studies of typically developing children, the accuracy of parental perceptions about children's weight status has been inconsistent (Adams, Quinn, & Price, 2005; Baughcum et al., 2000; Genovesi et al., 2005; Hirschler, Gonzalez, Talgham, & Jadzinsky, 2006; Jain et al., 2001; Jeffery, Voss, Metcalf, Alba, & Wilkin, 2005; Mamun, McDermott, O'Callaghan, Najman, & Williams, 2008; Maynard et al., 2003). In a systematic review of the accuracy of parental perception of weight status of their typically developing children, a large variability in the accuracy of perceptions was reported, ranging from 6.2% to 73% (Parry, Netuveli, & Saxena, 2008). In 19 of 23 studies reviewed, less than 50% of parents correctly identified their children as overweight (Parry et al., 2008). In a nationally representative sample of 5,500 children in the U.S. aged 2 to 11 years, approximately 42% of mothers accurately classified their overweight children as being overweight, and 58% of mothers misclassified their overweight children as being normal weight or underweight (Maynard et al., 2003).

The accuracy of parental perceptions of children's weight status often varies by the sex of the children. Several published scientific studies confirmed that parents, particularly mothers, were more likely to underestimate the weight of male children while overestimating the weight of female children among typically developing children (Mamun et al., 2008; Maynard et al., 2003; Manios, Kondaki, Kourlaba, Vasilopoulou, & Grammatikaki, 2009). The tendency towards underestimation of weight status for boys and overestimation for girls seems to reflect social norms in that the preference to be either thin or overweight, and the definition of ideal body weight is determined by cultural standards (Chang & Christakis,

2003; Wright & Whitehead, 1987). Sociocultural norms of thinness may pressure certain population subgroups, such as younger women, to be thinner (Crawford & Campbell, 1999). For girls, overweight may be viewed by some as symbolic of an individual's moral failing in self control; while for boys' muscular body types may be preferable and considered healthier (Ritenbaush, 1991). As a result, mothers are likely to perceive their overweight male children as being normal weight, and such perceptions may be related to an underestimation of boy's weight status. In contrast, mothers may be more critical of weight and body image issues for girls; and they may be more likely to overestimate their female children's body weight (Mamun et al., 2008; Maynard et al., 2003; Manios et al., 2009).

For children with ID, it is important to understand the parental perceptions of their children's weight status as one step in preventing overweight problems (Ha, Jacobson Vann, & Choi, 2010). Children with ID are often highly dependent on their parents due to their lower cognitive abilities, which can profoundly affect their functioning and adaptation to everyday life (Harris, 2005, p. 99). For children with ID, however, little is known about the relationship between parental perception about their children's weight status and children's actual BMI, even though existing evidence suggests that parental perceptions of their children's weight status play a pivotal role in providing healthy foods and vigorous activity (Ha et al., 2010). In one study regarding the accuracy of mothers' perceptions of their child's weight status, 87% of mothers of overweight children correctly classified their children as overweight (Ha et al., 2010). However, it is unclear why mothers of children with ID were more likely to classify their children's weight status accurately than those in many studies of children of typically developing children (Ha et al., 2010).

Parental perceptions about children's weight status are likely to influence the weight of children by mediating the children's eating and physical activity (Hill et al., 2003). During childhood, family environment is the key context for the development of food preferences, dietary intake patterns, and eating behaviors that shape children's body weight (Stang, Rehorst, & Golicic, 2004). Parents' control of access to food may foster certain preferences for high-fat and energy dense foods, and limit acceptance of a variety of foods (Davison & Birch, 2001b). In particular, children with ID are most likely to be affected by parental feeding habits due to the greater dependence (Rimmer et al., 2007).

Parenting Stress & Childhood Overweight

"Parenting" may be defined as purposive activities aimed at ensuring the survival and development of children (Hoghughi, 2004, p. 5). Parenting is viewed as dynamic, and involves a series of actions and interactions on the part of parents that include emotions, cognitions, and behaviors to foster children's growth and development (Belsky, 1984). Parenting stress is experienced by all parents and is a normal phenomenon. Some degree of parenting stress is normal and expected (Crnic & Low, 2002, p. 250). However, a high level of parenting stress can be harmful to a child's well-being (Mulsow, Caldera, Pursley, Reifman, & Huston, 2002). A high level of parenting stress is likely to be associated with less secure parent-children attachment relationships and poorer health outcomes for children (Hadadian & Merbler, 1996).

The construct of parenting stress has been defined in numerous ways with related different meanings. Parenting stress can be defined as the mismatch between perceived resources and the actual demands of the parenting role (Morgan, Robinson, & Aldridge, 2002). Parenting stress has also been defined as the aversive psychological reaction to the

demands of being a parent (Deater-Deckard, 1998). There are four models that may be used to explain parenting stress: the multifactorial model proposed by Mash and Johnston (1990); the parenting stress model which is the basis of the Parenting Stress Index (Abidin, 1995); the parent-child relationship theory of parenting stress (Deater-Deckard, 2004); and the daily hassles model of parenting stress (Crnic & Greenberg, 1990). Of these theories, the parenting stress model developed by Abidin (1995) is widely used to measure parenting stress. In Abidin's parenting stress model, the total stress experienced by parents in their parenting role is thought to be a function of both parent and children characteristics (Abidin, 1995). Under an adverse situation, such as life stress, parenting stress may be increased and the risk of dysfunctional parenting is likely to be elevated (Abidin, 1995). Parenting stress can influence children's development, and at the same time, children can also influence levels of parenting stress by their demands (Deater-Deckard, 2004).

Parenting stress is one of the most commonly measured concepts in the literature on children with disabilities (Deater-Deckard, 2004). Parents who have children with disabilities experience a variety of psychological stresses related to the children's disability. Parenting children with disabilities is stressful because special family adaptation is often needed for those families (Shapiro, Blacher, & Lopez, 1998). Parents are faced with additional parenting burdens, such as educational efforts to understand the children's behaviors, long-term care for children's medical problems, and certain developmental goals for walking and self-care that normally occur without much parent effort (Shapiro et al., 1998, p. 611). Parenting children with disabilities is likely to be a lifetime burden experienced by parents and siblings. The family must undergo a variety of profound changes to adapt to the presence of children with disabilities.

Most published studies have consistently reported that mothers of children with disabilities perceived higher levels of parenting stress than mothers of typically developing children (Beckman, 1991; Hadadian & Merbler, 1996; Margalit, Raviv & Ankonia, 1992; Solis & Abidin, 1991). In addition, parenting children with ID may negatively affect the well-being of other family members. Mothers of children with ID are often at risk for mental health problems, especially depression (Beckman, 1991). Mothers of children with developmental disabilities are at greater risk of depression as compared to mothers of typically developing children (Singer, 2006). Maternal depression is one of the most widely studied influences on parenting (Cicchetti, Rogosch, & Toth, 1998; Goodman & Gotlib, 1999; Radke-Yarrow, 1998). Depression is associated with problematic parenting behavior and maladaptive parent-child interactions (Conley, Caldwell, Flynn, Dupre, & Rudolph, 2004). Feelings of sadness and hopelessness may lead to parenting incompetence and ineffective parent-child interactions. A mother's depression may also result in negative effects, such as insensitivity, irritability, and being critical (Conley et al., 2004).

All parents of children with disabilities do not necessarily have problems with maladaptive emotions and negative parenting stress (Cho et al., 2000). Parents of children with disabilities tend to view the event differently; some parents may find beneficial meaning for having children with disabilities, for example, as God's plan, whereas others may appraise the experience negatively (Cho et al., 2000). In one study, parents of children with ID were more likely to pay attention to their children's health behaviors when they perceived the challenges presented by their children's disabilities in a positive manner (Black & Lobo, 2008).

Effective parenting can reduce the risk of childhood overweight by choosing healthy dietary patterns and physical activities (Ventura & Birch, 2008). A growing body of scientific literature has examined the association between parenting and health outcomes of children (Aran, Shalev, Biran, & Gross-Tsur, 2007; Regber, Berg-Kelly, & Marild, 2007). The incidence of overweight in children with ID may be reduced by effective parenting, although there have not been published peer-reviewed studies identifying the relationship between parenting and overweight in children with disabilities. Parenting was seen to significantly influence health in children with cerebral palsy after controlling for the severity of disability and children's age (Aran et al., 2007). Understanding parenting stress in families of children with ID is crucial to identifying predictors of overweight.

Dietary Patterns in Children with ID

Dietary Patterns

The single nutrient approach to identifying a relationship between diet and health outcomes has been widely used in nutritional research (Kant, 2004; Newby & Tucker, 2004; Ritchie et al., 2001). However, this method is limited by its ability to explain the relationships between dietary intakes and various kinds of diseases; people eat meals and snacks consisting of a variety of foods, rather than isolated nutrients (Hu, Rimm, Stampfer, Ascherio, Spiegelman, & Willett, 2000). For this reason, analyzing the effect of single nutrients alone ignores the inherent complexity of diet and does not identify the interplay of all individual foods that describe a complete food pattern (Kant, 2004). For example, when diets high in fiber tend to be high in vitamin C, folate, and potassium, we cannot be certain that the relationships between fiber and overweight are a consequence of Vitamin C or folate intake alone.

The use of food or food groups might help to capture the relationships between diet and health outcomes. Due to limitations in the single nutrient approach, studies of diet patterns have explored the relationship between diet and health outcomes because this approach can take into account the complex interaction between numerous components within the diet (Dam, 2005; Jacques & Tucker, 2001; Kant, 2004; Newby & Tucker, 2004; Ritchie et al., 2001). The dietary pattern approach is a statistical method, based on factor analysis, in which foods are placed into distinct non-overlapping food groups (Kant, 2004). This data reduction method identifies several independent factors in a correlation matrix and provides factor scores that allow individuals to be ranked in terms of how closely they conform to the total pattern (Jacques & Tucker, 2001). The dietary pattern approach has several advantages: (1) the dietary pattern approach can take into account the complex interaction between numerous components within the diet; (2) small cumulative effects of single nutrients and foods on health outcomes can be taken into account; and (3) research findings based on the dietary pattern approach are more comprehensive and informative (Hu, 2002; Kant, 2004; Newby & Tucker, 2004).

Dietary pattern analysis has been validated as an approach for exploring the relationship between dietary intakes and disease (Hu et al., 1999; Millen, Quatromoni, Copenhafer, Demissie, O'Horo, D'Agostino, 2001). Several studies have found the relationship between overall dietary patterns and chronic diseases such as cardiovascular disease (Hu et al., 2000), cancer (Chen et al., 2002) and overweight or obesity (Maskarinec et al., 2000; Ritchie et al., 2007; Shin et al., 2007) using the dietary pattern analysis. Dietary pattern analysis provides a complete assessment of the combinations of foods consumed and may be useful in identifying emerging dietary patterns in a certain population (Millen et al.,

2001). This analysis may be more informative for describing the nutritional etiology of childhood overweight because it does not look at each nutritional factor in isolation since the nutritional etiology of overweight is complex and still controversial (Johnson et al., 2008).

There are several distinct dietary patterns which are associated with diet-related diseases (Kant, 2004; Ritchie et al., 2001). Dietary patterns related to chronic diseases ranges from healthy, Mediterranean, traditional, prudent to Western dietary patterns. The Mediterranean diet has advantages due to its potential to prevent cardiovascular disease (Martinez-Gonzalez, Bes-Rastrollo, Serra-Majem, Lairon, Estruch, & Trichopoulou, 2009). The Mediterranean dietary pattern is defined as the dietary pattern found in the olive-growing areas of the Mediterranean region and is characterized by the following: high consumption of unrefined cereals, fruits, and vegetables; moderate-to-high consumption of fish; and low consumption of meat and meat products (Martinez-Gonzalez et al., 2009). In a study of dietary patterns in U.S. adults, two dietary patterns were identified using factor analysis: Western dietary pattern characterized by processed and red meats, eggs, potatoes, and refined grains; and prudent dietary pattern characterized by cruciferous vegetables, greens, carrots, salads, and fresh fruits (Fung, Schulze, Manson, Willett, & Hu, 2004; Heidemann, Schulze, Franco, van Dam, Mantzoros, & Hu, 2008; Osler et al., 2002; Schulze, Fung, Manson, Willett, & Hu, 2006; Qi, Cornelis, Zhang, van Dam, & Hu, 2009; Tseng & De Villis, 2001). Some traditional dietary patterns for a specific ethnic population have been reported, such as Korean dietary pattern (Shin et al., 2007; Song et al., 2009). Until recently, most published studies of dietary patterns have focused on adults and typically developing children, but little has been identified in the published, peer-reviewed scientific literature regarding dietary patterns of children with ID.

Three published studies were identified that examine the relationship between dietary patterns and overweight in Korean children (Li et al., 2006; Shin et al., 2007; Song et al., 2009). One study identified three major dietary patterns (Shin et al., 2007). The "Korean dietary pattern" was identified by higher intakes of vegetables, kimchi (Korean traditional spicy raw vegetables), seaweeds, beans, fruits, milk and dairy products. The "animal foods pattern" was characterized by high intake of animal foods such as beef, pork, poultry and fish as well as fast food including hamburgers and pizza. The "sweets pattern" showed high intake of ice cream, sweet drinks, chocolate, sweet baked goods and sugary foods (Shin et al., 2007). In other studies examining the association between dietary patterns, sexual maturation, and overweight in Korean children, four dietary patterns were identified (Li et al., 2006). The first dietary pattern, named "rice and kimchi" was characterized by green and yellow vegetables, garlic, white rice, meats, beans, bean products and vegetables (Li et al., 2006). The second dietary pattern was named "shellfish and processed meat." The third dietary pattern was named "pizza and drinks" identified by intake of soft drinks, pizza and hamburgers, juice, cookies and cakes. The fourth dietary pattern was named "milk and cereal," consisting of milk and yogurt, cereal, and other grains (Li et al., 2006). In an analysis of three consecutive studies of the Korean Nutrition Health and Nutrition Examination Survey (KNHANES), three dietary patterns were related to overweight in Korean children (Song et al., 2009). The "Korean traditional diet pattern" is characterized by higher consumptions of white rice, kimchi, vegetables, and fish, typical components of a traditional Korean diet. The "Modified dietary pattern" is a combination of "Korean traditional pattern" and "Western dietary pattern." The "Western dietary pattern" had a higher consumption of flour and bread, pizza and hamburgers, meat and meat

products, dairy products, and soft drinks (Song et al., 2009). Three studies indicated that animal food patterns, Western patterns, and sweets patterns increase the risk of overweight, while Korean dietary patterns or Korean traditional patterns were associated with positive health outcomes in Korean typically developing children (Li et al., 2006; Shin et al., 2007; Song et al., 2009).

Dietary Patterns & Overweight

Generally, healthy dietary patterns high in whole grains, fruit, and vegetables are expected to be associated with maintaining weight status or losing weight; whereas Westernized dietary patterns characterized by high-fat products, refined grains and sweets are more likely to be associated with weight gain (Johnson et al., 2008; Newby & Tucker, 2004; Ritchie et al., 2007; Quatromoni, Copenhafer, D'Agostino, & Millen, 2002). A healthy diet, high in vegetables and fruits, is expected to help people lose weight by enhancing satiety and reducing energy intake (Rolls, Ello-Martin, & Tohill, 2004). Vegetables and fruits help a person feel full or satiated because these foods tend to be high in fiber and water content which may be the best predictors of satiety (Rolls, Roe, & Meengs, 2004). These characteristics reduce energy density which is important for weight management (Rolls et al., 2004). Dietary patterns characterized as low in vegetables and fruits are associated with greater odds of excess adiposity in childhood (Johnson et al., 2008; Quatromoni et al., 2002).

Several studies have demonstrated that Western dietary patterns are likely to be associated with an increased risk of childhood overweight (Johnson et al., 2008; Li et al., 2006; Ritchie et al., 2007; Shin et al., 2007; Song et al., 2009; Woodward-Lopez, Ritchie, Crawford, & Gerstein, 2006). Using data from 1,203 children aged 5 to 9 years, dietary

patterns characterized as high in sweets and meats were associated with greater odds of having excess adiposity in childhood in United Kingdom (Johnson et al., 2008).

The consumption of sweetened beverages, including soft drinks, has been steadily increasing among children; and sweetened beverage consumption has been shown to dramatically increase as children grow older (French, Lin, & Guthrie, 2003). Researchers have long assumed that a high intake of sweetened beverages is associated with the increasing prevalence of overweight in children (Ariza, Chen, Binns, & Christoffel, 2004; Berkey, Rockett, Field, Gillman, & Colditz, 2004; Nicklas, Yang, Baranowski, Zakeri, & Berenson, 2003; Welsh, Cogswell, Rogers, Rockett, Mei, & Grummer-Strawn, 2005). However, the results of studies on the relationships between sweetened beverages and overweight among children and adolescents are mixed and inconclusive. Children's sweetened beverage consumption has been shown to be positively associated with their daily energy intake and overweight (Ariza et al., 2004; Berkey et al., 2004; Nicklas et al., 2003; Welsh et al., 2005). During a three year follow-up study of 16,771 children from 50 states, there were significant linear relationships between being overweight and consumption of sugar added beverages in both male and female children aged 9 to 14 years (Berkey et al., 2004). However, other studies have reported that consumption of sweetened beverage and soft drinks are not significantly correlated with increasing BMI among children, even though the quantities of fruit drinks, milk, regular and soft drinks are associated with total energy intake (Forshee & Storey, 2003; O'Connor, Yang, & Nicklas, 2006).

Summary

In general, the prevalence of overweight in children with ID is significantly higher than in typically developing children. Although many studies have examined the

associations between childhood overweight and multiple risk factors in typically developing children, little is known about the relationships between childhood overweight and multiple risk factors in children with ID.

To decrease the higher rate of overweight in children with ID, there is a need to identify the interrelationships between weight status in children and multiple risk factors, such as children's and parental risk factors and dietary patterns. Several risk factors are expected to influence overweight in children with ID, including: age, sex, severity of disability, dietary pattern; parental risk factors including parental BMI, parental perception about their children's weight status, parental education, and parenting stress. To date, risk factors influencing the weight status of children with ID are limited to children's characteristics such as children's age, sex and types of disability or severity of disability.

Other risk factors, including parental risk factors and dietary patterns, have not yet been supported by scientific literature. Generally, childhood overweight tends to run in families because of shared genes and shared environments, and children's eating and exercise behaviors are largely influenced by their family environment (IOM, 2005). Parents play a significant role in developing children's health behaviors and support the acquisition of eating habits, and provide the primary social learning environment for children (Lindsay et al., 2006). To better understand the higher rate of overweight among children with ID, it is clear that identifying risk factors that influence weight status in children with ID is an important first step. Therefore, these potential risk factors are the focus of the current study.

CHAPTER 3

METHODS

Research Design

A cross sectional study was performed to identify the relationships between children's and parental factors, dietary patterns, and weight status in children with intellectual disabilities aged 7 to 11 years. The selection of a research design depends on the research questions of interest. In this study, the research questions involve associations between child's weight status as a dependent variable (Y) and multiple independent variables (Xs), including children's age, sex, severity of disability, parental BMI, parental education, parental perception, parenting stress, and child's dietary patterns. To identify correlations between children's weight status and other variables at a fixed time point, a cross- sectional study design is needed; cross-sectional studies are appropriate for describing the status of phenomena or for describing relationships among phenomena at a fixed point in time (Brink & Wood, 1998, p. 161; Polit & Beck, 2004, p. 167).

Although other researchers often highlight the strengths of a longitudinal study design focusing on the causes of childhood overweight in typically developing children, a correlational study design was suitable for children with ID. Identifying relationships among variables rather than inferring causal relationships is needed as a first step in studying this phenomenon in children with ID because little is known about the associations between overweight or other health problems and children with ID. Therefore, a cross-sectional

research design is appropriate to describe overweight phenomena among children with ID because it allows for collecting a large amount of data about a problem (Polit & Beck, 2004, p. 195). After a cross-sectional study has been performed, longitudinal designs might then be helpful to focus on the causes of childhood overweight and to develop and evaluate tailored overweight prevention programs or weight reduction programs for children with ID. A cross-sectional study design was chosen for this study to test the relationships between children and parental risk factors, dietary patterns and weight status in children with ID aged 7 to 11 years.

Subjects and Settings

Subjects & Sample Size

The target population was children with ID aged 7 to 11 years who did not have physical disabilities and their biologic parents. For this study, a convenience sample of 88 children/parent pairs was recruited in three special schools in Daegu and one special school in Seoul. Both male and female children were recruited. The ethnicities of all participants in the study sample were Koreans.

Determining the minimum sample size is important for the process of testing research hypotheses adequately. A procedure known as power analysis may be a preferable way to estimate sample size; and it can also be used to estimate the likelihood that a study will reject the null hypothesis (Murphy, Myors, & Wolach, 2009, p. 24). Power analysis involves four basic concepts: statistical significance known as alpha level, a decision regarding the desired level of power, a statistical test, and the effect size (Lipsey, 1990, p. 30; Murphy et al., 2009, p. 13). To perform power analysis, the level of statistical power must first be selected by the investigative team. Once the desired level of power is selected, the

estimated effect size, the nature of the hypotheses being tested, and the alpha level are chosen for determining the sample size (Murphy et al., 2009, p. 79).

The value of sample size calculation is based on the effect size estimates approximating the true underlying effect sizes. There are three general methods for estimating effect sizes in statistical power analysis: inductive methods, deductive methods, and effect size conventions (Murphy et al., 2009, p. 72). Inductive and deductive methods for estimating effect sizes in power analyses to calculate the necessary sample size is not applicable when the true underlying effect sizes being tested have not been reported in previously published literature (Kleinbaum, Kupper, Muller, & Nizam, 1998). In this circumstance, researchers can use widely accepted effect size conventions, developed by Cohen (1988), that classify the effect size values as small, medium, and large effects (Murphy et al., 2009). For determining the necessary minimum sample size in a study of children with ID, therefore, effect size convention proposed by Cohen (1988) can be used. In addition, effect size calculation depends on which statistical methods, such as the t-test, ANOVA, regression or correlation, are used. In the case of using the Chi-square test, the effect size values of .10, .30, and .50 respectively represent small, medium, and large effects (Cohen, 1988, p. 225). For this study, the Chi-square test and a medium effect size were used to perform power calculations.

Sample size requirements can be determined by using software such as “Power and Precision,” “PASS” program and “G*power.” Using the ‘G*power’ software, power analysis calculations were conducted for the proposed statistical model including the following nine variables: children’s age, children’s sex, children’s severity of disability, parental perception about their children’s weight status, parenting stress, fathers’ BMI,

mothers' BMI, parental education, and dietary patterns. In this proposed study a sample size of 108 is sufficient for achieving the above-stated goals based on the Chi-square (χ^2) test, power of 0.80, an alpha level of .05, and a medium effect size (0.3).

Inclusion & Exclusion Criteria

Parents and their children were eligible for this study if their children had been: (1) diagnosed with Intellectual Disability (ID) by a Korean psychiatric doctor; (2) attended a participating special school; (3) lived with biologic parents; and (d) aged 7 to 11 years old.

Researchers have generally classified the period of childhood in one of two ways. In the U.K. research, childhood is predominately classified into three groups: the prepubescent period (ages 6 to 9-10 years old); early adolescence (ages 9-10 to 14 years old); and late adolescence (ages 14 to 18 years old), representing puberty and attainment of sexual maturity (Bogin, 1999; Bogin & Smith, 2000). The CDC (2005) classification system categorizes childhood into three groups: middle childhood (ages 6 to 11 years old); early adolescence (ages 12 to 14 years old); and middle adolescence (ages 15 to 17 years old). Selecting a target population group for childhood overweight interventions is important because the effect of intervention programs may vary depending on the age of children and corresponding differences in metabolism, developmental level, emotional development, and nutritional needs during each of the three childhood phases (Bogin, 1999).

There are several reasons to choose middle childhood for this study. First, children are becoming overweight at younger ages (Kim et al., 2006; Li, Ford, Mokdad, & Cook, 2006). The increasing trend of overweight in young children is important as this is considered to be a risk factor for persistent overweight during school years and adulthood (Stettler et al., 2005). Second, the higher prevalence of childhood overweight illustrates the

need to establish a more preventive approach at a younger age (Dietz, & Gortmaker, 2001). If obesity can be prevented before adulthood, the health risks from obesity may be decreased (Dietz, 2004). Therefore, the target population for this study is middle childhood, aged 7 to 11 years, because Korean elementary school systems usually allow children to enroll at 7 years of age.

Parents and their children were excluded from this study if their children had been: (1) diagnosed with Prader-Willi syndrome (PWS), which is expected to affect appetite or growth; and/or (2) diagnosed with cerebral palsy (Bandini et al., 2005; Hurvitz, Green, Hornyak, Khurana, & Koch, 2008). Prader-Willi syndrome is a genetic human obesity syndrome with eating problems and characteristic phenotypes, including gross hyperphagia, hypogonadism and growth hormone deficiency (Goldstone, 2004). People with PWS are highly motivated to eat, which may be due to a failed satiety response (Hinton et al., 2006). Overeating is the most prominent behavioral characteristic of PWS; and thus obesity among people with PWS is generally inevitable (Holland, Whittington, Butler, Webb, Boer, & Clarke, 2003). Cerebral palsy is a common neurological disorder characterized as an injury to the immature brain that results in variable neuromuscular and cognitive impairments (Gage, 1991). Children with cerebral palsy may be more sedentary than typically developing children, which places them at greater risk for obesity (Hurvitz et al., 2008; Rogozinski et al., 2007). For example, using data from the National Health and Nutrition Examination Survey (NHANES) 1999-2002 it has been estimated that the prevalence of overweight in children with physical disabilities was 1.7 times higher than in children without physical disabilities (Bandini et al., 2005). This suggests that children with ID having a co-occurring cerebral palsy and PWS should be excluded in this study to obtain

results that are more reliable because these children are likely to be highly susceptible to childhood overweight.

Study Setting

Children and their parents were recruited from four special schools that served children with intellectual disabilities in Daegu and Seoul, Korea. The Korean school system is divided into two different types of schools, special schools for children with disabilities and general schools for typically developing children. In eastern countries, it is believed that children should receive intensive, individualized, functional instruction in specialized settings, even though integrated settings are often considered preferable for children with disabilities in western societies. The majority of Korean children with ID attend segregated schools according to their special needs.

Protection of Human Subjects

The protocol for this study was reviewed and approved by the Institutional Review Board (IRB) for the Protection of Human Subjects at the University of North Carolina at Chapel Hill.

Informed Consent

To satisfy ethical standards for the protection of human subjects, the requirement for informed consent is the most fundamental (Karlawsih, 2006, p. 597). Informed consent was obtained in this study by use of a written informed consent form that was sent home to the parents of eligible children. The parents were asked, if they agreed, to sign the consent form and return one signed copy to the school in an envelope in the children's backpacks. Parents could choose not to participate in the study, or they could freely withdraw from study participation at any time without negative consequences. Children were not asked to assent

to participate in this study because of their low cognitive abilities; therefore, consent was obtained from the parents. The informed consent form describes the purpose of study, inclusion and exclusion criteria, the types of data to be collected, the study procedures, study duration, expected risks and discomforts, benefits, confidentiality, the right to refuse and withdraw from the study, compensation, and contact information (Appendix D, Parent consent form).

Vulnerable populations, such as persons with developmental delay or intellectual disabilities, need more careful protection of their rights during the entire research process. However, the ability to obtain "informed" consent from persons with ID is often questioned by researchers because of the lower cognitive abilities of these study participants (Brent, 2001, p. 222). As a result, researchers often describe the research study and review the consent document with a surrogate or proxy decision maker or a guardian, and ask either parents or legal guardians to give informed consent (Brent, 2001, p. 222). It is important for investigators to be aware that a legal guardian may not have the dependent person's best interests in mind (Polit & Beck, 2004, p. 155). Therefore, research with vulnerable populations should not only adhere to ethical standards, but should also be undertaken only when the risk/benefit ratio is minimal (Polit & Beck, 2004, p. 154).

Confidentiality

Confidentiality procedures were implemented throughout the study. After consent was obtained, the investigator assigned a confidential and sequential study identification number to each parent/child pair. Study identification numbers were documented on questionnaires (Appendix F), the Parenting Stress Index-Short Form (PSI-SF: Appendix G) and 3-day food records (Appendix H). All forms were identified by identification numbers

only, not participant names. Study identification numbers were used in all phases of the study. A site log book (Appendix E) linking participant names with study identification numbers was kept in a password protected computer. Those identification numbers were used to identify all data collected in the study. Once the study was completed and no further follow-up was anticipated, the identified data were destroyed.

All data collected for this study remained confidential. Survey questionnaires and 3-day food records data were kept in a locked file cabinet in the investigator's office. Once data were entered into a database with Excel files, the database was kept on the principal investigator's password-protected computer. The list of names and identification numbers were only shared among the researchers and school nurses. School personnel were involved with the data collection; however, they were not given access to the filed data. Study results that are published and presented will not include individual, identifiable information.

Data Collection

In December 2009, the principals of selected special schools in Daegu and Seoul were contacted by the principal investigator (PI) of this study. The PI contacted the principal of each special school by phone to schedule a meeting to obtain permission to conduct the study. One principal of one special school in Daegu declined to participate, and therefore that special school was excluded from this study. If principals agreed to participate in this study, they were asked to sign a "Research Implementation Agreement" (Appendix B). Four principals agreed to participate in this study. Once the principals agreed to participate, a school nurse and school teachers in each special school participated within their roles in the Korean school system. After obtaining permission from each principal, the PI met with school nurses to explain the study procedures and review the plans

and procedures, including the purpose of this study, data collection, parents' information letter (Appendix C), parents' informed consent (Appendix D), and study packets. Each study packet included a questionnaire (Appendix F and G) and 3-day food record (Appendix H). Before data collection, all involved school nurses and research assistants were trained by the PI for approximately one hour each. School nurses and research assistants were given copies of study documents and data collection guidelines to help them conduct the study. Research assistants were given opportunities to practice collecting and verifying dietary data using food records. This process involved role playing the process of making telephone calls to parents and conducting interviews to verify children's dietary intake.

Each school nurse was asked to assist the investigator with recruitment of study participants. School nurses and the PI reviewed the school health records to assess student eligibility for the study based on children's age and diagnoses. The school nurse created a list of potentially eligible children and their parents. Once the school nurse made a list of parents of eligible children, school nurses sent a parent informational cover letter and 2 copies of the informed consent form home to each parent in the children's backpacks. The school nurse documented the date the consent information was sent to the mothers on the subject list. The backpacks were checked by the school teachers each day during the study period for study documents. Any completed informed consent forms were given to the school nurse, logged in with the date received, and then checked by the PI prior to data collection.

After consent was obtained, the PI assigned a confidential and sequential unique study identification number to each child on a confidential list. The identification numbers for each school began with a unique prefix (1, 2, 3 or 4) to maintain a unique study

identification number for each child. The unique study identification numbers were written on each page of the study surveys and food record forms. The PI shared the confidential list with school nurses.

Data collection in this study consisted of two stages. Phase one included the survey completion. Phase two included the completion of 3-day food records. First, school nurses and the PI prepared survey packets for parents by addressing envelopes to parents and enclosing the survey with the matching study identification numbers in the appropriate envelopes. The survey packets included a cover letter, survey with study identification numbers, and return envelope. Then, school nurses worked with teachers to distribute the matched surveys to parents of eligible students by sending these documents home with children in their backpacks. Parents who completed the surveys returned them to school by placing them in the envelopes provided in the survey packets and sending them in their children's backpacks. The completed surveys were logged in as being received by the PI and stored in a locked file cabinet until the time of data entry by the PI and a research assistant.

Two sets of file folders, one for school nurses and the other for school teachers, were prepared for each participating child, listing the child's identification number. These file folders were used by school nurses and teachers to store documents. During the time period in which surveys were completed, both height and weight of participating children and their mothers were measured by a school nurse in school nurse's room using automatic digital height/weight measures (Appendix E). Mothers had been reminded, in the survey cover letter, that they should come to their respective child's school to have their heights and weights measured during the survey period. Fathers of children with ID were asked to

report their height and weight on the questionnaire.

During the second stage of data collection, after survey data collection was completed, the 3-day food record data collection process began. When the mothers came to school to be measured, the school nurse taught the mothers how to complete a dietary record using the 3-day food record form. Mothers received the food record study packet, including a 3-day food record form, written instructions about food record completion, and a return envelope from the school nurse. Fathers participating in this study were taught by the research team, using a phone call, how to complete a dietary record. The food record study packets were sent to fathers by placing them into children's backpacks. Parents were asked to complete food records, documenting all food & drink consumption, during two weekdays and one weekend day. Teachers used separate food record forms to record foods consumed by the participating children at school for the two weekdays.

To enhance compliance with dietary record keeping, the PI and research assistants visited the schools during the record-keeping period to informally meet with parents, teachers, and school nurses. In South Korea, some mothers of children with ID in elementary school come to school to pick up their children during weekdays. The PI and research assistants called parents and school nurses each day during the 3-day food record-keeping to ask if they needed additional help for accurate reporting of food records, and to assess whether the portion sizes and names of foods parents reported on the 3-day food-records were relatively accurate. After completing the 3-day food records, parents placed the completed forms in provided envelopes and returned the forms to the schools in the children's backpacks. The school nurses placed the completed forms in a locked file cabinet for the PI.

The PI visited the schools to teach the teachers how to keep a dietary record during the two weekdays that children were in school. Teachers were provided with a file folder for each participating child containing the 2-day food record form to be completed for food consumption at school. Written guidelines for completing the food records were also provided to teachers. Teachers stored the food records in locked cabinets when not in use. After completing the food records, the teachers gave the completed food diaries to the school nurses. In addition, the school dieticians provided recipes, ingredients, serving size details, and pictures of school lunches to the PI.

The PI and research assistants reviewed the completed study forms. For incomplete or unclear responses on survey and food records, the PI called parents to complete survey responses or food records. Once parents completed both the questionnaires and 3-day food records, they received $5 gift cards for a Korean book store.

The data collection timeline is shown in Table 3.1: Task 1 is “Obtain principal's permission”; Task 2 is “Subject selection”; Task 3 is “Parental informed consent”; Task 4 is “Survey completion”; Task 5 is “Measurement of height and weight”; and Task 6 is “3-day food records”.

Table 3.1

Data Collection Timeline

	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
School 1	Dec. 14-15	Dec. 14-15	Dec. 16-18	Dec. 17-19	Dec. 16-19	Dec. 20-22
School 2	Dec. 14-15	Dec. 14-15	Dec. 16-18	Dec. 17-19	Dec. 16-19	Dec. 20-22
School 3	Dec. 14-15	Dec. 14-15	Dec. 16-18	Dec. 17-19	Dec. 16-19	Dec. 20-22
School 4	Dec. 22	Dec. 23	Dec. 28	Dec. 29	Dec. 28-29	Dec. 30-31, Jan. 10, 2010

Note. Task 1 = Obtain principal's permission; Task 2 = Subject selection; Task 3 = Parental informed consent; Task 4 = Survey completion; Task 5 = Measurement of height and weight; and Task 6 = 3-day food records

Measurements

Study instruments measure child-level and parent-level data (Table 3.2). Instruments that were used to collect child-level data include: (1) abstract tools for recording both height and weight of children; (2) abstract tools for recording children's severity of disability; and (3) 3-day food records for reporting children's diets. Instruments used to collect parent-level data include: (1) abstract tools for recording height and weight of mothers and fathers; (2) Parenting Stress Index-Short Form; and (3) a demographic questionnaire. The instruments used in this study and all of the measures were written in the Korean language.

Instruments and Measurements for Children with ID

Age- and sex-specific BMI percentile for Korean children. Children's heights and weights were measured during December 2009. School nurses measured children's weights and heights after removing the children's shoes and any outside clothing. Heights were measured to the nearest 0.1 cm and weights to the nearest 0.1 kg using GM-3000F of automatic digital height/weight measures (NeoGM Tec., Korea). The heights and weights were documented on the abstract tools matched with study identification numbers.

The body mass index (BMI) was calculated the same way for both adults and children. The formula for BMI (weight/stature^2; kg/m^2) is weight in kilograms divided by height in meters squared. After the BMI was calculated, the BMI number was plotted on the Korean age- and sex-specific percentiles for BMI by Korea Centers for Disease Control and Prevention (KCDC, 2007) or KCDC BMI-for-age growth charts for either boys or girls to obtain a percentile ranking. BMI percentiles are the most commonly used indicator to assess the size and growth patterns of individual children (CDC, 2009; KCDC, 2007).

Table 3.2

Study Measures and Instruments

	Variables	Instruments
Children	Age & Sex	Demographic questionnaire
	Height & Weight	Abstract tool with a study identification number
	BMI percentile	Korean age- and sex-specific percentiles for children's BMI
	Severity of disability	Abstract tool
	Dietary patterns	3-day food records
Parents	Height & Weight	Father's height & weight from self-reported questionnaire Mother's height & weight from Abstract tool
	BMI	Formula for BMI calculation
	Parental education	Questionnaire
	Parental perception about their children's weight	Questionnaire
	Parenting stress	Parenting Stress Index-Short Form (PSI-SF)

Note. BMI = Body Mass Index

Korean age- and sex-specific percentiles for BMI classify children into four weight status groups: (1) *obese*, defined as at or greater than the 95th percentile (≥95th percentile); (2) o*verweight,* defined as at or greater than the 85th percentile but less than the 95th percentile (85th ≤ BMI < 95th percentile); (3) n*ormal weight,* defined as at or greater than the 5th percentile but less than the 85th percentile (5th ≤ BMI < 85th percentile); and (4) u*nderweight,* defined as less than 5th percentile (< 5th percentile) of the BMI for age- and sex- growth chart.

Severity of disability. The severity of disability for enrolled children was abstracted from the school health records. Children's severity of disability was also documented on the Abstract tool. The school health records included the disability information that was provided by parents when their respective children were enrolled in the Korean special school system. At enrollment parents were required to submit notes from psychiatrists listing the children's diagnosis and the severity of disability. Three disability categories are used in South Korea to classify the level of intellectual disabilities: mild, moderate and severe (Korean Ministry of Government Legislation, 2007).

3-Day Food records. The dietary intake of participating children was assessed by 3-day food records. These records were completed by parents at home and teachers in the participating schools. Food records were requested to cover two weekdays and one weekend day. Over 80 Korean food items were combined as several food groups using CAN-Pro 3.0 program for Korean nutritional analysis. Foods containing multiple ingredients were classified according to the primary ingredient. For example, Korean BBQ containing four food items including grilled beef, garlic, onion, and soy source was classified as a "meat" food group. Yet, food items with single nutrients were classified as an

individual food group as “eggs” and “nuts.” The number of food servings consumed in each respective food group was summed for each child. The children’s dietary patterns were then identified based on the sum of servings consumed in each food group over the three-day period.

Portion sizes of foods were estimated using household measures, food-specific portion size information from food packages, and serving size information obtained from the school dieticians. Parents and special school teachers were asked to describe serving portion sizes as small, medium or large, where a small portion was 50% smaller than an average portion, and a large one was 50% larger. Photographs with a realistic food model, developed by the Korean Rural Development Administration (2009), were used to help parents and special school teachers identify and report the appropriate portion sizes.

Instruments and Measurements for Parents

Body Mass Index (BMI) for Parents. Each school nurse measured the mothers’ heights and weights in a school nurse’s room during December 2009. School nurses measured mothers after removing their shoes and any outside clothing. Mothers’ heights were measured to the nearest 0.1 cm and weights to the nearest 0.1 kg using GM-3000F of automatic digital height/weight measures (NeoGM Tec., Korea). The heights and weights were also documented on the Abstract tools with the study identification numbers. Fathers’ heights and weights were self-reported in a survey. Measured heights and weights of mothers and reported heights and weights of fathers were used to compute BMIs. The formula for BMI (weight/stature^2; kg/m^2) is weight in kilograms divided by height in meters squared. Parental BMIs’ were classified according to the KCDC (2007) categories as: *obesity* (BMI $\geq$25), *overweight* ($23 \leq$ BMI < 25), *normal weight* ($18.5 \leq$ BMI < 23), and

underweight (BMI < 18.5).

Parental perceptions about their children' weight. The parental perceptions of children's weight status were obtained by asking: "Do you consider your child to be obese, overweight, just right, or underweight?" Responses were recorded using a four-point scale ranging from "obese," "overweight," "just right," to "underweight."

Parental education. The classic three variables representing socioeconomic status are education level, occupational class, and family income (Shrewsbury & Wardle, 2008). Parental education, as an indicator of SES, is considered to be one of the more reliable measures (Shrewsbury & Wardle, 2008). However, the concept of SES is complex and generally difficult to validly measure. In this study, both years of fathers' education and years of mothers' education were used as continuous variables.

Parenting Stress Index-Short Form (PSI-SF). To assess families' parenting stress, the Korean version of the Parenting Stress Index-Short Form (PSI-SF) was used. The PSI-SF was developed to measure the presence of parenting stress and troubled relationships between parents and children (Abidin, 1995). Specifically, the PSI-SF is intended to identify potentially dysfunctional parent-children relationships that may place a child at risk for emotional disturbance (Abidin, 1995). The shortened version of the PSI includes 36 of the 120 items included in the original PSI. It is written at a fifth grade reading level. It consisted of 33 items with a 5-point Likert scale (SA=Strongly Agree, A=Agree, NS=Not Sure, D=Disagree, SD=Strongly Disagree). Three items consisted of multiple choice questions. Total parenting stress scores were summed, with a possible range of 36 to 180. The Total parenting stress score provides an indication of the overall level of parenting stress.

Demographic survey. A survey was administered to parents to measure children's age and sex. The survey was written in Korean, but the responses were translated into English in this description.

Data Management

Data Entry

Before implementing data entry, a codebook was developed by the PI with numerical codes corresponding to the responses for each item. The survey responses and 3-day food records were coded and entered into computer files. These data were stored on the PI's password protected computer. For this study, data were entered into EXCEL (version 2007) by the PI and a research assistant.

Accuracy of data entry is another critical issue because data entry errors may distort findings and invalidate results (Wilcox, 1998). Therefore, accurate data entry and data verification are a necessary step. There are three general methods of data verification to select from: single data entry with visual checking, double data entry, and use of verifying programs. With single data entry with visual checking, the numbers and codes from the data file are printed and are then compared with codes on the original source. Double data entry involves entering all of the data twice and then comparing the two sets of records. The third method uses special verifying programs designed to perform comparisons during direct data entry, such as PowerChecker (Polit & Beck, 2004, p. 551). Previous research suggests that double data entry is more effective in reducing data entry errors when compared with entering the data once (Scott, Thompson, Wright-Thomas, Xu, & Barchard, 2008). Therefore, double data entry was performed for this study to enhance the accuracy of the data entry process. Two coders, the researcher and a research assistant, independently entered

the responses into two separate EXCEL files. These two files were compared for coding differences; and these differences were resolved by returning to the raw data for the correct response.

Missing Data Management

A common issue in survey design is the failure to collect complete information from participants due to their unwillingness or inability to provide requested information. This phenomenon is called "nonresponse." The problem of nonresponse, related to missing data, may distort the study results. For example, if all students are asked to complete a course satisfaction questionnaire at the end of a semester, many students may forget and therefore fail to respond to the questionnaire. Students with complaints may be the main responders to the questionnaire; and as a result, the responding students are not likely to be typical students. Therefore, there is a need to reduce nonresponse.

There are two approaches for reducing the potential for nonresponse bias: one is to use data collection strategies that improve the response rate; and the other is to collect information on all or a subset of the nonrespondents and incorporate this information into the sample estimates to reduce bias (Kessler, Little, & Groves, 1995). Several data collection strategies were used to reduce the nonresponse rate throughout the study. The first strategy was to send pre-notification letters to mothers of eligible children in an effort to increase cooperation (Kessler et al., 1995). In addition, parents were contacted by the PI or research assistants and probed for missing information. A financial incentive of $5 was given to participating mothers when they submitted the completed questionnaire and 3-day food records. Efforts to increase survey response rates may be more effective for decreasing nonresponse bias than adjusting for missing data with methods such as multiple imputation

(Kessler et al., 1995).

It is important to assess whether missing values, after collecting data, are considered to be random or are associated with the outcome variables (Rubin, 2004, p. 2). The reason researchers compare the characteristics of missing values is that missing data can influence the construct of validity. There are two common approaches for addressing missing values: (1) discard cases with missing values; or (2) impute values to replace missing values (Garson, 2008; Molenberghs & Kenward, 2007, p. 7). In the first approach, random missing data will be deleted because it seems to occur by chance (Todman & Dugard, 2007, p. 70). This is known as a process of casewise deletion, which is widely used in SAS and other statistical procedures due to simplicity. Variables with less than 5% missing values can be ignored (Little & Rubin, 1987). However, simply deleting cases with missing data can be dangerous because it assumes that cases are missing completely at random (Little & Rubin, 1987). In most real research settings, missing data are not at random. Non-random missing data are generally handled with imputation, where missing data are replaced by the mean value for the continuous variables, known as mean imputation, and by the most commonly occurring category for the categorical variables (Little, 2002; Todman & Dugard, 2007, p. 71).

Data Analysis

Exploratory Factor Analysis

Exploratory factor analysis was used to assess dietary patterns in children with ID. This approach allowed researchers to describe dietary patterns of children within complex dietary data and to assess differences in diet that could be used to make targeted food recommendations to improve overall diet quality (Johnson et al., 2008; Knol et al., 2005; Ritchie et al., 2007; Shin et al., 2009).

There are several steps of factors analysis to determine dietary patterns. First, data from 3-day food records were put into the Computer Aided Nutritional Analysis Program for Professionals 3.0 (CAN-Pro 3.0) software program developed by the Korean Nutrition Society (Seoul, South Korea, 2005). Foods were classified as discrete foods or primary ingredients to derive a nutrient-based database. Dietary intake data were assigned to categorize Korean food items previously defined by the Korean Nutrition Society's Food Composition Database (Korean Nutrition Society, 2005).

Second, over eighty food items were combined into several food groups based on the similarity of the nutrient content (i.e., fat, carbohydrate, and protein) of each food item, the frequency of usage, the customary use in the diet, and the nutrient profiles of each food item. The frequency of each food group was coded as the number of servings consumed over the three day study period to identify children's dietary patterns. If the mean number of servings consumed in any of the food groups was less than one serving per day they were deleted.

Third, factor analysis with SAS PROC FACTOR was conducted to define the dietary patterns using the SAS option of *principal component analysis*. There are two reasons to choose the method of *principal component analysis.* *Principal component analysis* is considered to be the best method for summarizing the interrelationships between a large number of variables and a smaller number of components (Tabachnick & Fidell, 2006). And, it is particularly useful when there is little theoretical basis for specifying a priori the number and patterns of common factors (Hurley et al., 1997; Kline, 1994, p. 10). It is important to determine if there are a sufficient numbers of significant correlations among the items to justify undertaking a factor analysis (Pett et al., 2003, p. 72). In determining the

number of factors to retain, food group components with eigenvalues greater than 1.00 are extracted. Furthermore, a scree plot of the extracted factors was used to identify distinct breaks in the slope of the plot and to check and define the number of food group components.

The last step for extracting dietary patterns is the choice of an appropriate rotation method to increase the representation of each food group to a component. Generally, *oblique rotation* is appropriate if there is some degree of correlation among the factors (Pett et al., 2003, p. 149). The specific type of oblique rotation chosen was direct oblimin because direct oblimin was commonly used in the case of the measures of physiological or psychological constructs which naturally are likely to be correlated to some degree (Pedhazur & Schmelkin, 1991). Therefore, oblique rotation was appropriate for the analysis of data in this study, and was considered an optimal approach to derive noncorrelated components as food patterns.

The rotated factor loading matrix was examined to look for items with weak loadings and items with strong loadings on multiple factors. Items with weak loadings, less than $\pm$ .30, were eliminated because these items failed to load significantly (Hair et al., 1995). Although there are some disagreements among scientists in the factor analysis about the multiple-loading problem, it is suggested to place the item with the factor that it is most closely related to conceptually (Pett et al., 2003, p. 173). Finally, the meaningful dietary pattern, which is composed of several food groups, was defined. These dietary patterns were named according to the characteristics of food patterns.

For further analysis of the relationships between dietary pattern and risk factors of childhood overweight, the factor scores of each dietary pattern were constructed. There are several different approaches that may be used to estimate factor scores, but there is no single

correct method of factor score estimation (Pett et al., 2003). Standardized factor coefficients can be generated in SAS PROC FACTOR using the subcommand SCORE. The OUT = option creates a data set containing all the data from the DATA = data set plus variables called Factor 1 and Factor 2. In other words, factor scores were generated by summing observed intakes of the component food items weighted by the factor loadings. These new variables contain the estimated factor scores for each individual. Each subject gets factor scores for each dietary pattern, with a higher score indicating a higher adherence to the respective pattern.

Descriptive & Basic Statistical Analysis

Study data were analyzed using SAS version 9.2 (SAS Institute Inc., Cary, NC). Each variable was checked for outliers, missing data and distribution. In descriptive analyses, continuous variables were presented as mean values and standard deviations; and categorical variables were presented as absolute and relative frequencies. Descriptive statistics for children's and parental characteristics were presented by children's sex differences.

Once children's dietary patterns were determined, the Pearson correlation and Spearman correlation coefficients were used to measure the correlation between the children's and parental risk factors and children's dietary pattern scores. The two tests, the Pearson correlation and Spearman correlation coefficients, are very similar. The main difference between the Pearson and Spearman correlation coefficients is that the Pearson correlation coefficient is a parametric test that can be used with interval or ratio measurement scale; the Spearman correlation coefficient is a non-parametric test that can be used with ordinal, interval, or ratio variables (Plichta & Garzon, 2009, p. 261). Pearson correlation

coefficients are parametric and were used with continuous variables such as children's age. Spearman correlation coefficients are non-parametric and were used with variables such as children's sex and severity of disability.

The relationships between children's and parental risk factors and children's weight status were examined using Chi-square (χ^2) with Fisher's exact test for categorical variables and ANOVA for continuous variables to determine group differences among them.

Logistic Regression

Logistic regression analysis was performed to examine the relationships between Korean dietary pattern score and Westernized dietary pattern score and weight status in children with ID aged 7 to 11 years when both children's and parental risk factors are controlled. For this step, severity of disability was collapsed into two levels, mild or moderate ID and severe ID. Parental perception about their children's weight status was collapsed into two levels, accurate perception and misperception including both underestimation and overestimation. Children in two dietary patterns were classified into two groups by conducting SAS PROC RANK, a lower intake group and a higher intake group in each dietary pattern. These groups were established based on the frequencies in each dietary pattern. Statistical significance was set at $\alpha = 0.05$. Odds ratios (OR) and 95% confidence intervals (CI) were computed to assess the strength of the associations between multiple independent variables and the outcome variable.

Logistic regression was selected to answer the research questions in this study because it finds the best fit and the most parsimonious model to describe the relationships between multiple independent variables and a categorical outcome variable (Polit & Beck, 2004, p. 537; Tabachnick & Fidell, 2006, p. 437). Logistic regression analysis offers

several advantages over other methods. First, there are no assumptions about the distribution of the independent factors, such as a normal distributions, linear relationships, or equal variances within each group (Tabachnick & Fidell, 2006, p. 437). Second, this method can analyze predictors of all levels of measurement including continuous, discrete and dichotomous factors (Tabachnick & Fidell, 2006, p. 437). Third, it provides odds ratios that can be interpreted to determine the effect each predictor has on the development of childhood overweight (Polit & Beck, 2004, p. 538).

CHAPTER 4

RESULTS

Respondents and Non-respondents Participating in the Survey

The target population was 211 children with ID aged 7 to 11 years without physical disabilities and their biologic parents from five special schools. Of these schools, one of the special schools refused to participate in this study. Therefore, 140 biological parents from four of five special schools in South Korea were approached about the study (Table 4.1). Three schools were located in Daegu (75%) and one school was in Seoul (25%). Ninety one parents of children with ID (65%) agreed to participate in this study. Of the responding 91 subjects, three cases were excluded. One case was an extreme outlier based on the child's dietary pattern and the child's weight because child had Prader-Willi syndrome. Two cases refused to complete diet surveys. Finally, 88 (62.9%) subjects participated, including 65 male children (73.9%) and 23 female children (26.1%).

Table 4.1

Survey Participation Response Rates

	Respondents % (n)	Non-respondents % (n)
School 1	43.5 (10)	56.5 (13)
School 2	54.7 (29)	45.3 (24)
School 3	63.6 (21)	36.4 (12)
School 4	90.3 (28)	9.7 (3)
Total	62.9 (88)	37.1 (52)

Preparation for Data Analysis

Study data, including both questionnaires and 3-day food records, were entered into EXCEL (version 2007). Data cleaning was conducted before data analysis. All data were reviewed using SAS for accuracy of data entry, outliers, missing values, fit between their distributions and the assumptions of linearity of multivariate analysis. To ensure the accuracy of a data file, descriptive statistics were conducted with SAS PROC MEANS and PROC UNIVARIATE. For continuous variables, such as fathers' and mothers' age, height and weight, dietary pattern scores, years of fathers' and mothers' education, and parenting stress scores, values greater than 2 or 3 standard deviation (SD) from the mean were verified for accuracy against the original data set. Scores that appeared incorrect for any reason were examined against the original surveys. For categorical variables, such as children's age and sex, children's severity of disability and parental perceptions about their children's weight status, the range of these categorical variables was checked. No out-of-range numbers for these categorical variables were identified. At each step of the review process, all miscoded data were corrected. Finally, all values of continuous variables were within acceptable predefined ranges.

Missing values existed for the continuous variables of fathers' age and fathers' education. Missing values for fathers' age (n=2) and fathers' education (n=1) were replaced by the mean values in all cases. Other survey variables were fully completed without missing values.

For examining of reliability of the PSI-SF, Cronbach's alpha coefficients were used in this study. Cronbach's alpha of the PSI-SF was .893 (n=88, number of items=36). This value is acceptable as a Cronbach's alpha of at least .70 or higher is deemed adequate to

retain an item in a scale (Pett, Lackey, & Sullivan, 2003). The PSI-SF has acceptable levels of reliability.

Multicollinearity can occur in logistic regression models as a result of strong correlations between two or more independent variables. The existence of multicollinearity inflates the variances of the parameter estimates, and it may lead to distortions in the magnitudes of regression coefficient estimates (Tabachmick & Fidell, 2006, p.443). To assess for multicollinearity among variables, the collinearity diagnostics of SAS PROC REG were conducted. The years of fathers' and mothers' education were found to be highly correlated; therefore, years of fathers' and mothers' education were collapsed into one variable in this model as "parental education."

Characteristics of Children with ID and Their Parents

Children's Characteristics

Male children represented 73.9% of the respondents (Table 4.2.1). The mean age of children was 9.9 years of age for males and 9.7 years of age for females. The mean height was 135.4 (cm); and the mean weight was 34.7(kg). Two thirds of the children (67.1%) were classified as normal weight, 14% were underweight, 9% were overweight, and 10% were obese based on BMI percentiles. The overweight or obese proportions were higher among female children (21.7%) than those of male children (18.4%). More than half of the children (58%) had moderate intellectual disabilities, and 36% had severe intellectual disabilities. Almost 40% of the participating children took medications at the time of study. Of these, approximately 65% took anticonvulsant medications, such as Tegretol, Depakote, Trileptal, Lamictal, Depakene, and Topamax. In addition, one third took antidepressant or psychotic medications, such as Lexapro, Benztropine, Seroxat, Dumirox, and Celexa. Approximately 30% had one or more chronic diseases along with their intellectual disabilities. Children were reported to have several types of chronic diseases: seizures (77%), congenital heart disease (8%), and other chronic diseases (15%). No statistically significant differences in children's characteristics were observed between male and female children for the variables age, height, weight, BMI, severity of disability, medication, types of medication, comorbidities, and types of chronic diseases.

Table 4.2.1

Children's Characteristics Stratified by Children's Sex

	Male	Female	Total	
	n=65	n=23	n=88	
Children's Characteristics	% (n)	% (n)	% (n)	*p/F*
Children's age (years)				0.4014
Range	7-11	7-11	7-11	
Mean (SD)	9.89 (1.19)	9.74 (1.01)	9.85 (1.14)	
Children's height (cm)				0.8031
Range	113.8-165.3	115.4-158.9	113.8-165.3	
Mean (SD)	137.50 (11.38)	129.47 (11.77)	135.40 (11.96)	
Children's weight (kg)				0.1005
Range	17.8-73.0	18.5-57.1	17.8-73.0	
Mean (SD)	36.87 (12.82)	28.70 (9.35)	34.73 (12.49)	
Children's BMI				0.6087
Underweight	10.77 (7)	21.74 (5)	13.64 (12)	
Normal weight	70.77 (46)	56.52 (13)	67.05 (59)	
Overweight	7.69 (5)	13.04 (3)	9.09 (8)	
Obese	10.77 (7)	8.70 (2)	10.23 (9)	
Severity of disability				0.7496
Mild ID	4.62 (3)	8.70 (2)	5.68 (5)	
Moderate ID	60.00 (39)	52.17 (12)	57.95 (51)	
Severe ID	35.38 (23)	39.13 (9)	36.36 (32)	

Children's Characteristics	Male n=65 % (n)	Female n=23 % (n)	Total n=88 % (n)	*p/F*
Medication				0.8553
Yes	36.92 (24)	34.78 (8)	36.36 (32)	
No	63.08 (41)	65.22 (15)	63.64 (56)	
Types of medication				0.4791
Anticonvulsant	60.87 (14)	75.0 (6)	64.52 (20)	
Antipsychotic	39.13 (9)	25.0 (2)	35.48 (11)	
Comorbidity				0.5242
Yes	27.69 (18)	34.78 (8)	29.55 (26)	
No	72.31 (47)	65.22 (15)	70.45 (62)	
Types of chronic disease				N/A
Seizures	77.78 (14)	75.0 (6)	76.92 (20)	
Klinefelter syndrome	5.56 (1)	0 (0)	3.85 (1)	
Angelman syndrome	5.56 (1)	0 (0)	3.85 (1)	
Phenylketouria	5.56 (1)	0 (0)	3.85 (1)	
Myelodysplastic syndrome	0 (0)	12.50 (1)	3.85 (1)	
Congenital heart disease	5.56 (1)	12.50 (1)	7.69 (2)	

Note. ID = Intellectual disability

Parental Characteristics

The mean age of participating fathers was 42 years; and mothers' mean age was 40 years. Over 50% of fathers were overweight or obese; whereas 29% of mothers were overweight or obese. The majority of fathers (95%) and mothers (94%) had completed formal education at a higher than high school level. The mean duration of parental education was 14 years for fathers and 13 years for mothers. Forty percent of fathers were office workers, 18% of fathers ran small businesses, and only 4% of fathers were unemployed. Most mothers were housewives (80%), followed by office workers (6%), small business owners (5%), teachers (2%), and researchers (2%). Approximately 55% of the parents accurately perceived their children's weight status. Parents of female children more accurately perceived their children's weight status than those of male children. Only 50% of parents of male children accurately perceived their children's weight status, whereas 65% of parents of female children correctly perceived their children's weight status. Parents of female children were more likely to overestimate their child's weight status; and parents of male children were more likely to underestimate their children's weight status. The majority of parents were married (91%). Over 90% of the children had one or more siblings. Male children were less likely to have a sibling than female children. The mean parenting stress score was not different between parents of male children and parents of female children. Significant differences in parental characteristics were observed between male and female children for two variables, fathers' age (p = .0007) and numbers of sibling (p = .0075; Table -4.2.2).

Table 4.2.2

Parental Characteristics Stratified by Children's Sex

	Male	Female	Total	
	n=65	n=23	n=88	
Parental Characteristics	% (n)	% (n)	% (n)	*p/F*
Fathers' age (years)				0.0007
Range	34-57	37-68	34-68	
Mean (SD)	42.27 (4.12)	42.57 (7.21)	42.34 (5.01)	
Mothers' age (years)				0.4776
Range	27-51	35-51	27-51	
Mean (SD)	39.27 (4.27)	40.13 (4.79)	39.51 (4.41)	
Fathers' BMI				0.7600
Range	18.11-31.38	17.30-27.78	17.30-31.38	
Mean (SD)	23.56 (2.47)	23.58 (2.58)	23.56 (2.48)	
Underweight	1.56 (1)	4.76 (1)	2.35 (2)	0.8269
Normal weight	43.75 (28)	38.10 (8)	42.35 (36)	
Overweight	21.88 (14)	28.57 (6)	23.53 (20)	
Obesity	32.81 (21)	28.57 (6)	31.76 (27)	
Mothers' BMI				0.0653
Range	16.02-38.63	18.26-27.24	16.02-38.63	
Mean (SD)	21.99 (3.51)	21.80 (2.45)	21.94 (3.24)	
Underweight	15.0 (9)	8.70 (2)	13.25 (11)	0.9137
Normal weight	56.67 (34)	60.87 (14)	57.83 (48)	

Overweight	13.33 (8)	26.09 (6)	16.87 (14)	
Obesity	15.0 (9)	4.35 (1)	12.05 (10)	
	Male	Female	Total	
	n=65	n=23	n=88	
Parental Characteristics	% (n)	% (n)	% (n)	*p/F*
Fathers' education				0.3083
Range	6-20	9-16	6-20	
Mean (SD)	14.26 (2.81)	14.14 (2.29)	14.24 (2.68)	
College	64.06 (41)	57.14 (12)	62.35 (53)	0.8167
High school	31.25 (20)	38.10 (8)	32.94 (28)	
Middle school	1.56 (1)	4.76 (1)	2.35 (2)	
Elementary school	3.13 (2)	0 (0)	2.35 (2)	
Mothers' education				0.8132
Range	6-18	6-16	6-18	
Mean (SD)	13.62 (2.45)	13.30 (2.53)	13.53 (2.46)	
College	51.67 (31)	39.13 (9)	48.19 (40)	0.4390
High school	41.67 (25)	56.52 (13)	45.78 (38)	
Middle school	5.0 (3)	0 (0)	3.61 (3)	
Elementary school	1.67 (1)	4.35 (1)	2.41 (2)	
Fathers' occupation				N/A
Office worker	34.38 (22)	57.14 (12)	40.00 (34)	
Small business owner	17.19 (11)	19.05 (4)	17.65 (15)	
Researcher	9.38 (6)	4.76 (1)	8.24 (7)	

Driver	9.38 (6)	4.76 (1)	8.24 (7)	
Construction laborer	9.38 (6)	4.76 (1)	8.24 (7)	
Government official	1.56 (1)	4.76 (1)	2.35 (2)	
Administrative director	1.56 (1)	0 (0)	1.18 (1)	
Army	1.56 (1)	0 (0)	1.18 (1)	
Construction director	1.56 (1)	0 (0)	1.18 (1)	
Doctor	1.56 (1)	0 (0)	1.18 (1)	
Entrepreneur	1.56 (1)	0 (0)	1.18 (1)	
Financial manager	1.56 (1)	0 (0)	1.18 (1)	
Machine operator	1.56 (1)	4.76 (1)	2.35 (2)	
Teacher	1.56 (1)	0 (0)	1.18 (1)	
Writer	1.56 (1)	0 (0)	1.18 (1)	
Unemployed	4.69 (3)	0 (0)	3.53 (3)	
Mothers' occupation				N/A
Housewife	78.69 (48)	82.61 (19)	79.76 (67)	
Office worker	6.56 (4)	4.35 (1)	5.95 (5)	
Small business owner	3.28 (2)	8.70 (2)	4.76 (4)	
Teacher	3.28 (2)	0 (0)	2.38 (2)	
Researcher	3.28 (2)	0 (0)	2.38 (2)	
Government official	0 (0)	4.35 (1)	1.19 (1)	
Pharmacist	1.64 (1)	0 (0)	1.19 (1)	
Nurse	1.64 (1)	0 (0)	1.19 (1)	
Writer	1.64 (1)	0 (0)	1.19 (1)	

	Male	Female	Total	
	n=65	n=23	n=88	
Parental Characteristics	% (n)	% (n)	% (n)	*p/F*
Accuracy of parental perception about their child's weight				0.3742
Accurate	50.77 (33)	65.22 (15)	54.55 (48)	
Underestimation	18.46 (12)	8.70 (2)	15.91 (14)	
Overestimation	30.77 (20)	26.09 (6)	29.55 (26)	
Marital status				0.4744
Married	90.77 (59)	91.30 (21)	90.91 (80)	
Divorced	3.08 (2)	0 (0)	2.27 (2)	
Separated	6.15 (4)	0 (0)	4.55 (4)	
Widowed	0 (0)	8.70 (2)	2.27 (2)	
Number of siblings				0.0075
0	7.69 (5)	4.35 (1)	6.82 (6)	
1	76.92 (50)	52.17 (12)	70.45 (62)	
2	15.38 (10)	39.13 (9)	21.59 (19)	
3	0 (0)	4.35 (1)	1.14 (1)	
Parenting stress				0.7961
Range	68-155	72-133	68-155	
Mean (SD)	99.85 (17.88)	99.09 (16.90)	99.65 (17.53)	

Dietary Pattern Analysis

Dietary intake data were classified according to Korean food items previously defined by Korean Nutrition Society's Food Composition Database (Korean Nutrition Society, 2005). Over eighty food items were combined into 14 food groups. Of these 14 food groups, two food groups, "fat" and "nuts", were deleted because their average daily frequency of intake was less than 1. A total of 12 food groups were used for the dietary pattern analysis (Table 4.3).

In the factor analysis performed, the Kaiser's measure of sampling adequacy for 12 Korean food groups was .4906; this value was close to meeting a satisfactory factor analysis level because the value of Kaiser's measure should be greater than 0.5 to be considered a satisfactory factor analysis (Pett et al., 2003, p. 72). Using Principal Components extraction through SAS PROC FACTOR, two factors with eigenvalues greater than 1.00 were extracted: Factor 1 (47.2%) and Factor 2 (17.4%) accounted for 64.6 percent of the total variance. A scree plot identified the extracted factors by identifying a distinct break in the slope of the plot (Figure 4.1). The distinct break in the slope is shown in the scree plot; and two factors are retained with eigenvalues greater than 1.00.

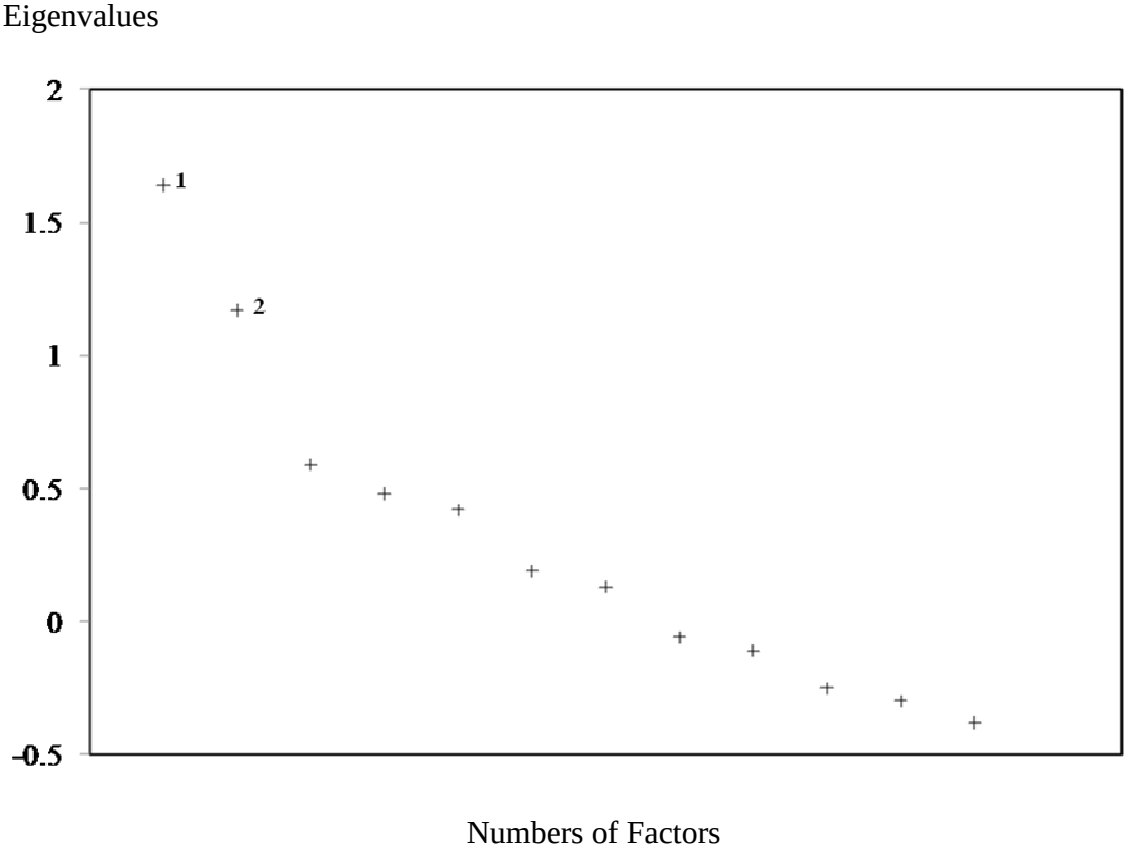
Table 4.3

Foods and Food Groups used in the Factor Analysis

Food Groups	Food Items
Korean style grains	White rice, other grains (barley, brown rice, black rice, millet)
Breads and noodles	Breads: white and dark breads, pizza, hamburger, Danish, pastry, cakes Noodles & dumpling: Korean instant noodle (Ramyun), spaghetti, Korean style noodles, udong
Potatoes	Potatoe, sweet potatoe
Beans	Tofu, soya beans
Kimchi (Korean traditional spicy raw vegetables)	Korean cabbage kimchi, seasoned cubed radish roots, young radish kimchi, other kinds of kimchi
Vegetables & fruits	Vegetables: bean sprouts, cucumber, broccoli, corn, spinach, lettuce, onion, carrots, mushrooms, chili pepper, squash, garlic, lotus root Fruits: pears, apples, tomato, banana, grapes, strawberry, pineapple, persimmon, melon
Meat	Beef: sliced beef, tender loin Pork: tender loin, shoulder, belly Chicken: boiled chicken, fried chicken Processed meat: ham, sausage, nuggets Organ meat: soondae (Korean style sausage)

Food Groups	Food Items
Fish	Fresh fish: mackerel, hairtail, codfish, gray mullet, croaker, squid, octopus, clams Canned fish: canned tuna Dried fish: dried anchovy, dried squid, dried whitebait Processed fish: fish cakes
Eggs	Eggs, quail eggs
Seaweed	Dried laver, sea mustard
Milk & dairy products	Milk: whole milk, chocolate milk Dairy products: yogurt, yogurt drinks, cheese
Sugary product	Sugary foods: honey, candy, gum, chocolate, jelly, ice cream Snack: chips, biscuits, cookies Sweet drinks: coke, cider, other soft drinks

Figure 4.1 Scree Plot of Eigenvalues for 12 Korean Food Groups



In the factor-loading matrix for two factors rotated with the direct oblimin of oblique rotation, food groups were ordered and grouped by size of factor loading and factors (Table 4.4). Items with weak loadings of less than .20 (e.g. breads and noodles, seaweeds, and milk and dairy products) were dropped from this study. "Potatoes" had a multiple-loading problem, which was included into both Factor 1 and Factor 2. Finally, "potatoes" would be included into Factor 2 because "potatoes" was conceptually related to Factor 2.

There were 12 food groups in the two identified factors. Factor 1 was heavily loaded with vegetables and fruits, fish, kimchi, and beans. Factor 2 was loaded with meats, potatoes, Korean grains, sugary foods, and eggs. Each factor was given a descriptive label: Factor 1 (Korean dietary pattern) included vegetables and fruits, fish, kimchi, and beans; and Factor 2 (Westernized dietary pattern) included meats, potatoes, Korean grains, sugary foods, and eggs. These labels reflected the overall theme for each factor. Cronbach's alpha for two factors was .6277, indicating that the value was close to be accepted to retain two factors.

Table 4.4

Factor-loading Matrix for Dietary Patterns in Children with ID

	Dietary Patterns*	
Food Groups	Factor 1: Korean Dietary Patterns	Factor 2: Westernized Dietary Patterns
Vegetables & Fruits	.52628	-
Fish	.57499	-
Kimchi	.51419	.27349
Beans	.47565	-
Meats	-	.78958
Potatoes	.41580	.47689
Korean style grains	-	.35098
Sugary foods	-	.33388
Eggs	-	-.35511
Breads and noodles	-	-
Seaweeds	-	-
Milk & dairy products	-	-

Note. *Absolute values of factor loading < .20 are suppressed for simplicity

Study Aim 1

Question 1: Relationships between Dietary Pattern Scores and Children's Risk Factors

Based on Pearson and Spearman correlation coefficients, children's age was significantly, associated with Korean dietary pattern scores in a positive direction (r = .25, p = .02). This value indicates that older children were more likely to have higher Korean dietary pattern scores than younger children. Children's age was not significantly associated with Westernized pattern scores (Table 4.5.1). Children's severity of disability was negatively associated with Westernized dietary pattern scores (r = - .22, p = .04). Children with mild or moderate ID were more likely to score high on the Westernized dietary pattern than children with severe ID. Severity of disability was not significantly associated with Korean dietary pattern scores. Korean dietary pattern scores and Westernized dietary pattern scores did not differ significantly between male and female children.

Question 2: Relationships between Dietary Pattern Scores and Parental Risk Factors

Parenting stress scores were significantly related to Korean dietary pattern scores (r = .23, p = .03), (Table 4.5.2). This value indicates that higher parenting stress scores are associated with higher scores on the Korean dietary pattern. The Westernized dietary pattern scores were not significantly associated with parenting stress scores. Westernized dietary pattern scores were significantly related to mothers' BMI (r = .24, p = .03). High BMI values in mothers were associated with high scores on the Westernized dietary pattern for their children. Years of fathers' education was negatively related to Westernized dietary pattern scores in children (r = -.23, p = .04). Lower levels of fathers' education were associated with higher scores on the Westernized dietary pattern for their children.

Table 4.5.1

Correlation Coefficients for Relationships between Dietary Pattern Scores and Children's Risk Factors

	Dietary Pattern Score	
Children's Risk Factors	Korean Dietary Pattern	Westernized Dietary Pattern
Children's age	.25*	-.02
Children's sex	-.08	-.18
Severity of disability	-.02	-.22*

* $p < 0.05$

Table 4.5.2

Correlation Coefficients for Relationships between Dietary Pattern Scores and Parental Risk Factors

	Dietary Pattern Score	
Parental Risk Factors	Korean Dietary Pattern	Westernized Dietary Pattern
Fathers' BMI	-.03	.14
Mothers' BMI	-.07	.24*
Fathers' education	.04	-.23*
Mothers' education	.15	-.19
Accuracy of parental perceptions about their children's weight	.11	-.14
Parenting stress	.23*	.09

* $p < 0.05$

Study Aim 2

Question 3: *Relationships between Weight Status in Children and Children's Risk Factors*

No statistically significant associations between children's weight status and children's risk factors (age, sex, and severity of disability) were identified, using Chi-square tests with Fisher's exact test and ANOVA (Table 4.6.1). Overweight or obese children with ID were slightly older than normal weight children, although the relationship was not significant ($p = .4078$). Children with moderate ID were more likely to be overweight or obese, but this relationship was not statistically significant.

Question 4: *Relationships between Weight Status in Children and Parental Risk Factors*

Children's weight status was not found to be significantly associated with parental risk factors, including fathers' BMI, mothers' BMI, fathers' education, mothers' education, parental perception about their children's weight status, and parenting stress (Table 4.6.2). Although the relationship was not statistically significant, mothers of overweight or obese children were more likely to be overweight or obese than mothers of normal weight children ($p = .0552$). In overweight or obese children, the mean years of fathers' education was lower than those in normal weight children; this relationship was close to significant ($p = .0541$). Approximately 66% of parents accurately perceived their children's weight status in this study. Parental perceptions about their children's weight status were more likely to be accurate for parents of overweight children than in parents of normal weight children ($p = .0772$). Parenting stress scores in parents of obese children were higher, on average, than those in normal weight and overweight children, but this relationship was not significant ($p = .7103$).

Table 4.6.1

Relationships between Weight Status in Children and Children's Risk Factors

	Children's Weight Status				
	Underweight	Normal	Overweight	Obese	
	n=12	n=59	n=8	n=9	
Children's Risk Factors	% (n)	% (n)	% (n)	% (n)	*p*
Children's age					0.4078
Range	8-11	7-11	8-11	8-11	
Mean (SD)	10.17 (0.94)	9.71 (1.19)	10.25 (1.04)	10.00 (1.12)	
Children's sex					0.4132
Male	58.33 (7)	77.97 (46)	62.50 (5)	77.78 (7)	
Female	41.67 (5)	22.03 (13)	37.50 (3)	22.22 (2)	
Severity of disability					0.1587
Mild/Moderate ID	58.33 (7)	57.63 (34)	87.5 (7)	88.89 (8)	
Severe ID	41.67 (5)	42.37 (25)	12.5 (1)	11.11 (1)	

Note. ID = Intellectual disability

Table 4.6.2

Relationships between Children's Weight Status and Parental Risk Factors

	Children's Weight Status				
	Underweight	Normal	Overweight	Obese	
	n=12	n=59	n=8	n=9	
Parental Risk Factors	% (n)	% (n)	% (n)	% (n)	*p*
Father's BMI					0.6462
Range	18.11-25.95	17.30-28.73	21.26-27.68	19.38-31.38	
Mean (SD)	22.85 (2.48)	23.55 (2.34)	24.12 (2.66)	24.11 (3.35)	
Underweight	9.09 (1)	1.72 (1)	0 (0)	0 (0)	0.3460
Normal weight	45.45 (5)	43.10 (25)	42.86 (3)	33.33 (3)	
Overweight	18.18 (2)	24.14 (14)	14.29 (1)	33.33 (3)	
Obesity	27.27 (3)	31.03 (18)	42.86 (3)	33.33 (3)	
Mother's BMI					0.0552
Range	16.02-25.11	16.79-28.04	18.66-27.24	21.34-38.63	
Mean (SD)	21.37 (2.62)	21.55 (2.82)	22.60 (2.62)	24.58 (5.42)	
Underweight	16.67 (2)	16.36 (9)	0 (0)	0 (0)	0.6419
Normal weight	66.67 (8)	56.36 (31)	71.43 (5)	44.44 (4)	
Overweight	8.33 (1)	14.55 (8)	14.29 (1)	44.44 (4)	
Obesity	8.33 (1)	12.73 (7)	14.29 (1)	11.11 (1)	

	Children's Weight Status				
	Underweight	Normal	Overweight	Obese	
	n=12	n=59	n=8	n=9	
Parental Risk Factors	% (n)	% (n)	% (n)	% (n)	*p*
Fathers' education					0.0541
Range	9-20	6-20	12-16	6-16	
Mean (SD)	13.73 (3.04)	14.72 (2.53)	13.43 (1.51)	12.33 (3.08)	
College	45.45 (5)	67.24 (39)	57.14 (4)	55.56 (5)	0.1604
High school	45.45 (5)	31.03 (18)	42.86 (3)	22.22 (2)	
Middle school	9.09 (1)	0 (0)	0 (0)	11.11 (1)	
Elementary school	0 (0)	1.72 (1)	0 (0)	11.11 (1)	
Mothers' education					0.0967
Range	9-18	6-18	12-16	6-14	
Mean (SD)	13.58 (2.68)	13.89 (2.44)	12.86 (1.57)	11.78 (2.33)	
College	41.67 (5)	54.55 (30)	42.86 (3)	22.22 (2)	0.2124
High school	50.00 (6)	40.00 (22)	57.14 (4)	66.67 (6)	
Middle school	8.33 (1)	3.64 (2)	0 (0)	0 (0)	
Elementary school	0 (0)	1.82 (1)	0 (0)	11.11 (1)	
Accuracy of parental perceptions					0.0772
Accurate	66.67 (8)	45.76 (27)	50.00 (4)	100.00 (9)	
Underestimation	50.00 (0)	22.03 (13)	12.50 (1)	0 (0)	
Overestimation	33.33 (4)	32.20 (19)	37.50 (3)	0 (0)	

	Children's Weight Status				
	Underweight	Normal	Overweight	Obese	
	n=12	n=59	n=8	n=9	
Parental Risk Factors	% (n)	% (n)	% (n)	% (n)	*p*
Parenting stress					0.7103
Range	78-122	68-155	72-127	84-133	
Mean (SD)	99.08 (15.93)	99.20 (18.14)	96.75 (17.14)	105.89 (17.28)	

Study Aim 3

Two sets of logistic regression analyses were performed to assess whether relationships varied between those who had Korean dietary pattern score versus those who had Westernized dietary pattern score. The first set of logistic regression analysis was conducted on child's weight status with two categories, normal weight and overweight as an outcome variable, and nine independent variables: children's age, children's sex, severity of disability, father's BMI, mother's BMI, years of parental education, accuracy of parental perception about their child's weight status, parenting stress, and Korean dietary pattern scores. Another set of logistic regression analysis was similarly conducted with one categorical outcome variable and nine independent variables including Westernized dietary pattern scores.

Question 5: Relationships between Korean Dietary Pattern and Weight Status in Children

Regression coefficients, Wald statistics, odds ratios (OR), and 95% confidence intervals (CI) for odds ratios measuring the relationships between children's and parental risk factors, Korean dietary pattern scores and weight status in children are presented (Table 4.7.1). A test of the full regression model, with all nine predictors against a constant-only model, was statistically significant (χ^2 (7, N=76) = 23.95, p = .004), indicating that the factors were informative in distinguishing between normal weight children and overweight or obese children.

Table 4.7.1

Logistic Regression of Relationships between Children's and Parental Risk Factors, Korean Dietary Pattern Scores, and Overweight in Children with ID

Risk Factors	*B*	Wald Chi-Square	OR	95% CI Lower	95% CI Upper	*P*
Children's age	0.48	4.73	1.62	0.736	3.556	0.2314
Children's sex						0.8064
Male	Reference					
Female	0.22	0.06	1.25	0.207	7.565	
Severity of disability						0.0670
Mild or Moderate ID	Reference					
Severe ID	-2.34	3.36	0.09	0.008	1.177	
Father's BMI	0.07	0.18	1.07	0.788	1.448	0.6733
Mother's BMI	-0.05	0.09	0.95	0.709	1.283	0.7549
Parental education	-0.29	5.21	0.75	0.586	0.960	0.0225
Accuracy of parental perceptions						0.2456
Accurate perception	Reference					
Inaccurate perception	-0.93	1.35	0.39	0.081	1.901	
Parenting stress	0.02	0.57	1.02	0.975	1.059	0.4502
Korean dietary pattern						0.0641
Low pattern score	Reference					
High pattern score	-1.68	3.43	0.19	0.032	1.103	

The parental risk factor, parental education (OR = .75, 95% CI: 0.586-0.960, p = .02), was associated with children's overweight status. The odds of overweight in children decreased as years of parental education increased (OR = .75). In addition, Korean dietary pattern scores approached significance as a risk factor or children's overweight (OR = .19, 95% CI: 0.032-1.103, p = .06). This can be interpreted as low Korean dietary pattern scores were associated with higher odds of being overweight, controlling other risk factors.

Question 6: Relationships between Westernized Dietary Pattern and Weight Status in Children

The second set of logistic regression analysis was performed using children's and parental predictors, and Westernized dietary pattern scores (Table 4.7.2). A test of the full model with all nine predictors against a constant-only model was statistically significant (χ^2 (7, N=76) = 21.05, p = .012), indicating that the factors were informative in distinguishing between normal weight children and overweight or obese children. Two risk factors, severity of disability (OR = .07, 95% CI: 0.006-0.888, p = .0402) and parental education (OR = .78, 95% CI: 0.623-0.972, p = .0272), were significantly associated with children's overweight status in this set of logistic regression analysis. Mild or moderate ID was significantly more likely to be related to overweight than severe ID. The odds of overweight in children decreased as years of parental education increased (OR = .78). There was no significant relationship between Westernized dietary pattern scores and overweight in children.

Table 4.7.2

Logistic Regression of Relationships between Children's and Parental Risk Factors, Westernized Dietary Pattern Scores, and Overweight in Children with ID

Risk Factors	*B*	Wald Chi-Square	OR	95% CI Lower	95% CI Upper	*P*
Children's age	0.20	0.37	1.22	0.641	2.336	0.5408
Children's sex						0.7430
Male	Reference					
Female	-0.29	0.11	0.75	0.130	4.297	
Severity of disability						0.0402
Mild or Moderate ID	Reference					
Severe ID	-2.65	4.21	0.07	0.006	0.888	
Father's BMI	0.12	0.63	1.13	0.841	1.506	0.4275
Mother's BMI	-0.06	0.19	0.94	0.707	1.247	0.6641
Parental education	-0.25	4.88	0.78	0.623	0.972	0.0272
Accuracy of parental perceptions						0.3867
Accurate perception	Reference					
Inaccurate perception	-0.71	0.75	0.49	0.099	2.450	
Parenting stress	0.01	0.33	1.01	0.973	1.051	0.5643
Westernized dietary pattern						0.3335
Low pattern score	Reference					
High pattern score	0.76	0.94	2.14	0.459	9.930	

Summary

Using exploratory factor analysis, two distinct dietary patterns were derived from 3-day food records of children with ID. A "Korean dietary pattern" was the first obtained, which had high factor loadings on foods such as vegetables and fruits, fish, kimchi, and beans. The second component labeled "Westernized dietary pattern" loaded highly on foods such as meats, potatoes, Korean style grains, sugary foods, and eggs.

Study Aim 1

When examining the relationships between dietary pattern scores and children's risk factors, children's age was significantly associated with Korean dietary pattern scores in a positive direction. Children with mild or moderate ID had higher scores on the Westernized dietary pattern than children with severe ID. Among the relationships between dietary pattern scores and parental risk factors in children, parenting stress was significantly positively related to Korean dietary pattern scores. Furthermore, the Westernized dietary pattern scores were significantly related to mother's BMI in that mothers with higher BMI values were found to have children with higher scores on the Westernized dietary pattern. Fathers' education was negatively associated with Westernized dietary pattern scores.

Study Aim 2

Children's weight status was not found to be significantly associated with parental risk factors, including fathers' BMI, mothers' BMI, fathers' education, mothers' education, parental perception about their children's weight status, and parenting stress. Although the significant associations were not identified between children's weight status and children's or parental risk factors, including children's age, sex, and severity of disability, mothers' BMI (p = .0552) and years of fathers' education (p = .0541) were close to be significant. In

addition, parental perceptions about their children's weight status were more likely to be accurate in parents of overweight children than in parents of normal weight children..

Study Aim 3

This study identified that severity of disability and parental education were significant factors of overweight in children with ID when other children's and parental risk factors are controlled. Mild or moderate ID had higher odds of overweight than severe ID. Lower level of parental education was associated with overweight in participating children. In addition, the relationship between lower scores on the Korean dietary pattern and an increased risk of overweight in children approached statistical significance, when controlling for children's and parental risk factors. No association between Westernized dietary pattern scores and overweight in children was observed.

CHAPTER 5

DISCUSSION

Conclusions

The purpose of this study was to identify the relationships between children's and parental risk factors, children's dietary patterns, and weight status in Korean children with ID aged 7 to 11 years. As part of this investigation, exploratory factor analysis was used to identify dietary patterns in participating children. Using children's (n=88) dietary intake data that were collected from parents and teachers, two dietary patterns were identified, the "Korean dietary pattern" and "Westernized dietary pattern." The Korean dietary pattern was high in vegetables, fruits, fish, kimchi, and beans. The "Westernized dietary pattern" was high in meats, potatoes, Korean style grains, sugary foods, and eggs.

In this study, two risk factors, severity of disability and parental education, were significantly associated with overweight in children with ID. Children with mild or moderate ID had a greater likelihood of being overweight when compared with children with severe ID. And, children whose parents had lower levels of education were more likely to be overweight than children whose parents had higher levels of education. Furthermore, low scores on the Korean dietary pattern were associated with a greater risk of being overweight in children; whereas Westernized dietary pattern scores were not associated with the risk of childhood overweight. This suggests that the Korean dietary pattern, characterized as frequent consumption of vegetables, fruits, fish, kimchi, and beans, may

facilitate healthier weight patterns in children with ID when compared with the Westernized dietary pattern.

In this chapter, significant findings from this study and possible explanations for inconsistent findings in previous research are presented. The study's strengths and limitations are described. Finally, the implications for school nursing practice, nursing models, and future research are explored.

Study Aim 1: Relationships between Dietary Patterns, Children's and Parental Risk Factors in Children with ID

Dietary Patterns in Children with ID

Findings from this study provide important insights into the relationships between dietary patterns and overweight in Korean children with ID aged 7 to 11 years. Using exploratory factor analysis, two distinct dietary patterns were derived from 3-day food records of children with ID, the Korean dietary pattern and Westernized dietary pattern. The Korean dietary pattern is high in vegetables, fruits, fish, kimchi, and beans. The Westernized dietary pattern is high in meats, potatoes, Korean style grains, sugary foods, and eggs. This finding is supported by previous studies which have identified two dietary patterns, including "healthy dietary patterns" and "Western dietary patterns" (Fung et al., 2004; Heidemann et al., 2008; Osler et al., 2002; Schulze et al., 2006; Qi et al., 2009). In the U.S. Nurses' Health Study II of 51,670 women, two dietary patterns were derived by factor analysis, the Western dietary pattern and the prudent dietary pattern. The prudent dietary pattern has also been called a healthy dietary pattern (Schulze et al., 2006). Two dietary patterns, prudent pattern and Western pattern, were also observed through factor analysis in a study of 72,113 women that evaluated the relationship between dietary patterns

and all-cause mortality related to chronic disease (Heidemann et al., 2008). Some studies have discussed additional dietary patterns; yet the majority of identified published studies discussing dietary patterns have described patterns that share components of both the Korean or Western patterns identified in the current study. For example, in the Baltimore Longitudinal Study of Aging, five dietary patterns were identified, including "healthy dietary pattern," "white bread," "alcohol," "sweets," and "meat and potatoes" (Newby, Muller, Hallfrisch, Qiao, Andres, & Tucker, 2003). These dietary patterns could be more simply classified as "Healthy dietary pattern" and "Western dietary pattern" because four of the patterns, including white bread, alcohol, sweets, meat and potatoes, share components of the Western dietary pattern. Finally, dietary patterns are similar across different cultures, despite different methods of data collection and analysis and different types and numbers of foods consumed.

Relationships between Dietary Patterns and Parental BMI

Interestingly, this study found a significant positive relationship between mothers' BMI and children's Westernized dietary pattern scores. Several previously published studies have attempted to examine the relationships between sociodemographic factors and dietary patterns (Aranceta, Perez-Rodrigo, Ribas, & Serra-Majem, 2003; Deshmukh-Taskar, Nicklas, Yang, & Berenson, 2007; Jouret et al., 2007; O'Dea & Wilson, 2006). However, peer-reviewed published studies examining the relationship between mother's BMI and children's dietary pattern scores have been identified in typically developing children or those with ID. The positive relationship found between mothers' weight status and children's dietary patterns may best be explained by the obesogenic family environment.

It is assumed that parents contribute to an obesogenic environment that can lead to accelerated weight gain for both themselves and their children through poor dietary patterns.

Relationships between Dietary Patterns and Parental Education

This study found an association between fathers' education and Westernized dietary pattern scores. Higher educational levels in fathers were associated with lower scores on the Westernized dietary pattern. However, previously published peer-reviewed studies identifying the relationships between fathers' education and dietary patterns have not been identified.

The associations between parental education and dietary patterns in typically developing children have been observed in previous studies (Cooke et al., 2004; Johnson et al., 2008; North & the Avon Longitudinal Study of Pregnancy and Childhood Study Team, 2000; van der Horst et al., 2007). In the Avon Longitudinal Study of Parents and Children, 1,203 children aged 5 to 9 years were studied to identify dietary patterns. Children's dietary patterns high in meats, fats, and sweets were associated with lower levels of maternal education (Johnson et al., 2008). This suggests that children of less educated mothers are more likely to consume a diet high in meats, fats, and sweets (Johnson et al., 2008). The dietary intake of children whose mothers have been classified as being in lower social classes are more likely to include an intake high in processed sweets and soft drinks. Whereas, mothers in higher social classes are more likely to encourage their children to eat fresh vegetables and fruits compared with mothers of lower social classes (Dynesen, Haraldsdottir, Holm, & Astrup 2003; Kant & Graubard, 2007; Robinson et al., 2004; Vereecken, Keukelier, & Maes, 2004). This demonstrates the association between parents' influence on children's food preferences and dietary intake patterns (Birch & Fisher, 1998; Cullen, Baranowski,

Rittenberry, Cosart, Hebert, & de Moor, 2001; Fisher, Mitchell, Smiciklas-Wright, & Birch, 2002). It is believed that parents with lower educational levels tend to lack nutritional knowledge and therefore their families are more likely to consume Westernized dietary patterns, including fast foods and sweets (Tepper, Choi, & Nayga, 1997; Parmenter & Wardle, 1999). These findings suggest the need to consider the family's socioeconomic status when designing a tailored weight management program and emphasize the parent's vital role in helping children with ID select healthy foods and thereby reduce Westernized foods.

Study Aim 2: Relationships between Weight Status and Children's and Parental Risk Factors in Children with ID

Relationships between Weight Status in Children with ID and Parental BMI

The relationship between mothers' BMI and children's weight status approached statistical significance using ANOVA; although the associations between fathers' or mothers' BMI and overweight in children was not significant in logistic regression modeling. This finding is consistent with previous studies reporting that children's weight status is more closely related to mothers' BMI than fathers' BMI (Cutting et al., 1999; Danielzik et al., 2002). For example, the Kiel Obesity Prevention Study examined the relationships between children's BMI and parental BMI among 3,306 children aged five to seven years. In the Kiel Obesity Prevention Study, children's BMI was more closely associated with mothers' BMI than with fathers' BMI (Danielzik et al., 2002). One possible explanation for the significant relationship between mothers' BMI and children's weight status could be that children's food environment may be shaped more by mothers than fathers (Whitaker et al., 1997). Generally, mothers selected foods and prepared each meal for children and family

members in their home environment. Mothers are often more directly involved in helping their children select foods and develop eating behaviors than fathers.

Relationships between Weight Status in Children with ID and Parental Perception about Children's Weight

The accuracy of parental perceptions about their children's weight status was expected to be associated with overweight in children with ID because parental perceptions are likely to influence children's weight through mediating children's eating and physical activity behaviors (Hill et al., 2003). For children with ID, it is believed that parents who accurately perceived overweight in their children are more likely to intervene with children's health behaviors than those parents who do not accurately recognize overweight in their children. Contrary to expectations, in the current study parental perceptions about their children's weight status was not significantly related to children's weight category.

In this study, approximately 66% of parents accurately perceived their children's weight status. And, over 70% of parents of obese or overweight children accurately perceived their children's weight status. The relatively high percentage of accurate perceptions of weight status in parents of children in this study is surprising. In studies of typically developing children, parents' perception of weight status have shown great variability, ranging from 6.2% to 73% (Parry, Netuveli, & Saxena, 2008). For example, in a national representative sample of 5,500 children in the U.S. aged 2 to 11 years, 42% of mothers accurately perceived their overweight children as being overweight (Maynard et al., 2003). It is unclear why parents of children with ID were more likely to classify their children's weight status accurately when compared to studies of parents of typically developing children. One plausible explanation is that parents of children with ID are more

closely involved with the physical care of their children and are therefore more likely to observe weight and other health problems (Ha et al., 2010).

The relatively high proportion of parents who accurately perceived their children's weight status in the current study was consistent with one previously published study of children with ID (Ha et al., 2010). In the previous study, conducted in six special schools in Korea, 87% of mothers of 206 overweight children with ID correctly classified their children as overweight (Ha et al., 2010). In this study, the accuracy of parental perceptions about children's weight status was lower than in the previously published study (66% vs. 87%). One plausible explanation may be that fathers' and mothers' perceptions differ with respect to assessing their children's weight status. For example, it has been reported that mothers ere significantly more likely than fathers to be concerned about identifying weight problems in their children (Adams et al., 2005). The current study evaluated both fathers' and mothers' perceptions of weight status; whereas only mothers' perceptions were measured in the previous study (Ha et al., 2010).

Study Aim 3: Relationships between Dietary Patterns and Weight Status in Children with ID

Relationships between Dietary Patterns and Weight Status in Children

Until recently, the relationship between dietary patterns and overweight in children with ID has not been studied extensively and published in scientific literature. The current study found an inverse relationship between Korean dietary pattern scores and overweight in children with ID. The Korean dietary patterns, high in vegetables, fruits, fish, kimchi, and beans, might facilitate appropriate weight gain. Multivariate logistic regression models in this study provided some evidence to suggest that lower scores on the Korean dietary pattern were statistically associated with the risk of developing overweight in children with ID.

These findings are consistent with previous studies that reported that healthy dietary patterns in typically developing children are less likely to be associated with a risk of childhood overweight (Shin et al., 2007; Woodward-Lopez et al., 2006). For example, a "Healthy dietary pattern," characterized by consumption of vegetables, seaweed, kimchi and beans, was inversely related to overweight in typically developing children in Korea (Shin et al., 2007). According to data from the Korean National Health and Nutritional Examination Survey 1998 - 2005, Korean dietary patterns declined from 48% in 1998 to 44% in 2005, and Westernized dietary patterns rose from 34% in 1998 to 36% in 2005 (Song et al., 2009). During this period, the prevalence of overweight or obese children and adolescents greatly increased from 12.3% in 1997 to 20.9% in 2005 (Oh et al., 2008). Although these are aggregate level data, such changes in food consumption patterns are likely to have important implications for helping to explain the increased overweight rates being observed in children.

In previously published studies, the risk of developing childhood overweight was higher in children with Westernized dietary patterns (Johnson et al., 2008; Li et al., 2006; Ritchie et al., 2007; Shin et al., 2007; Song et al., 2009; Woodward-Lopez et al., 2006). Interestingly, in this study no significant relationship was identified between Westernized dietary pattern scores and overweight in children with ID. The majority of published studies have found that Westernized dietary patterns high in meats and sweets were associated with greater odds of excess adiposity in childhood (Johnson et al., 2008; Li et al., 2006; Ritchie et al., 2007; Shin et al., 2007; Song et al., 2009; Woodward-Lopez et al., 2006). Using data from 1,203 children aged 5 to 9 years, one study found that dietary patterns characterized as high in sweets and meats were associated with greater odds of excess adiposity in children (Johnson et al., 2008). Several Korean studies have found that

Westernized dietary patterns, characterized as a higher consumption of meat and meat products and sweets, were significantly associated with childhood overweight when compared to Korean traditional dietary patterns high in vegetables, kimchi, and fish (Li et al., 2006; Shin et al., 2007; Song et al., 2009).

Westernization of the culture, over the past three decades in Korea, has resulted in major changes in food sources and food intake in Korean children (Kim et al., 2000). Korean traditional diets have rapidly changed over the past century as Westernized diets, sometimes characterized by animal-based food products and fast foods, have greatly increased (Kim et al., 2000; KFDA, 2003). Evidence of the association between Westernized dietary patterns and overweight in children with ID was not observed in the current study. A potential explanation for the differences observed between the current results and previous studies may be differences in the types of foods that were included in the Westernized dietary pattern in the respective studies. For example, in this study, a "Korean style grain" (e.g., white rice) was classified in the Westernized dietary pattern as an unhealthy food group, whereas it was classified as a healthy food group in other studies (e.g., barley, brown rice, black rice, millet) (Li et al., 2006; Shin et al., 2007). Variations in assignment of foods to dietary patterns may account for some observed difference between results in the current study and previously published studies.

Relationships between Severity of Disabilities and Weight Status in Children with ID

The severity of intellectual disability was expected to be associated with overweight in children in this study. Children diagnosed with mild or moderate ID were found to have a significantly higher risk for developing overweight compared to children with severe ID after controlling for other risk factors of overweight. This result was consistent with

previous studies in adults with ID using the same or similar measures for severity of intellectual disability (Fox & Rotatori, 1982; Hove, 2004; Kelly et al., 1986; Moran et al., 2005; Rimmer et al., 1993; Robertson et al., 2000). In studies of adults with ID using multivariate analyses, severity of disability was identified as an independent risk factor for adult obesity. These studies also found that the prevalence of obesity increased as the severity of disability decreased from profound ID to mild ID (Fox & Rotatori, 1982; Hove, 2004; Moran et al., 2005; Robertson et al., 2000).

While studies of adults with ID suggest a strong relationship between the severity of disability and obesity, most studies in children have not found this same relationship between the severity of ID and obesity (De et al., 2008; Fox et al., 1985; Lin et al., 2005). In an Australian study of 98 children with ID and developmental delay aged 2 to 18 years, severity of disability was classified into three levels; mild, moderate and severe or profound (De et al., 2008). No differences were identified in the prevalence of overweight in children with ID when stratified by the severity of their disability (De et al., 2008). A study in Taiwan, with a representative sample of 279 children with ID aged 4 to 18 years, used four levels of disability and found no significant relationship between the severity of disability and overweight (Lin et al., 2005).

The possible reasons for the discrepancies in findings concerning the relationship between ID and overweight, between adults and children are not clear. One possible explanation may be that adults with mild or moderate ID have greater access to and a wider selection of foods (Kelly et al., 1986; Robertson et al., 2000); while children with mild or moderate ID depend on their parents or other adults to access and choose their foods. Furthermore, severity of disability may influence dietary intake in children with ID because

of physiologic or other factors. Several studies have evaluated the nutritional status of children with severe ID (Sanchez-Lastres, Eiris-Punal, Otero-Cepeda, Pavon-Belinchon, & Castro-Gago, 2003) and have found that children with severe ID, due to epilepsy or other neurological problems, were malnourished due to oral motor problems that affect feeding (Sanchez-Lastres et al., 2003). Whether these differences between overweight in adults and children with ID result from environmental causes, poor appetite, or an interaction of physiologic factors is not understood.

Relationships between Parental Education and Weight Status in Children with ID

Families who parent children with disabilities tend to be from a lower socioeconomic status (SES) (Emerson & Hatton, 2007a, 2008; U.S. Census Bureau, 2003). Families of lower SES have been shown to have lower health status, on average, compared with families of higher SES, independent of intellectual disabilities (Emerson & Hatton, 2007a; Graham, 2005). Therefore, families of lower SES who care for children with disabilities may be expected to have greater health challenges (Emerson & Hatton, 2007a, 2007b; Fujiura & Yamaki, 2000; Graham, 2005; Leonard, 2002). As expected this study found an inverse relationship between parental education and prevalence of childhood overweight in children with ID. Low levels of parental education were significantly related to greater risk of childhood overweight. This finding is supported by previous studies focusing on the relationships between parental education and overweight in typically developing children (Baltrus, Everson-rose, Lynch, Raghunathan, & Kaplan, 2007; Juliusson, Eide, Roelants, Waaler, Hauspie, & Bjerknes, 2010; Lamerz et al., 2005; Shrewsbury & Wardle, 2008). In a systematic review of cross-sectional studies from 1990 to 2005, parental education levels were negatively associated with childhood overweight (Shrewsbury & Wardle, 2008). In a

Norwegian study using a nationally representative sample of 6,386 children, low levels of parental educational were associated with an increased likelihood of overweight in children (Juliusson et al., 2010). One possible explanation for the negative relationship between parental education and childhood overweight is that highly educated parents pay more attention to their children's weight (Danielzik, et al., 2002; Danielzik, Czerwinski-Mast, Langnase, Dilba, & Muller, 2004). Furthermore, preferences in children's dietary intake may be explained by differences in parents' nutritional knowledge. For example, educated parents are more likely to have knowledge about healthier foods and incorporate those choices into a healthier diet (Wardle, Parmenter, & Waller, 2000); while less educated adults may lack nutritional knowledge and have a tendancy consume greater amounts of fast food and sweets (Tepper, Choi, & Nayga, 1997; Parmenter & Wardle, 1999).

Only one identified study has focused on the relationship between SES and overweight in Korean children with ID, and they found that the relationships between SES and overweight children with ID were not significant (Ha et al., 2010). The previous study, consisting of 206 Korean children from six special schools, measured family income as an indicator of SES. The relationship between family income, an indicator of SES, and overweight children with ID was not found to be significant (Ha et al., 2010). The previously reported results differ from the findings of the current study and may be explained by the potential biases associated with use of self-reported income data as well as the complexity of appropriately measuring SES. In Korea, "family income" may not be a good indicator for measuring SES because many Korean families are reluctant to report their income to others through a self-reported questionnaire and frequently fail to complete the item "family income." As a result, these non-significant findings may be partially

explained by nonresponse bias due to 18% of missing data which may distort the study findings in the previous study. For these reasons, the current study used parental education as an indicator of SES when estimating associations between SES and overweight in children with ID. Future studies using larger and diverse samples are needed to clarify relationships between SES and overweight in children with ID.

Relationships between Parental BMI and Weight Status in Children with ID

Based on an understanding of how childhood overweight can be influenced by parents, this study's findings that fathers' and mothers' BMI were not significantly associated with overweight in children with ID was not expected. These results are in contrast to previous studies that found a significant relationship between parental BMI and childhood overweight in typically developing children (Agras et al., 2004; Burke et al., 2001; Danielzik et al., 2002; Davison & Birch, 2002, 2005; Fiore et al., 2006; Kosti et al., 2008; Whitaker et al., 1997). In previous studies, the most powerful, identified risk factor for childhood overweight was having obese parents (Agras et al., 2004; Agras & Mascola, 2005; Blair et al., 2007; Burke et al., 2001; Fiore et al., 2006; Whitaker et al., 1997; Wu & Suzuki, 2006). The reason for these conflicting results is unclear. It is possible that unmeasured environmental influences on children's BMI or some unknown genetic influences may have influenced the study findings (IOM, 2005; Marti et al., 2008).

Relationships between Parenting Stress and Weight Status in Children with ID

Generally, parents of children with ID report higher levels of child-related stress and a lower feeling of parenting competence than parents of typically developing children (Hastings & Lloyd, 2007; Singer, 2006). Due to high parenting stress, parents of children with special care needs may feed their children more frequently in order to pacify them, and

thus contribute to childhood overweight (Parsons et al., 1999). This phenomenon was demonstrated in a prospective longitudinal study designed to identify risk factors for childhood overweight. Parents frequently offered food to their difficult children to reduce the frequency of tantrums, particularly when the children demonstrated food-related tantrums (Agras et al., 2004). As a result, it was expected that the high parenting stress might be associated with overweight in children with ID.

A non-significant relationship was observed between parenting stress and overweight children with ID. This non-significant association is supported by another published study that focused on the relationship between overweight in typically developing children and parenting stress (Guilfoyle, Zeller, & Modi, 2010). Investigators in that study found that parenting stress was not significantly associated with children's body weight. Possible explanation for the non-significant relationship between parenting stress and overweight in children in the current study is that the PSI-SF may not be the best instrument for capturing context-specific parenting stress related to childhood overweight. The PSI-SF is most commonly used to identify dysfunctional parent-child relationships in children with disabilities, not necessarily to identify dysfunctional parent-child relationships in overweight children with disabilities (Deater-Deckard, 2004). An obesity-specific parenting stress measurement may be more effective in capturing the relationship between parental stress and the weight status of children with ID.

Strengths and Limitations

Study Strengths

The major strength of this study is that this is the first published study that examines the relationships between childhood overweight and multiple risk factors, including dietary

intake. Specifically, the findings of this study can provide a baseline for future studies of the variance of childhood overweight in the population. By increasing the collective understanding of the risk factors that contribute to overweight in children with ID, the findings of this study may, in combination with the results of other scientific inquiry, be useful for designing future overweight prevention programs targeting children with ID.

A second strength of this study is the homogeneity of the study sample. The age of participating children was limited to 7 to 11 years. The homogeneous age group of children in the sample is meaningful because their developmental characteristics are likely to be similar. Furthermore, children with ID having co-occurring cerebral palsy, Prader-Willi syndrome, or Down's syndrome were excluded in this study because growth and development of those children is generally different from other children with ID. For example, Prader-Willi Syndrome (PWS) is a highly variable genetic disorder affecting multiple body systems whose most consistent major manifestations include mild intellectual disability, growth hormone insufficiency causing short stature, and early childhood-onset obesity (Cassidy & Driscoll, 2009). Thus, a major cause of morbidity and mortality of PWS is morbid obesity. Children with ID having co-occurring cerebral palsy may have an altered body composition due to oral motor problems, physical inactivity and nutrition problems (Bandini et al., 2005; Hurvitz et al., 2008). In addition, children with mild cerebral palsy not having oral motor problems are likely to be overweight because of decreased physical inactivity (Hurvitz et al., 2008). This strongly suggests that children with ID and co-occurring cerebral palsy, PWS, or Down's syndrome may be more susceptible to either underweight or overweight than children with ID alone.

Third, food records used in this study may be a more valid measure of diet assessments for children with ID when compared with other dietary assessments such as food frequency questionnaires (FFQ) and food histories. Food records providing detailed information regarding food intake are appropriate for this population because little is known about food intake in children with ID. Measuring dietary intake of children with ID can be challenging because children, because of low cognitive abilities, may have difficulty recalling and quantifying food consumption. Typically, parents of children with ID are valuable resources for documenting their children's food intakes because they are usually familiar with their children's eating behaviors and typically preparetheir food (Brent, 2001, p. 222). Generally, a parent proxy can be a valuable source of information about children's dietary intake and may be used as an alternative to a child's self-report (Sprangers & Aaronson, 1992).

There is a risk that parents may under-report critical values when recording or measuring dietary intake (IOM, 2005; Livingstone, Robson, & Wallace, 2004) because they may not be able to consistently observe in- and out-of-home eating in their children (IOM, 2005; Livingstone, Robson, & Wallace, 2004). To reduce under-reporting, dietary data can be obtained through dietary assessments by a qualified interviewer (McCabe-Sellers, Bowman, Stuff, Champagne, Simpson, & Bogle, 2007). Therefore, the 3-day food records were supplemented with telephone calls by qualified interviewers, used to reduce the probability of under-reporting and recall bias in this study. Follow-up telephone calls for dietary assessments to parents were conducted by senior university students who were majoring in nutrition to increase the accuracy of dietary reporting. The primary language spoken by the research assistants was Korean. Each research assistant had clinical

experience with conducting nutritional surveys as well as strong background in the field of nutrition. Before data collection began, the research assistants were trained by the PI in how to obtain the children's dietary intake.

Limitations

The limitations of the study should be considered when interpreting the results. The major limitation of this study is its small sample size. Generally, the most important component affecting statistical power is the sample size, (Lipsey, 1990, p.137). Although the power in this study is somewhat low (0.71) because of the small sample size, it may be sufficient for rejecting the null hypotheses.

Second, a convenience sample from two metropolitan areas in South Korea was used for this study; which is likely to reduce the generalizability of findings. Participants from rural areas or small cities were not recruited for this study. It is possible that the characteristics of participants living in metropolitan areas may be different when compared to children with ID living in rural areas or small cities in South Korea. Dietary patterns and physical activities in families of children with ID can vary between families living in metropolitan areas and families living in rural areas or small cities (Cleland et al., 2010). In the Resilience for Eating and Activity Despite Inequality (READI) study, designed to compare the weight status of women and children living in 40 rural areas and 40 urban areas, the BMI of women and children living in rural areas was significantly higher than those living in urban areas (Cleland et al., 2001). Therefore, a future study with a larger and more representative sample of children with ID, from various geographical areas in South Korea is needed to potentially increase generalizability within the country.

Third, a large variability in the response rate was found in participating schools, ranging from 44% to 90%. Although the total response rate (63%) supports the credibility of the results, the large variability in the response rate of this study may reflect some sampling bias, which may indicate that those who did not to respond may differ with respect to some variable of interest. This study was conducted in two metropolitan areas. Daegu is the third largest city and Seoul is the largest city in Korea. The response rates of three special schools in Daegu ranged from 44% to 64%, whereas one special school in Seoul completed questionnaires with a 90% response rate. The differences in response rates may be explained by parental characteristics. The parents living in Seoul generally had higher educational levels than those residing in Daegu. Thus, it is possible that parents with higher educational levels living in Seoul may be more interested and motivated to complete a survey aimed at improving the health status of their children with ID.

The fourth limitation of this study is the lack of objective measurements to validate dietary intake for children with ID. Although the food record is viewed as the gold standard for dietary assessments, it may not represent periods of typical intake, may contain error, and may under- or overestimate actual nutrient intakes (Subar et al., 2001). In order to validate a diet assessment, one must generally have a standard against which the instrument can be measured. Biomarkers are often used as relatively ideal standards in some types of assessments because they do not rely on the subject's reporting. Unfortunately, there are many dietary components for which biomarkers are not available, making them an impractical standard (Block, Coyle, Hartman, & Scoppa, 1994).

The fifth limitation of this study is that the cross-sectional study design cannot provide a causal inference for risk factors of childhood overweight nor test hypothese.

Cross-sectional studies are generally hypothesis-generating studies that can provide information about populations either at one point or at a series of points in time, but are unable to provide information about cause and effect (Polit & Beck, 2004, p. 167). Longitudinal research or experimental designs are more likely to provide better insights into causal relationships compared with cross-sectional studies that identify descriptive data or associations (Lynn, 2009, p. 6; Menard, 2002, p. 3). A prospective cohort study may provide great insights regarding the etiologic impact of children's characteristics, parental characteristics, and food intakes on childhood overweight over time.

The sixth study limitation pertains to the measurement of heights and weights of children and mothers by a school nurse in each special school who had not received specific training. The lack of height and weight measurement training could lead to variability between special schools. In Korean school systems, children's height and weight screenings are conducted annually. The school nurses assisting with the study had more than five years of school nursing experience, including measuring children's heights and weights using national guidelines. Although school nurses have experiences with measuring children's heights and weights, the lack of consistent training could lead to subjectivity in measurement. Subjectivity may create the potential for variability across special schools and inter-rater reliability.

Another study limitation was the omission of statistical adjustment for the potential effect of antiepileptic medications on childhood overweight. In this study, 36% of children with ID were on some type of medications, and of these children, 65% were on an antiepileptic medication. Although all antiepileptic medications do not contribute to overweight and obesity, certain antiepileptic medications, such as valproic acid,

carbamazepine, gabapentin, and vigabatrin, may be a compounding factor in the development of overweight in children with epilepsy (Biton, 2003). Weight gain is a frequently reported side effect of antiepileptic medications; however, it is unclear if the high rate of overweight in children with epilepsy is coincidental or a result of other common mechanisms, (Verrotti, la Torre, Trotta, Mohn, & Chiarelli, 2009; Daniels, Nick, Liu, Cassedy, & Glauser, 2009).

The final limitation of this study was the incomplete testing of the modified Vulnerable Populations Model. For the proposed model to be tested a stronger study design is needed as well as several pre-requisites: (1) interrelationships between variables should be identified because of the need for imposing a hypothesized linear order; (2) quantitative instrumentation for each of the model constructs ; and (3) the model should be tested using structural equation modeling techniques or path analysis which may provide estimates of the goodness of fit of the models (Schumacker & Lomax, 2004; Tabachnick & Fidell, 2006, p.680). Because studies of the interrelationships between multiple risk factors and overweight in children with ID haves not been identified, interrelationships are identified first and then testing of the model can be conducted in future studies using alternative study designs. This study examined relationships derived from the Vulnerable Populations Model, such as the relationships between multiple risk factors and overweight in children with ID, but did not specifically test the full model.

Implications for School Nursing Practice

Health education, as part of a coordinated school health program, is an essential part of childhood overweight prevention (Story et al., 2006). Both nutrition and physical health education can help children adopt healthy eating patterns and physically active lifestyles (CDC, 2008). In Korea, health education and physical education in the special school

system may serve as the most effective resources for children with ID because parents may have difficulty accessing trained special educators and exercise facilities outside of the school system. Health education provided by a school nurse and physical education provided by a special school teacher are required for children with ID in the 5th and 6th grade elementary school curriculum in Korea. Healthy food choices can result from appropriate nutritional knowledge; and thus, health education, including nutrition and overweight prevention programs, is needed. Although the results of this study are descriptive only, this is a first step toward suggesting that school health education may need to focus on retaining Korean dietary patterns, which tend to be high in vegetables and fresh fruits. The evidence from this study, combined with other scientific knowledge, suggest that school nurses may want to discourage school children from consuming highly Westernized dietary patterns that are high in fat and fast foods.

The findings from this study provide one small step in the process of collecting sufficient information that can be used to develop overweight prevention strategies aimed at decreasing childhood overweight and maintaining ideal body weight in children with ID. The school setting is an ideal environment to enhance healthy dietary patterns and physical activity behaviors for children (IOM, 2005; Lobstein et al., 2004; Story, Kaphingst, & French, 2006) because over 95 % of children and adolescents are enrolled in schools. No other institution has as much continuous contact and influence on children during their first two decades of life (IOM, 2005; Koplan et al., 2005; Story, Kaphingst, Robinson-O'Brien, & Glanz, 2008). Therefore, school based prevention programs or interventions for weight control have the potential to positively influence lifelong eating and exercise habits for children (Katz, 2009; Story et al., 2006).

In many eastern countries it is believed that children with ID should receive intensive, individualized, functional instruction in specialized school settings. Korean special schools may have an opportunity to strengthen children's health by providing health education and various kinds of overweight prevention and intervention strategies. School lunches are designed by a school dietitian to provide one-third of all energy requirements for a day. A physical education and health education are required components of the educational system in South Korea. Therefore, school systems serving children with ID are well positioned to assist children in achieving and maintaining healthy weight by promoting physical activity and healthy eating habits. In particular, it is likely that the Korean special school system may serve as the only available resource for most children with ID because of limited accessibility of trained special educators and exercise facilities outside schools for children with ID.

Korean school nurses have a responsibility to care for children with chronic illnesses and their families, to provide primary health care, including annual physical assessments and basic treatments, and to provide health education in the school setting. While providing emergent, acute, and chronic care, they conduct health screenings from first grade through twelvth grade and assess children's height and weight screening annually. As Korean school nurses are the only source of primary health care and health education in the special schools, they are uniquely positioned for these roles and are the appropriate health care professionals to provide childhood overweight prevention services. Thus, there is expected to be a need for school-based healthy weight promotion programs conducted by school nurses.

Theoretical Implications

The Vulnerable Populations Model, developed by Flaskerud and Winslow (1998), was utilized to conceptualize the relationship among three constructs: resource availability, relative risk, and health status. Vulnerability is affected by both external and internal factors, resource availability and individual risk. Resource availability is viewed as the availability of societal and environmental resources. Relative risk is defined here as the ratio of the risk to develop negative health outcomes for a given exposure. And, health status is defined in this model as an outcome of vulnerability (Sebastian, 2004, p. 754). Three constructs in the model create a cycle of vulnerability in which relative risk and poor resource availability strengthen negative health outcomes. In other words, multiple risk factors lead to the development of negative health outcomes; and adequate resources can provide buffering effects on negative health outcomes or the vulnerability of populations. In this study, a modified model of the Vulnerable Populations Model was used, including two of the three concepts, relative risk and health status. This modified model was developed because this study focused only on identifying risk factors of overweight in children with ID.

To decrease the generally higher rate of overweight in vulnerable populations, it is important to first identify risk factors that contribute to overweight in children with ID. A second important step is to find available resources to assist children with maintaining ideal weight by intervening in the cycle of vulnerability. The current study found that several risk factors of childhood overweight were significantly statistically associated with a higher prevalence of overweight in children with ID. These findings suggest that the higher rate of childhood overweight may be decreased when researchers, clinicians or others intervene in the cycle of vulnerability by decreasing exposure to identifiable risk factors for overweight.

For example, based on findings of this study, it is possible that an alteration in the dietary patterns of children through education of children, parents, or school personnel may be a way to decrease childhood overweight.

Implications for Future Research

The present study contributes to existing literature examining the relationship between multiple risk factors and overweight in children with ID. It also provides several directions for future research. This study has suggested that several factors may contribute to overweight in children with ID aged 7 to 11 years. There is some evidence to suggest that children with mild or moderate ID are more likely to become overweight than children with severe ID. And, it is possible that the risk for developing overweight in children with ID is higher when parents have lower levels of education. To better understand and potentially substantiate these hypothesized relationships, future research should study these relationships using stronger study designs and larger sample from various geographical areas. Furthermore, efforts should be made to increase the response proportions to improve the credibility of research findings. Research which focuses on reasons for nonresponse and strategies for addressing the lack of study participation should be explored in the future studies as well.

Although this study examined the relationship between children's dietary patterns and overweight in children with ID, future research is needed to include other potential risk factors of childhood overweight such as physical activity, eating behaviors, and medications that may influence the development of overweight children with ID. Children with disabilities tend to be less physically active than those without disabilities (Longmuir & Bar-Or, 2000; Rimmer et al., 2004). Recent surveys indicate that 65% of children with

disabilities engage in no leisure-time physical activity, compared with 33% of typically developing children (CDC, 2009). Furthermore, severity of disability may influence dietary intake in children with severe ID through an interaction between physiological or neurological problems and behavioral problems. Several studies evaluating the nutritional status of children with severe ID found that they were malnourished due to oral motor problems that affect feeding and eating behaviors (Eisenhower, Baker, & Blacher, 2005; Sanchez-Lastres, Eiris-Punal, Otero-Cepeda, Pavon-Belinchon, & Castro-Gago, 2003). To identify risk factors significantly contributing to overweight in children with ID, future research that examines both eating behaviors and physical activity may help to better understand the development of overweight.

Another suggestion for future research is to fully test the Vulnerable Populations Model. This study did not include the concept of "resource availability;" but understanding this concept is important for future studies because a lack of adequate resources may increase the vulnerability of children with ID to overweight. According to the original Vulnerable Populations Model, risk factors and available resources that may lead to the development of negative or positive health outcomes are interrelated within a cycle of vulnerability. Child health providers and other advocates could intervene in the cycle of vulnerability by providing resources to promote positive health outcomes. Resource availability is viewed as the availability of societal and environmental resources; it may improve health outcomes in vulnerable population by fostering resilience which is the characteristic of being able to recover from problems and of possessing a sense of inner strength (Sebastian, 2004, p. 754).

Risk of overweight in children with ID may be decreased through several interventions, such as parent education programs and overweight prevention programs. Three types of resources may be important to supporting healthy weight promotion: social resources, economic resources, and educational resources. Social resources include social supports; and economic resources include income (Flaskerud & Winslow, 1998). Of these resources, social support is thought to be a vital resource for families of children with disabilities who are dealing and coping with stressful situations (Dunst, Trivette, & Hamby, 1994; Sarason, Pierce, & Sarason, 1990). Families of children with disabilities may require emotional, physical, financial, and social support resources beyond what is needed by families of children without disabilities (Baxter, Cummins, & Yiolitis, 2000). Families having sufficient support are more likely to have higher levels of parental satisfaction and more likely to be effectively engaged in with health services for their children (Singer & Irvin, 1989). Family researchers have identified several strategies for supporting families, such as parent training and parental empowerment. These interventions may help these families to function at higher levels and to achieve better health outcomes (Floyd & Gallagher, 1997). There is a need to understand the cycle of vulnerability and the kinds of resources and intervention program that may decrease overweight status in children with ID.

The increasing rates of overweight in children with ID are of concern. The present study suggests that several risk factors, including severity of disability, parental education, and Korean dietary patterns, may contribute to overweight in Korean children with ID. However, these findings are only descriptive and do not support causal effects between multiple risk factors of childhood overweight and overweight in children with ID. Furthermore, the current study focused, to a great extent, on measuring dietary patterns in

children with ID. It did not intend to validate dietary patterns using an objective assessment of dietary intakes. As a result, future research, using longitudinal or other hypothesis-testing study designs, is needed to potentially substantiate suggested associations and identify causal relationships between multiple risk factors and overweight in children with ID. Additionally, there is a need to validate dietary intake in children with ID.

Appendix I:

BMI Percentile Table for Boys aged 2-18 years - Korean

Age (y)	BMI Percentile									
	3rd	5th	10th	25th	50th	75th	85th	90th	95th	97th
2 - 2.5	14.00	14.33	14.85	15.72	16.71	17.70	18.24	18.60	19.15	19.51
2.5 - 3	13.96	14.23	14.66	15.41	16.29	17.22	17.75	18.12	18.67	19.05
3 – 3.5	13.93	14.15	14.51	15.16	15.97	16.87	17.41	17.79	18.40	18.82
3.5 - 4	13.88	14.08	14.40	14.99	15.75	16.65	17.21	17.62	18.29	18.78
4 – 4.5	13.83	14.01	14.31	14.88	15.63	16.54	17.13	17.58	18.34	18.90
4.5 - 5	13.77	13.95	14.26	14.83	15.59	16.55	17.17	17.66	18.50	19.14
5 – 5.5	13.72	13.91	14.22	14.82	15.63	16.65	17.32	17.85	18.78	19.49
5.5 - 6	13.68	13.88	14.22	14.86	15.72	16.82	17.56	18.13	19.14	19.93
6 – 6.5	13.65	13.87	14.23	14.93	15.87	17.07	17.86	18.49	19.59	20.44
6.5 - 7	13.64	13.88	14.27	15.03	16.06	17.36	18.23	18.91	20.09	21.01
7 - 8	13.65	13.93	14.38	15.24	16.41	17.89	18.86	19.62	20.93	21.93
8 – 9	13.74	14.06	14.59	15.60	16.97	18.68	19.80	20.66	22.13	23.24
9 – 10	13.91	14.27	14.88	16.04	17.58	19.51	20.76	21.72	23.34	24.54
10 – 11	14.16	14.57	15.24	16.52	18.22	20.34	21.71	22.74	24.48	25.77
11 – 12	14.49	14.93	15.65	17.02	18.86	21.12	22.57	23.67	25.50	26.85
12 – 13	14.89	15.35	16.10	17.54	19.45	21.81	23.32	24.46	26.35	27.75
13 – 14	15.35	15.82	16.59	18.05	20.00	22.40	23.93	25.09	27.02	28.43
14 – 15	15.85	16.32	17.08	18.55	20.49	22.88	24.40	25.56	27.48	28.90
15 – 16	16.38	16.83	17.58	19.01	20.90	23.24	24.74	25.87	27.77	29.16
16 – 17	16.90	17.33	18.06	19.43	21.26	23.51	24.95	26.05	27.89	29.24
17 – 18	17.38	17.80	18.49	19.81	21.55	23.70	25.08	26.13	27.89	29.19
18 - 19	17.80	18.20	18.87	20.14	21.81	23.86	25.18	26.18	27.85	29.08

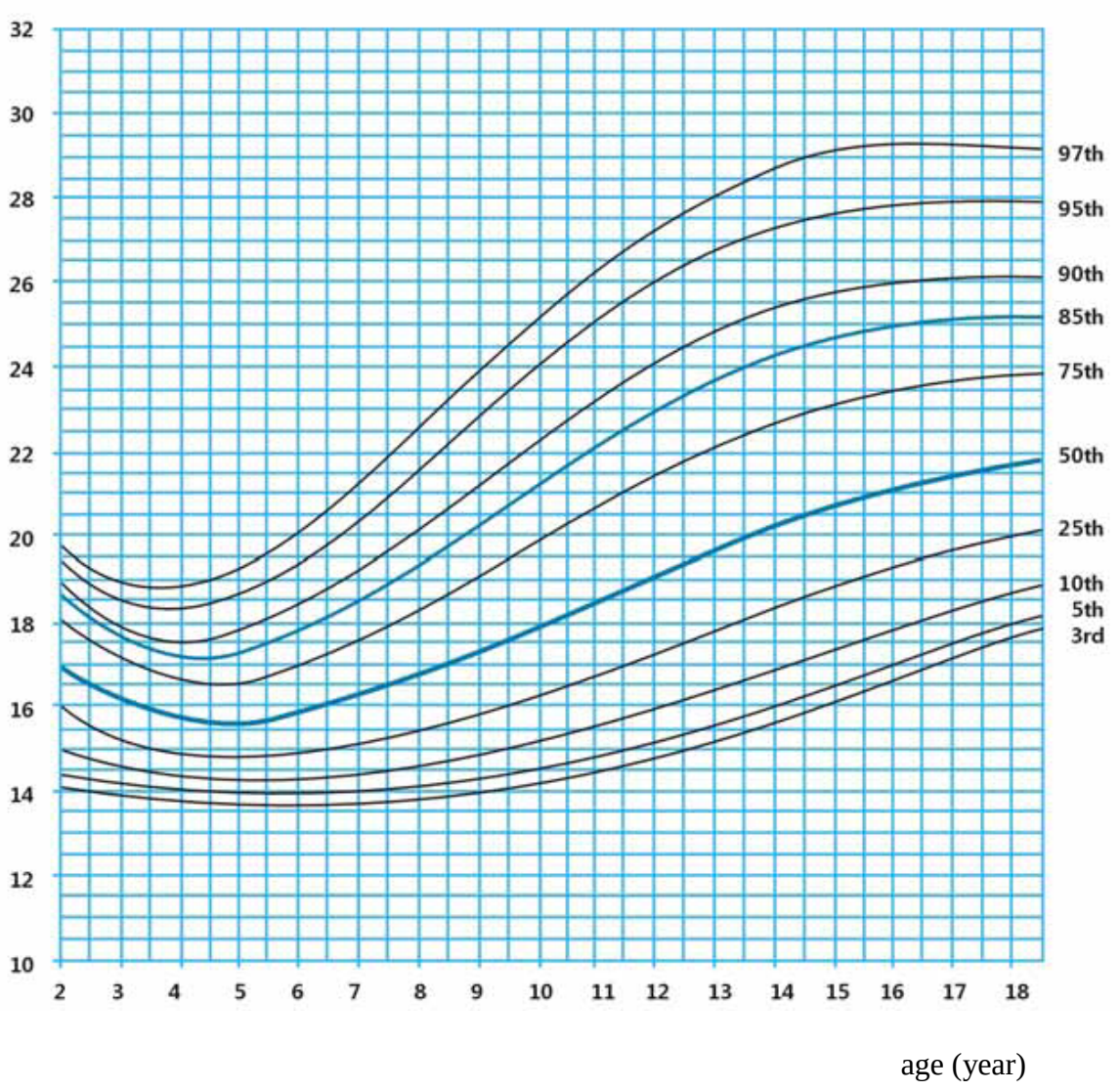
Appendix II:

BMI Percentile Table for Girls aged 2-18 years - Korean

Age (y)	BMI Percentile									
	3rd	5th	10th	25th	50th	75th	85th	90th	95th	97th
2 - 2.5	13.82	14.12	14.58	15.38	16.34	17.35	17.93	18.33	18.94	19.35
2.5 - 3	13.76	14.02	14.42	15.15	16.01	16.96	17.50	17.89	18.48	18.88
3 – 3.5	13.69	13.92	14.29	14.95	15.76	16.67	17.21	17.59	18.19	18.60
3.5 - 4	13.62	13.84	14.18	14.80	15.59	16.49	17.03	17.42	18.04	18.48
4 – 4.5	13.55	13.76	14.09	14.70	15.48	16.39	16.95	17.36	18.03	18.51
4.5 - 5	13.49	13.69	14.02	14.64	15.43	16.38	16.97	17.41	18.13	18.65
5 – 5.5	13.43	13.64	13.98	14.61	15.44	16.44	17.07	17.54	18.33	18.90
5.5 - 6	13.39	13.60	13.96	14.63	15.50	16.56	17.24	17.75	18.61	19.24
6 – 6.5	13.36	13.59	13.96	14.67	15.61	16.75	17.48	18.03	18.96	19.64
6.5 - 7	13.34	13.59	13.99	14.75	15.75	16.98	17.77	18.36	19.36	20.10
7 - 8	13.36	13.63	14.08	14.92	16.04	17.40	18.27	18.94	20.05	20.87
8 – 9	13.47	13.77	14.28	15.24	16.51	18.06	19.05	19.80	21.05	21.98
9 – 10	13.66	14.01	14.57	15.65	17.06	18.78	19.88	20.71	22.09	23.10
10 – 11	13.95	14.33	14.95	16.12	17.65	19.53	20.71	21.61	23.08	24.16
11 – 12	14.33	14.73	15.39	16.64	18.27	20.25	21.51	22.45	23.99	25.11
12 – 13	14.78	15.20	15.89	17.18	18.88	20.93	22.22	23.18	24.77	25.91
13 – 14	15.29	15.71	16.41	17.73	19.45	21.53	22.83	23.80	25.38	26.53
14 – 15	15.83	16.25	16.95	18.26	19.97	22.03	23.31	24.27	25.83	26.96
15 – 16	16.36	16.78	17.47	18.75	20.42	22.42	23.67	24.60	26.11	27.21
16 – 17	16.87	17.27	17.93	19.17	20.77	22.69	23.89	24.78	26.24	27.29
17 – 18	17.30	17.68	18.31	19.49	21.01	22.84	23.99	24.84	26.24	27.25
18 - 19	17.60	17.96	18.56	19.68	21.13	22.88	23.98	24.80	26.15	27.13

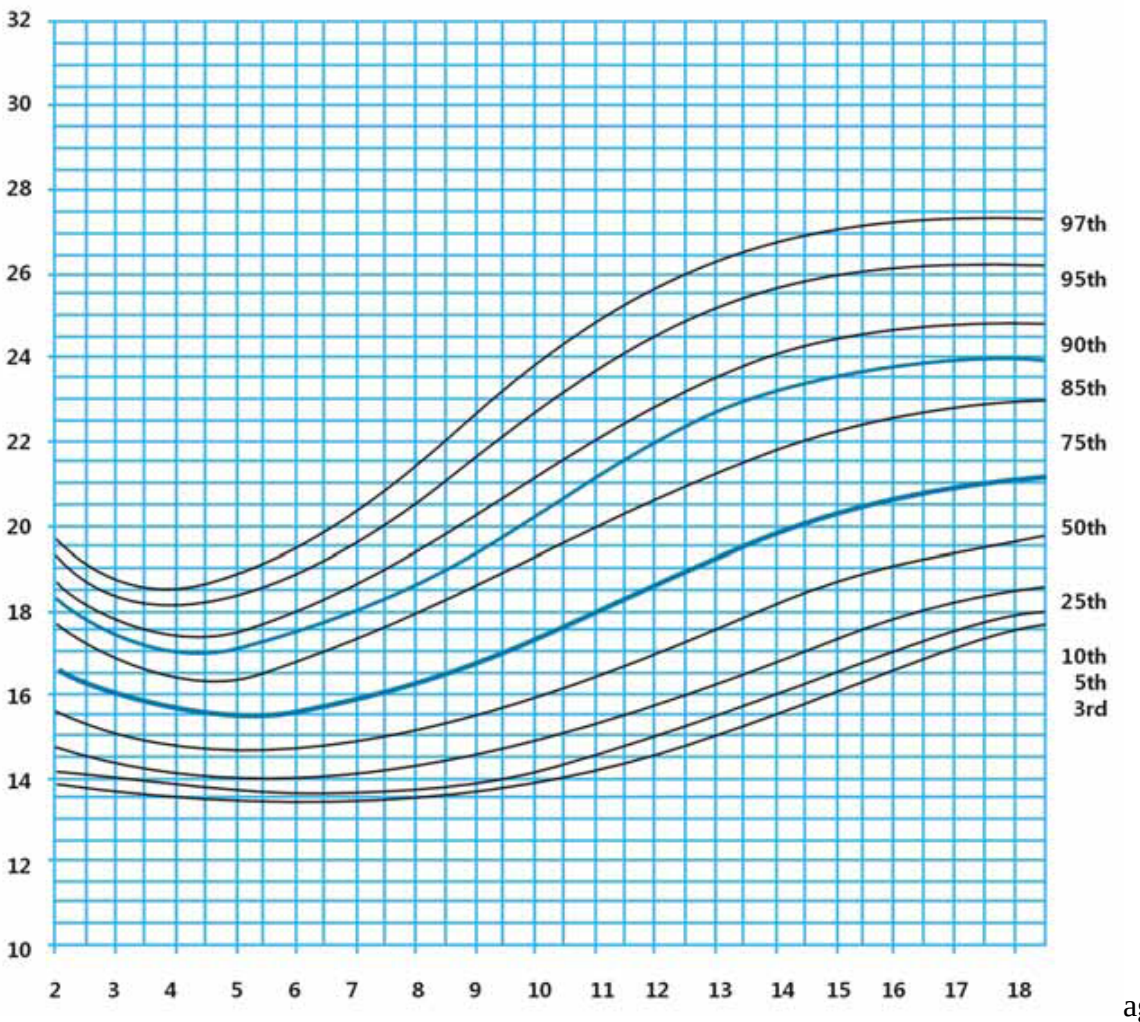
Appendix III:

BMI Percentile Chart for Boys aged 2-18 years - Korean



Appendix IV:

BMI Percentile Chart for Girls aged 2-18 years - Korean



Appendix V:

Study Implementation Agreement of Principals in Special Schools

I hereby give consent to Yeongmi Ha, a doctoral student at the University of North Carolina at Chapel Hill (UNC-CH) School of Nursing in Chapel Hill, North Carolina, USA, to recruit study participants in our school from December 15 to December 31, 2009 for her research entitled "Relationships between Children and Parental Factors, Dietary Patterns and Weight Status in Children with Intellectual Disabilities in South Korea." While implementing this study, the principal investigator, Yeongmi Ha, will be expected to follow all policies and procedures as stated and approved by the UNC-CH human subject review committees to protect the rights and safety of participants. All collected data will be used for the study purpose ONLY. Data-sharing will only be permitted with research personnel on this study. This letter signifies my approval and consent to allow Yeongmi Ha to conduct this study at the school named below.

School name: _____

School Principal (signature): _____

Phone: _____

Address: _____

Principal investigator (signature): _____

Phone: _____

Address: _____

Date: _____

Appendix VI:

Study Implementation Agreement of Principals in Special Schools - Korean

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Appendix VII:

Parents' Information Letter for Consent Forms

School of Nursing, CB #7460, Carrington Hall
Chapel Hill, NC 27599-7460

Relationships between Children's and Parental Risk Factors, Dietary Patterns and Weight Status in Children with Intellectual Disabilities in South Korea

December 15, 2009

Dear Parent:

Because being overweight or underweight can lead to health problems in children, we are conducting a research study focused on the factors that may influence the development overweight in children with intellectual disabilities. You and your child enrolled at the special school are selected for this study because your child attends one of four special schools where the study will be conducted. A total of approximately 108 mothers and their children will be chosen to participate in this study. Your participation in this study is completely voluntary.

To participate in the study you would:

- Review the enclosed parent consent form. If you agree to participate please sign both copies of the consent form, return one signed copy to school in the enclosed envelope in your child's backpack; and, keep one copy of the consent form for your records.
- After the signed consent is received by the investigator a survey will be sent to you in your child's backpack. This survey asks about the stress your may experience related to caring for your child, your perception of your child's weight, and information about your family. We expect that is should take you about 20 minutes or less to complete the survey. You are free to answer or not answer any particular question and have no obligation to complete answering the questions once you begin.
- Go to your child's school to have your height and weight measured by the school nurse. You should call the school nurse at (phone #) to arrange for a day and time for this.
- When you get weighed and measured by the school nurse, you will receive instruction about how to complete a 3-day food record. You will be asked to keep a list of all of the foods your child eats during the 3 days. The teachers at school will keep a similar list of the foods your child eats when at school. When you have completed this 3-day food record for your child, you will send it back to school in an envelope provided to you with the food record forms.

Your participation is confidential. You are asked not to put any identifying information, such as your child's name, on the survey or 3-day food record. Identification numbers on the forms will help us match the information you give us with your child's name. Yet, all information obtained in this study will be reported as group data. No individual can be or will be identified in reports. We plan to publish the results of this research and communicating these results to the professional nursing associations. The only persons who will have access to these data are the investigators named on this letter, the school nurses and teachers handling the forms, and data entry personnel.

The anticipated risks to you and your child for participating in this study are expected to be minimal. We do not anticipated that you or your child will receive direct benefits from being involved with it. However, there will be professional benefit from this study, as the information we obtain will be communicated to the profession through publication in the literature, presentation at professional meetings and directly dissemination to the professional associations. And, it is expected that this information will help school nurses plan programs that may improve the health of children. The only expected cost to you is your time to participate. After you complete the survey and food diary you will be given a $5 gift card for your participation.

You may contact us with any questions at (Korea phone number) or by email (email address).

All research on human volunteers is reviewed by a committee that works to protect your rights and welfare. If you have questions or concerns about your rights as a research subject you may contact, anonymously if you wish, the Institutional Review Board at 1-919-966-3113 (US) or by email to IRB_subjects@unc.edu.

Thank you for considering participation in this study. We hope that we can share your views with the greater professional community and use your response to help shape recommendations for addressing a health promotion of children with intellectual disabilities.

At this time we would appreciate your reviewing the enclosed parent consent form. And, if you choose to participate, please sign and date both copies, keep one copy, and send the second copy back to school in your child's backpack.

Sincerely,

Julie Jacobson Vann, PhD, MS, RN
Clinical Assistant Professor

Yeongmi Ha, MSN, RN
Doctoral candidate

Appendix VIII:

Parents' Information Letter for Consent Form - Korean

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Julie Jacobson Vann, ▪▪▪
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Appendix XI:

Parents' Information Letter for Questionnaires

School of Nursing, CB #7460, Carrington Hall
Chapel Hill, NC 27599-7460

Relationships between Children's and Parental Risk Factors, Dietary Patterns and Weight Status in Children with Intellectual Disabilities in South Korea

December 15, 2009

Dear Parent:

Thank you for agreeing to your and your child's participation in the research study (named above) that is focusing on the factors that may influence the development overweight in children with intellectual disabilities. And, thank you for returning the signed informed consent form.

At this time we are requesting that you complete the enclosed survey that asks about the stress you may experience related to caring for your child, your perception of your child's weight, and information about your family. We expect that is should take you about 20 minutes or less to complete the survey. You are free to answer or not answer any particular question and have no obligation to complete answering the questions once you begin.

If you have not contacted the school nurse to arrange to have your height and weight measured by the school nurse, it would be helpful if you contact the school nurse in the next day or two at (phone #) to arrange a day and time for this. When you get weighed and measured by the school nurse, you will receive instruction about how to complete a 3-day food record for your child. You will be asked to keep a list of all of the foods your child eats during the 3 days. The teachers at school will keep a similar list of the foods your child eats when at school. When you have completed this 3-day food record for your child, you will send it back to school in an envelope provided to you with the food record forms.

We would like to remind you that your participation is confidential. You are asked not to put any identifying information, such as your child's name, on the survey or 3-day food record. Identification numbers on the forms will help us match the information you give us with your child's name. Yet, all information obtained in this study will be reported as group data. No individual can be or will be identified in reports. We plan to publish the results of this research and communicating these results to the professional nursing associations. The only persons who will have access to these data are the investigators named on this letter, the school nurses and teachers handling the forms, and data entry personnel.

The anticipated risks to you and your child for participating in this study are expected to be minimal. We do not anticipated that you or your child will receive direct benefits from being involved with it. However, there will be professional benefit from this study, as the information we obtain will be communicated to the profession through publication in the literature, presentation at professional meetings and directly dissemination to the professional associations. And, it is expected that this information will help school nurses plan programs that may improve the health of children. The only expected cost to you is your time to

participate. After you complete the survey and food diary you will be given a $5 gift card for your participation.

You may contact us with any questions at (Korea phone number) or by email (email address).

All research on human volunteers is reviewed by a committee that works to protect your rights and welfare. If you have questions or concerns about your rights as a research subject you may contact, anonymously if you wish, the Institutional Review Board at 1-919-966-3113 (US) or by email to IRB_subjects@unc.edu.

Thank you for considering participation in this study. We hope that we can share your views with the greater professional community and use your response to help shape recommendations for addressing a health promotion of children with intellectual disabilities.

At this time we would appreciate your completing the enclosed survey, place it in the enclosed envelope, and send the survey back to school in your child's backpack.

Sincerely,

Julie Jacobson Vann, PhD, MS, RN
Clinical Assistant Professor

Yeongmi Ha, MSN, RN
Doctoral candidate

Appendix X:

Parents' Information Letter for Questionnaires - Korean

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Julie Jacobson Vann, ▪▪▪
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Appendix XI:

Parent Consent Form

University of North Carolina-Chapel Hill
Parental Permission for a Minor Child to Participate in a Research Study
Social Behavioral Form

IRB Study #_____
Consent Form Version Date: _____

Title of Study: Relationships between Children's and Parental Risk Factors, Dietary Patterns and Weight Status in Children with Intellectual Disabilities in South Korea

Principal Investigator: Yeongmi Ha, MSN, RN
UNC-Chapel Hill Department: School of Nursing
UNC-Chapel Hill Phone number:
Email Address:
Faculty Advisor: Julie Jacobson Vann, PhD, MS, RN
Funding Source and/or Sponsor: N/A

Study Contact telephone number:
Study Contact email:

What are some general things you should know about research studies?
You are being asked to allow your child to take part in a research study. To join the study is voluntary. You may refuse to give permission, or you may withdraw your permission for your child to be in the study, for any reason. Even if you give your permission, your child can decide not to be in the study or to leave the study early.

Research studies are designed to obtain new knowledge. This new information may help people in the future. Your child may not receive any direct benefit from being in the research study. There also may be risks to being in research studies.

Details about this study are discussed below. It is important that you understand this information so that you and your child can make an informed choice about being in this research study.
You will be given a copy of this permission form. You and your child should ask the researchers named above, or staff members who may assist them, any questions you have about this study at any time.

What is the purpose of this study?
The purpose of this research study is to learn about the factors that may influence the

development of overweight in children with intellectual disabilities.

Are there any reasons your child should not be in this study?
Your child should not be in this study if he or she has cerebral palsy.

How many people will take part in this study?
If your child is in this study, your child will be one of approximately 108 people in this research study.

How long will your child's part in this study last?
Your child will be enrolled in this study for one to two weeks. Your child's height and weight will be measured in the school nurse's room. This will take approximately 10 minutes.

Your involvement in this study will involve three activities during the one to two week period. You will be asked to complete a survey that is expected to take 20 minutes or less. You will be asked to be weighed and measured at the school nurse's room. At that time you will receive instructions on how to complete a food record for your child. This visit is expected to take approximately 10 to 20 minutes. And, you will be asked to record your child's food intake on a food-record form for 3 days. It is expected that this may take you approximately 20 minutes per day for each of 3 days. Additional follow-up is not anticipated.

What will happen if your child takes part in the study?

- Your child's height and weight will be measured in the school nurse's room.
- You will be asked to complete a survey and 3-day food records for your child. The survey asks about your perception of your child's weight, stress you may experience related to caring for your child, and information about your family.
- You will be asked to have your height and weight measured by the school nurse.
- You will be taught how to keep a dietary record for your child. You will be asked to keep a record of your child's food intake for 3 days. These food records will be requested for 2 weekdays and 1 weekend day.
- You will be asked to send completed forms to your child's special school in your child's backpack.

What are the possible benefits from being in this study?
Research is designed to benefit society by gaining new knowledge. Your child may not benefit personally from being in this research study.

What are the possible risks or discomforts involved from being in this study?
The possible risks or discomforts to you or your child for participating in this study are

expected to be minimal and may include:

- Possible discomfort for your child during measurement of height and weight.
- Possible emotional discomfort about answering questions about your stress in parenting;
- Possible discomfort when having your height and weight measured;

To minimize these possible risks the school nurses and investigator will explain all procedures to you and your child. And, the investigator will be available to answer any questions or discuss any concerns that you may have.

There may be uncommon or previously unknown risks. You should report any problems to the researcher.

How will your child's privacy be protected?

Your child's privacy will be protected by:

- Paper records, such as the completed surveys and 3-day food records, will be stored in a locked file cabinet in the investigator's office.
- Information that is entered into computer files will be kept on a password-protected computer of the investigator.
- Child or parent names will not be listed on study documents with child and family information. Identification numbers will be used on forms. The list of names and identification numbers will only be shared with people working on the study.
- Study information will not be shared with school personnel, except in summary reports that will not list names of children or parents.

Participants will not be identified in any report or publication about this study. Although every effort will be made to keep research records private, there may be times when federal or state law requires the disclosure of such records, including personal information. This is very unlikely, but if disclosure is ever required, UNC-Chapel Hill will take steps allowable by law to protect the privacy of personal information. In some cases, your information in this research study could be reviewed by representatives of the University, research sponsors, or government agencies (for example, the FDA) for purposes such as quality control or safety.

Will your child receive anything for being in this study?

You will receive a $5 gift card for taking part in this study after you return the completed survey and food records to the school.

Will it cost you anything for your child to be in this study?

There will be no costs for being in the study other than your time.

What if you or your child has questions about this study?

You and your child have the right to ask, and have answered, any questions you may have about this research. If you have questions, complaints or concerns, you should contact the researchers listed on the first page of this form.

What if you or your child has questions about your child's rights as a research participant?
All research on human volunteers is reviewed by a committee that works to protect your rights and welfare. If you or your child has questions or concerns about your child's rights as a research subject, or if you would like to obtain information or offer input, you may contact the Institutional Review Board at 919-966-3113 (US) or by email to IRB_subjects@unc.edu.

- -

Title of Study: Relationships between Children's and Parental Risk Factors, Dietary Patterns and Weight Status in Children with Intellectual Disabilities in South Korea

Principal Investigator: Yeongmi Ha, MSN, RN

Parent's Agreement:

I have read the information provided above. I have asked all the questions I have at this time. I voluntarily give permission to allow my child to participate in this research study.

_____
Printed Name of Research Participant (Child)

_____ _____
Signature of Parent Date

_____
Printed Name of Parent

_____ _____
Signature of Research Team Member Obtaining Permission Date

_____
Printed Name of Research Team Member Obtaining Permission

Appendix XII:

Parent Consent Form - Korean

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IRB [illegible] #______________________

[illegible]: _______________

[illegible]: [illegible], [illegible], [illegible],
[illegible]

[illegible]: [illegible], MSN, RN
[illegible]
[illegible]:
[illegible]: Julie Jacobson Vann, PhD, MS, RN

[illegible]:
[illegible]:

[illegible]

[illegible]. [illegible]. [illegible], [illegible]. [illegible].

[illegible], [illegible]. [illegible], [illegible].

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(1-919-966-3113)

(IRB_subjects@unc.edu)

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[illegible]

[illegible]: [illegible], MSN, RN

[illegible]:

[illegible], [illegible].
[illegible].

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Appendix XIII:

Data Abstraction Tool

Relationships between Children's and Parental Risk Factors, Dietary Patterns and Weight Status in Children with Intellectual Disabilities in South Korea

Data Abstraction Tool & Child & Mother Heights & Weights

Child's Measurements		Mother's Measurements	
Date measured:		Date measured:	
Height	Weight	Height	Weight
cm	kg	cm	kg

Data Abstraction from School Records

Type of Information	List Level of Disability & Name of Medication(s)	Most Recent Date of Information
Child's Level of Disability		
Medication		
Medication		
Medication		
Medication		
Medical Diagnoses or Syndromes		
Medical Diagnoses or Syndromes		
Medical Diagnoses or Syndromes		

This study has been approved by the University of North Carolina at Chapel Hill Institutional Review Board for human subject participation. If you have any questions about the study, please contact Yeongmi Ha by telephone at ** or by email at **.

Appendix XIV:

Data Abstraction Tool - Korean

:		:	
cm	kg	cm	kg

.

Appendix XV:

Questionnaire

Relationships Between Children's and Parental Risk Factors, Dietary Patterns and Weight Status in Children with Intellectual Disabilities in South Korea

Parent Survey about Weight Status of Children with Intellectual Disabilities

Survey Instructions

Instructions: Your responses to the following questions will be used to help us understand the factors that may influence weight status in children.

Please complete this survey by answering questions on the line provided or placing an (X) in the box next to the response that best describes your answer.

After completing this survey, please place it in the envelope sent to you and send it back to your child's school in his or her backpack.

Please do not write your name or your child's name on this survey.

Thank you for assisting us with our research study. We appreciate your help!

This study has been approved by the University of North Carolina at Chapel Hill Institutional Review Board for human subject participation. If you have any questions about the study, please contact Yeongmi Ha by telephone at 053-421-4936 or by email at tiffanyny@paran.com.

Information about Your Child in a Special School

Please answer these questions for your child in a special school.

1. What is your child's date of birth? __ __ / __ __ __ __

Month Year

2. What is your child's sex?

□ Male
□ Female

3. What grade is your child in now?

_____ Grade

4. Over the past full year (12 months), did your child take any types of medication regularly?

□ No, my child did not take any medications on a regular basis.
□ Yes (Name of medication: _____)
□ Other (Specify: _____)

5. Does your child have any type of genetic syndrome or chronic diseases?

□ No
□ Yes (Specify: _____)

Information about Parent and Family Members

1. What is your husband's height and weight?

Height _____ cm

Weight _____ kg

2. How would you classify your child's weight status [answer for your child in special school]?

- Underweight
- Just right
- Overweight
- Obese

3. What is your marital status?

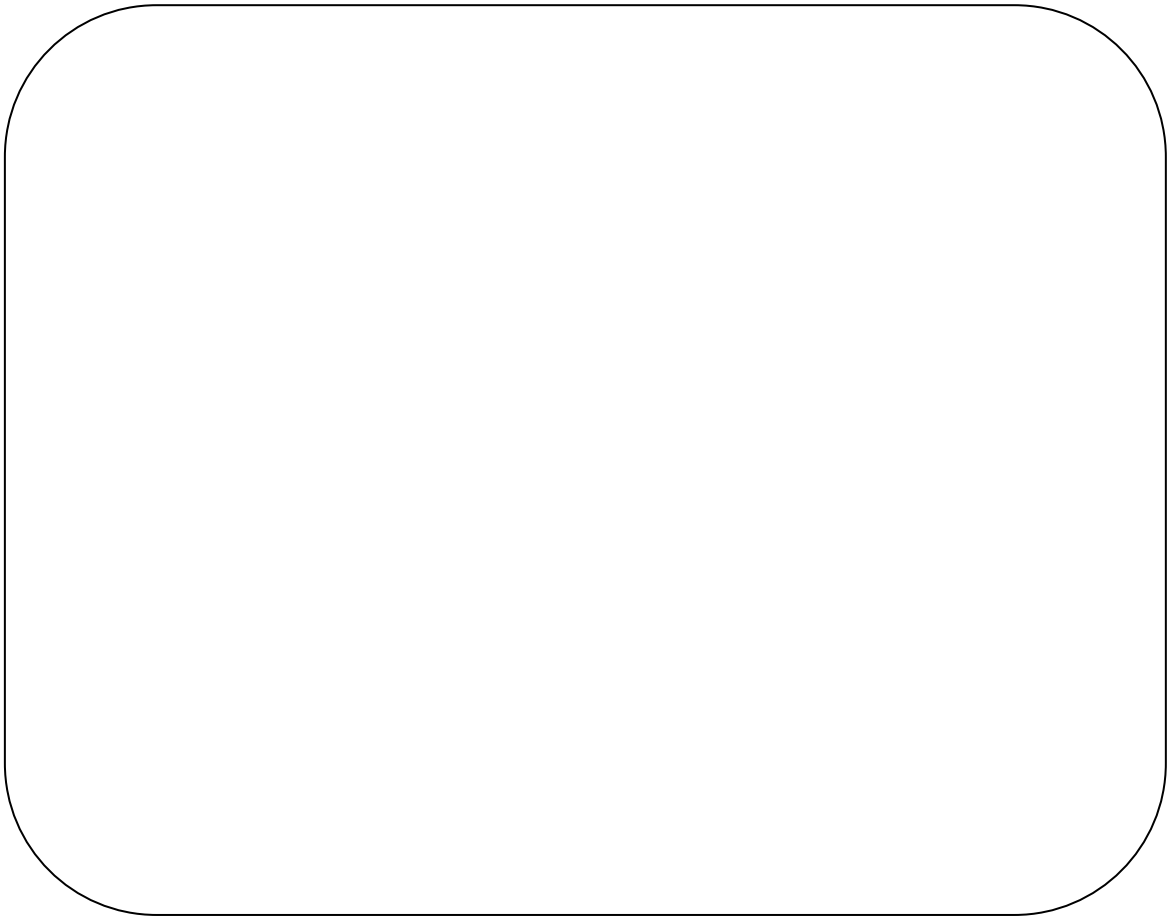
- Married
- Separated
- Divorced
- Living with Significant other/Partner
- Widowed

4. Please give the following information about the current member of your family in the household.

Relationship	Sex	Date of Birth	Occupation	Others

Thanks again for completing this survey!

If you have any additional thoughts about any of the above topics, please share them here.



School of Nursing
University of North Carolina at Chapel Hill

Appendix XVI:

Questionnaire - Korean

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3. [illegible]?

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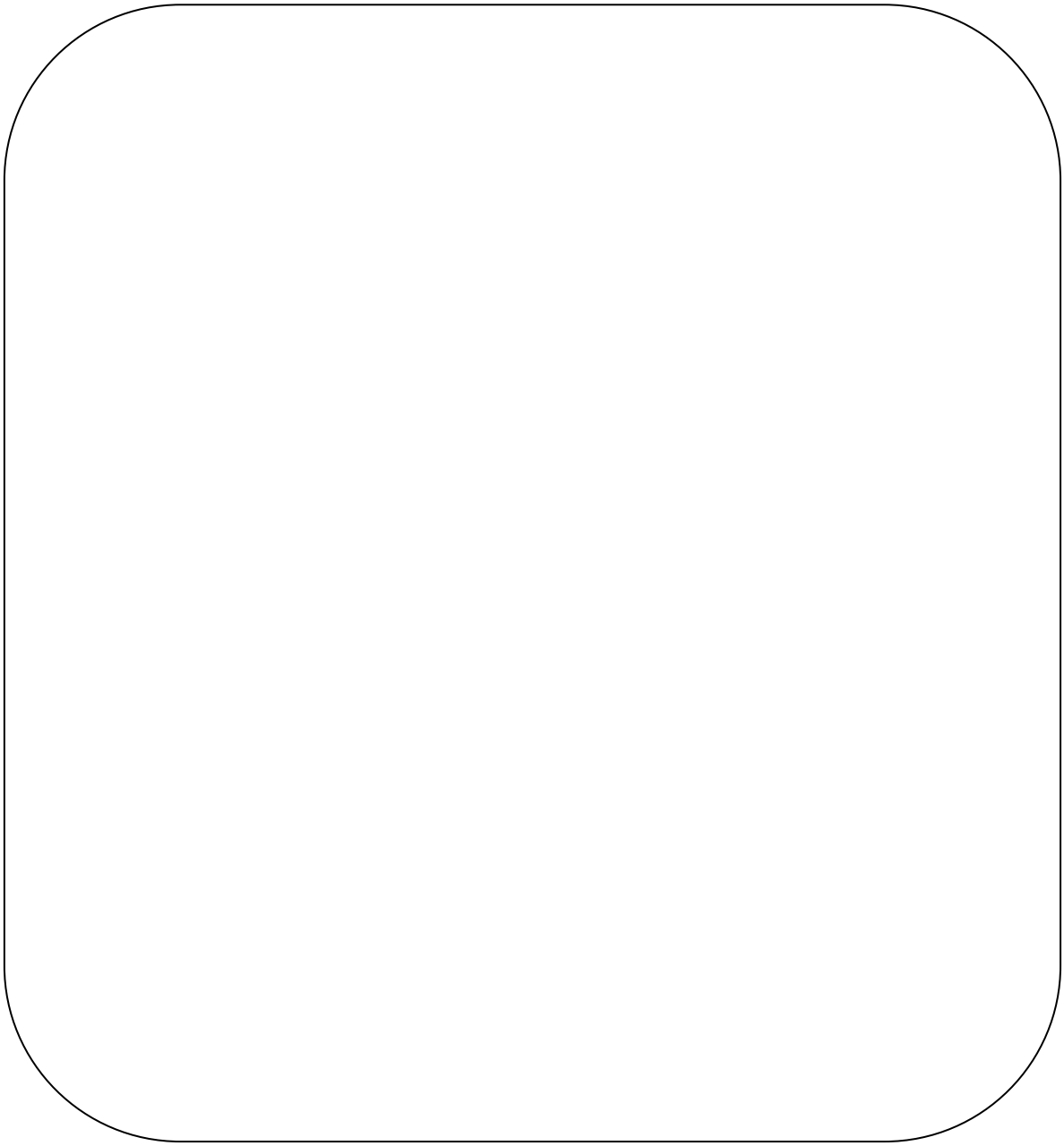

Appendix XVII:

Parenting Stress Index-Short Form (PSI-SF)

Parenting Stress Index-Short Form

Directions: This questionnaire contains 36 statements. Read each statement carefully. For each statement, please focus on your child in a special school, and circle the response that best represents your opinion. While you may not find a response that exactly states your feelings, please circle the response that comes closest to describing how you feel. Your first reaction to each question should be your answer. Circle only one response for each statement, and respond to all statements.

SA	A	NS	D	SD
Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree

1	I often have the feeling that I can't handle things very well	SA	A	NS	D	SD
2	I find myself giving up more of my life to meet my child's needs than I ever expected	SA	A	NS	D	SD
3	I feel trapped by my responsibilities as a parent	SA	A	NS	D	SD
4	Since having this child, I have been unable to do new and different thing	SA	A	NS	D	SD
5	Since having a child, I feel that I am almost never able to do things that I like to do	SA	A	NS	D	SD
6	I am unhappy with the last purchase of clothing I made for myself	SA	A	NS	D	SD
7	There are quite a few things that bother me about my life	SA	A	NS	D	SD
8	Having a child has caused more problems than I expected in my relationship with my spouse	SA	A	NS	D	SD
9	I feel alone and without friends	SA	A	NS	D	SD

10	When I go to a party, I usually expect not to enjoy myself	SA	A	NS	D	SD
11	I am not as interested in people as I used to be	SA	A	NS	D	SD
12	I don't enjoy things as I used to	SA	A	NS	D	SD
13	My child rarely does things for me that make me feel good	SA	A	NS	D	SD
14	Most times I feel that my child does not like me and does not want to be close to me	SA	A	NS	D	SD
15	My child smiles at me much less than I expected	SA	A	NS	D	SD
16	When I do things for my child, I get the feeling that my efforts are not appreciated very much	SA	A	NS	D	SD
17	When playing, my child doesn't often giggle or laugh	SA	A	NS	D	SD
18	My child doesn't seem to learn as quickly as most children	SA	A	NS	D	SD
19	My child doesn't seem to smile as much as most children	SA	A	NS	D	SD
20	My child is not able to do as much as I expected	SA	A	NS	D	SD
21	It takes a long time and it is very hard for my child to get used to new things	SA	A	NS	D	SD
22	For the next statement, choose your response from the choices "1" to "5" below. I feel that I am: 1. Not very good at being a parent 2. A person who has some trouble being a parent 3. An average parent 4. A better than average parent 5. A very good parent	1	2	3	4	5
23	I expected to have closer and warmer feelings for my child than I do and this bothers me	SA	A	NS	D	SD
24	Sometimes my child does things that bother me just to be mean	SA	A	NS	D	SD
25	My child seems to cry or fuss more often than most children	SA	A	NS	D	SD
26	My child generally wakes up in a bad mood	SA	A	NS	D	SD
27	I feel that my child is very moody and easily upset	SA	A	NS	D	SD
28	My child does a few things which bother me a great deal	SA	A	NS	D	SD

29	My child reacts very strongly when something happens that my child doesn't like	SA	A	NS	D	SD
30	My child gets upset easily over the smallest things	SA	A	NS	D	SD
31	My child's sleeping or eating schedule was much harder to establish than I expected	SA	A	NS	D	SD
32	For the next statement, choose your response from the choices "1" to "5" below. I have found that getting my child to do something or stop doing something is: 1. Much harder than I expected 2. Somewhat harder than I expected 3. About as hard as I expected 4. Somewhat easier than I expected 5. Much easier than I expected	1	2	3	4	5
33	For the next statement, choose your response from the choices "10+" to "1-3" Think carefully and count the number of things which your child does that bothers you. For example: dawdles, refuse to listen, overactive, cries, interrupts, fights, whines, etc. 1. 1-3 2. 4-5 3. 6-7 4. 8-9 5. 10+	10+	8-9	6-7	4-5	1-3
34	There are some things my child does that really bother me a lot	SA	A	NS	D	SD
35	My child turned out to be more of a problem than I had expected	SA	A	NS	D	SD
36	My child makes more demands on me than most children	SA	A	NS	D	SD

Appendix XVIII:

Parenting Stress Index-Short Form (PSI-SF) - Korean

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[illegible] 36 [illegible]. [illegible], [illegible].

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2	[illegible].	1	2	3	4	5
3	[illegible].	1	2	3	4	5
4	[illegible].	1	2	3	4	5
5	[illegible].	1	2	3	4	5
6	[illegible].	1	2	3	4	5
7	[illegible].	1	2	3	4	5
8	[illegible].	1	2	3	4	5
9	[illegible].	1	2	3	4	5
10	[illegible], [illegible].	1	2	3	4	5
11	[illegible].	1	2	3	4	5
12	[illegible].	1	2	3	4	5

13	▪▪ ▪▪▪ ▪▪ ▪▪▪ ▪▪ ▪▪ ▪▪ ▪▪ ▪▪▪.	1	2	3	4	5
14	▪▪▪ ▪▪ ▪▪▪ ▪▪ ▪▪▪▪ ▪▪ ▪▪▪ ▪▪▪ ▪▪▪▪ ▪▪▪▪ ▪▪▪ ▪▪.	1	2	3	4	5
15	▪▪ ▪▪▪ ▪▪ ▪▪▪ ▪▪▪ ▪▪ ▪▪ ▪ ▪▪ ▪▪▪	1	2	3	4	5
16	▪▪ ▪▪ ▪▪▪ ▪▪ ▪▪▪▪ ▪▪ ▪, ▪▪ ▪▪▪ ▪▪ ▪▪▪▪ ▪▪▪ ▪ ▪▪.	1	2	3	4	5
17	▪▪ ▪▪▪ ▪ ▪ ▪▪ ▪▪▪▪ ▪▪▪ ▪▪▪ ▪▪ ▪▪▪.	1	2	3	4	5
18	▪▪ ▪▪▪ ▪▪ ▪▪▪▪ ▪▪ ▪▪▪ ▪▪▪ ▪▪▪ ▪▪ ▪ ▪▪.	1	2	3	4	5
19	▪▪ ▪▪▪ ▪▪ ▪▪▪▪▪ ▪▪ ▪ ▪▪ ▪▪.	1	2	3	4	5
20	▪▪ ▪▪▪ ▪ ▪▪▪▪ ▪▪ ▪▪ ▪ ▪▪▪ ▪▪▪.	1	2	3	4	5
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22	▪▪ ▪▪▪▪ ▪▪: 1. ▪▪▪ ▪▪▪▪ ▪▪▪ ▪▪▪▪ 2. ▪▪▪ ▪▪▪ ▪▪ ▪▪▪▪ 3. ▪▪▪ ▪▪▪▪ 4. ▪▪▪ ▪▪▪▪ ▪▪ ▪▪ 5. ▪▪ ▪▪ ▪▪▪▪	1	2	3	4	5
23	▪▪ ▪▪ ▪▪ ▪▪ ▪▪▪ ▪▪▪ ▪ ▪▪▪ ▪▪▪ ▪▪▪▪ ▪▪▪▪ ▪▪▪ ▪▪▪ ▪▪▪ ▪▪ ▪▪ ▪▪▪.	1	2	3	4	5
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Appendix XIX:

3-Day Food Record for Parents

TO: Parents:

FROM: Yeongmi Ha, a doctoral student at the University of North Carolina at Chapel Hill

Phone: **
Email: **

RE: Completion of the Food Record

Thank you for participating in this important study.

Enclosed you will find:

- Written instruction for completing the Food Record
- Food photographs
- Forms to use for recording child's food intake

To assist us with this part of the study, could you please:

- (1) Read the Instruction for Completing the Food Record
- (2) Keep a record of what your child eats for two weekdays and one weekend day (Sunday).
- (3) Return your completed food records during the scheduled time to your child's school in his or her backpack.

It will be most helpful if you complete your child's food record as soon as possible.

Thank you so much for your participation!

This study has been approved by the University of North Carolina at Chapel Hill Institutional Review Board for human subject participation. If you have any questions about the study, please contact Yeongmi Ha by telephone at 053-421-4936 or by email at tiffanyny@paran.com.

Relationships between Children's and Parental Risk Factors, Dietary Patterns and Weight Status in Children with Intellectual Disabilities in South Korea

3-Day Food Record
Instructions for Completing 3-Day Food Records

- Please record all foods and drinks that your child has for 3 days (scheduled days). Do not change your child's eating habits for this record.
- Describe the type of food eaten as clearly as you can. Use the sample provided as a guide. Only record one food item per line.
- If there is any brand name of the food product that your child eats, please write it.
- Write down beverages, even water. Make sure to record all beverages that your child consumes in the food type description.
- Describe combination foods. If your child is eating combination foods, such as pizza with various toppings, make sure to record these ingredients.
- Estimate serving size. Estimate the serving size to the best of your ability. You may refer to the food photos of one serving size that we provide to you.
- Record time. Record the approximate time of day each meal or snack is eaten.
- Eating out. Please include the name of the restaurant. Remember to record the size of serving and how your child's meal is prepared.
- Don't worry. If you weren't able to complete the food record for whatever reason, please contact the investigator at 053-421-4936. I will help you to address any concerns you may have.
- Any questions? If you have any questions about completing the food record, please contact the principal investigator, Yeongmi Ha at 053-421-4936.

Description of Serving Sizes (Example)*

Please refer to the food photos as the examples of one serving sizes. You can use the following pictures to estimate the food amount.

Grains



Vegetables



Meat

* Photographs are adapted from a booklet developed by Korean Rural Development Administration (2009).

3-Day Food Record (EXAMPLE)

Day/Time	Breakfast/Lunch/ Dinner/Snack/Other	Food type (Brand name)	Serving size/Amount	Place to eat
12/20, 9am	Breakfast	Bread	1 piece (Medium)	Home
		Orange juice	1 cup (120cc)	Home
12:30pm	Lunch	Shrimp Fried rice	1 plate (Large)	TGI Friday

3-Day Food Record for Parents

Day/Time	Breakfast/Lunch/ Dinner/Snack/Other	Food type (Brand name)	Serving size/Amount	Place to eat

Appendix XX:

3-Day Food Record for Parents - Korean

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Appendix XXI:

3-Day Food Record for Teachers

TO: Teachers:

FROM: Yeongmi Ha, a doctoral student at the University of North Carolina at Chapel Hill
Phone:
Email:

RE: Completion of the Food Record

Thank you for helping with this important study.

Enclosed you will find:

- Written instruction for completing the Food Record
- Food photographs
- Forms to use for recording child's food intake

To assist us with this part of the study, could you please:

- (1) Read the Instruction for Completing the Food Record
- (2) Keep a record of what your students eat for each of 2 days while at school. Separate forms are to be used for each of your students.
    - Parents will begin completing food records at home.
    - We would like for you to complete food records at school.
- (3) Return the completed food records to the School Nurse or Yeongmi Ha.

Thank you so much for your assistance!

This study has been approved by the University of North Carolina at Chapel Hill Institutional Review Board for human subject participation. If you have any questions about the study, please contact Yeongmi Ha by telephone at ** or by email at **.

Relationships between Children's and Parental Risk Factors, Dietary Patterns and Weight Status in Children with Intellectual Disabilities in South Korea

3-Day Food Record (2 Days at School)
Instructions for Completing 3-Day Food Records

- Please record all foods and drinks that your students have for 2 of the 3 study days (scheduled days). Do not change your students' eating habits for this record.
- Use a separate record for each student.
- Describe the type of food eaten as clearly as you can. Use the sample provided as a guide. Only record one food item per line.
- If there is any brand name of the food product that the children eat, please write it.
- Write down beverages, even water. Make sure to record all beverages that your students consume in the food type description.
- Describe combination foods. If your students eat combination foods, such as pizza with various toppings, make sure to record these ingredients.
- Estimate serving size. Estimate the serving size to the best of your ability. You may refer to the food photos of one serving size that we provide to you.
- Record time. Record the approximate time of day each meal or snack is eaten.
- Eating out. Please include the name of the restaurant. Remember to record the size of serving and how your child's meal is prepared.
- Don't worry. If you weren't able to complete the food record for whatever reason, please contact the investigator at (phone number). I will help you to address any concerns you may have.
- Any questions? If you have any questions about completing the food record, please contact the principal investigator, Yeongmi Ha at (phone number).

Description of Serving Sizes (Example)*

Please refer to the food photos as the examples of one serving sizes. You can use the following pictures to estimate the food amount.

Grains



Vegetables



Meat

- * Photographs are adapted from a booklet developed by Korean Rural Development Administration (2009).

Food Record (EXAMPLE)

Day/Time	Breakfast/Lunch/ Dinner/Snack/Other	Food type (Brand name)	Serving size/Amount	Place to eat
12/21, 10am	Other	milk	1 carton (230cc)	classroom
12:30pm	Lunch	Shrimp Fried rice	1 plate (Large)	School cafeteria
		Green tea	1 cup (200cc)	School cafeteria
1:30pm	Other	water	1 cup (150cc)	classroom

2-Day Food Record for Teachers

Day/Time	Breakfast/Lunch/ Dinner/Snack/Other	Food type (Brand name)	Serving size/Amount	Place to eat

Appendix XXII:

3-Day Food Record for Teachers - Korean

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