



## Research Article

## Estimation of Effects of Factors Related to Preschooler Body Mass Index Using Quantile Regression Model



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## ARTICLE INFO

## Article history:

Received 14 November 2013

Received in revised form

9 May 2014

Accepted 23 July 2014

## Keywords:

obesity

preschooler

quantile regression

## SUMMARY

**Purpose:** The purpose of this study was to investigate Korean preschoolers' obesity-related factors through an ecological approach and to identify Korean preschoolers' obesity-related factors and the different effects of ecological variables on body mass index and its quantiles through an ecological approach.

**Methods:** The study design was cross-sectional. Through convenience sampling, 241 cases were collected from three kindergartens and seven nurseries in the Seoul metropolitan area and Kyunggi Province in April 2013 using self-administered questionnaires from preschoolers' mothers and homeroom teachers.

**Results:** Results of ordinary least square regression analysis show that mother's sedentary behavior ( $p < .001$ ), sedentary behavior parenting ( $p = .039$ ), healthy eating parenting ( $p = .027$ ), physical activity-related social capital ( $p = .029$ ) were significant factors of preschoolers' body mass index. While in the 5% body mass index distribution group, gender ( $p = .031$ ), preference for physical activity ( $p = .015$ ), mother's sedentary behavior parenting ( $p = .032$ ), healthy eating parenting ( $p = .005$ ), and teacher's sedentary behavior ( $p = .037$ ) showed significant influences. In the 25% group, the effects of gender and preference for physical activity were no longer significant. In the 75% and 95% group, only mother's sedentary behavior showed a statistically significant influence ( $p < .001$ ,  $p = .012$  respectively).

**Conclusion:** Efforts to lower the obesity rate of preschoolers should focus on their environment, especially on the sedentary behavior of mothers, as mothers are the main nurturers of this age group.

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## Introduction

Obesity is classified as a disease, and many developed welfare states have set obesity prevention as one of their main national public health goals (World Health Organization, 2000). However, except for a few underdeveloped nations, the prevalence rate of obesity is increasing (De Onis, Blossner, & Borghi, 2010; Rokholm, Baker, & Sorensen, 2010; Stamatakis, Wardle, & Cole, 2010; Wang & Lobstein, 2006), suggesting that interventions to reduce obesity are not being effectively implemented. In Korea, one of every five preschoolers is overweight or obese, with the number steadily rising (Ministry of Health and Welfare, 2011).

Obesity in childhood not only causes disease at an early age, but may also cause children to be subjected to negative views, and thus

is a major concern that calls for early intervention (Barness, Opitz, & Gilbert-Barness, 2007). An obese child can develop not only physical complications such as hyperlipidemia, fatty liver, high blood pressure, or diabetes, but also psychological and social problems, such as sense of inferiority and dissatisfaction, bullying, loss of confidence, depression, and negative body image (Erickson, Robinson, Haydel, & Killen, 2000). Therefore, obesity is a health problem that must be addressed.

Obesity at an early age often develops into teenage and adult obesity (Lloyd, Langley-Evans, & McMullen, 2012; Singh, Mulder, Twisk, Van Mechelen, & Chinapaw, 2008), and obesity over a prolonged period can cause problems due to exposure to dangerous factors related to chronic adult diseases (Reilly & Kelly, 2011). Thus, it can be cost effective with regard to public health to intervene obesity at an early age. Also, life habits formed in the preschool age often continue through the adult period (Burke, Beilin, & Dunbar, 2001; Janz, Dawson, & Mahoney, 2000), so it is desirable to promote healthy lifestyles to prevent obesity in the early period of life (Griffiths, Hawkins, Cole, & Dezateux, 2010; Livingstone, McCaffrey,

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& Rennie, 2006). Recently, obesity prevention programs have focused on preschool age children, with the ages of subjects becoming younger and younger (Lakshman et al., 2013).

For effective preschooler obesity interventions, one must consider characteristics of childhood obesity and environmental determinants affecting such factors, for example, the mother's obesity-related lifestyle behaviors, attitude, or beliefs (Kleiser, Rosario, Mensink, Prinz-Langenohl, & Kurth, 2009; Kuhl, Clifford, & Stark, 2012; Summerbell et al., 2012). Also, in order for intervention programs aimed at preschoolers to succeed, factors related to nurturing, as well as the participation of parents, must be included as key features (Summerbell et al.). Factors related to child-care facilities where preschoolers spend a significant amount of time (Benjamin et al., 2009; Ward, Vaughn, McWilliams, & Hales, 2010), as well as the regional community environment to which children belong (Weir, Etelson, & Brand, 2006), must also be considered. This is in accordance with the ecological approach which states that the environmental circumstances surrounding an individual must be considered if human factors are to be systematically understood.

Seen from this viewpoint, multi-systematic contributors are found to have an influence on childhood obesity. However, to date, there has been little research aimed to systematically determine factors related to obesity focusing on children in educational and child-care facilities (Campbell & Hesketh, 2007).

In the present study, multiple linear regression analysis or logical regression analysis was used for the statistical analyses. Multiple linear regression analysis was used with body mass index (BMI) as the dependent variable, and logistic regression analysis was used with obesity status (whether a subject was obese or not) as a dependent variable using BMI percentile. Linear regression estimates can only make statements about how factors shift the mean of the BMI distribution, whereas probit or logit estimates shed light on a particular outcome (BMI percentile > 95%) without regard to the rest of the BMI distribution (Abrevaya, 2001). These methods only explain the average value of the dependent variable and thus have the disadvantage of not being able to explain the top 95% or the bottom 5% of the group, which is the high-risk group. Also, it may be unrealistic to assume that a factor which influences the average of the dependent variable affects the rest of the distribution of BMI. On the other hand, the quantile regression approach enables researchers to better understand how various factors impact different BMI distribution quantiles (Abrevaya). This method estimates the factors for each quantile of the dependent variable, as well as its impact (Buchinsky, 1998), and is thus proposed as an appropriate method for this study. Applying an intervention in accordance with BMI level enables a differential approach, since it captures the various ways in which factors influence each of the different quantiles of BMI distribution.

In order to acquire substantive data for an effective intervention, this study aimed to investigate deciding factors related to obesity according to BMI quantile using a quantile regression model and ecological approach.

### Purpose

The purpose of this study was to investigate Korean preschoolers' obesity-related factors through an ecological approach and to identify different effects of ecological variables according to BMI quantile.

### Conceptual framework of this study

For a comprehensive look at related factors, an ecological model was employed as a theoretical framework (Figure 1) (McLeroy, Bibeau, Steckler, & Glanz, 1988), with diverse variables such as

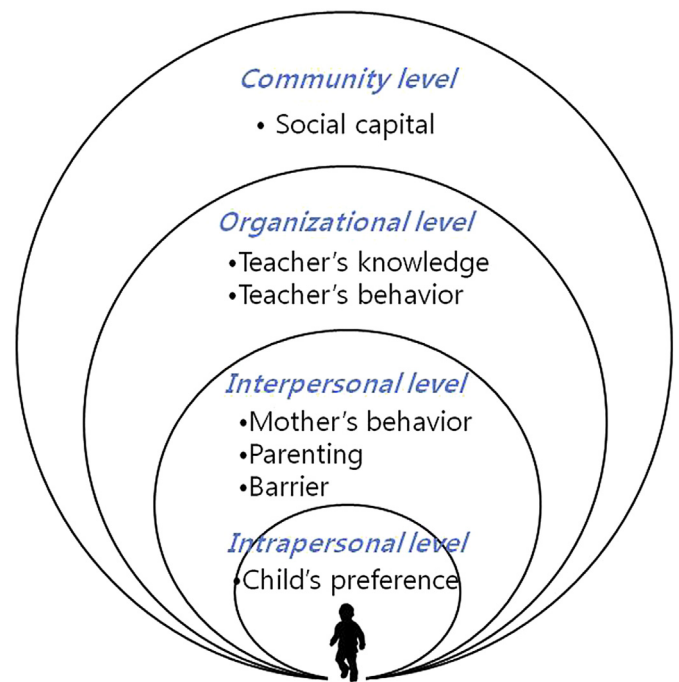


Figure 1. Conceptual framework of this study according to McLeroy's ecological model (1988).

intrapersonal, interpersonal, organizational, and community level variables that affect preschoolers' BMIs.

### Methods

#### Study design

The present study was a cross-sectional study aimed at identifying the variables which impact the BMI levels of preschoolers.

#### Setting and sample

The subjects of this study included 241 mothers and 20 home-room teachers. Data were collected through convenience sampling from 10 kindergartens and nurseries in the Seoul metropolitan area and Kyunggi Province. The heads of childhood educational facilities were contacted to request their cooperation; the survey was conducted at those facilities that agreed. Study participants met inclusion criteria if they were mothers of children aged 2–5 years having no history of motor-sensory or cognitive impairment. The mother of 262 preschoolers who met the study criteria were asked to participate in the study, and 254 mothers agreed to participate. Data from 13 participants were deleted from the analysis because they missed a lot of questions. Thus, the final sample for the analysis was 241 participants. To confirm the appropriateness of the sample size in the present study, G\*power 3.1.4 (Faul, Erdfelder, Lang, & Buchner, 2007), which is a method of computing sample size for multiple regression analysis, was used. The calculation applied a medium effect size of 0.15, a significance level of 5%, 95% power, and 12 predictors, resulting in a minimum sample size of 184. Thus, the appropriate sample size was secured to conduct this research.

#### Ethical consideration

This study was conducted after acquiring approval from the Institutional Review Board of College of Nursing, Yonsei University (IRB, College of Nursing, 2012-0018).

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