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STRUCTURAL MODELLING OF INFLUENTIAL FACTORS AFFECTING WEIGHT PROBLEM OF PRIMARY SCHOOL CHILDREN IN SELANGOR, MALAYSIA

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By

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STRUCTURAL MODELLING OF INFLUENTIAL FACTORS AFFECTING WEIGHT PROBLEM OF PRIMARY SCHOOL CHILDREN

IN SELANGOR, MALAYSIA

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MARYAM KHEIROLLAHPOUR

July 2014

Chairman: Shamarina Shohaimi, Ph.D
Faculty: Science

The main objective of this study is to identify and develop a comprehensive model that can be used to estimate and evaluate the factors affecting weight problems in children. To fulfill such an aim Structural Equation Modeling (SEM) was applied, which is one of the complete and flexible technique for testing and estimating causal relations using a combination of statistical data and qualitative causal assumptions. The new structural model would present the overall relations among the factors that lead to weight gain in children. A growing body of research consistently points out that the socio-economic level of the family; parental feeding practice and physical activity play an important role in the weight status of children. **T**he proposed models in this study explore the connection among these variables based on the definitions of the latent variables. Six structural models were tested to identify the direct and indirect relationship between the socio-economic factors and parental feeding practice, general level of physical activity and weight status of children.

The structural model was assessed for convergent validity and construct reliability (internal consistency). Three hundred and ninety primary school children aged between seven (7) and nine (9) years old in Selangor and Kuala Lumpur, as well as their parents, participated as subjects in this study. Their Body Mass Index was measured while the data on parental feeding practice was obtained using a validated Malay version of the Children Feeding Practice Questionnaire CFPQ. Concerning the methodology of the current study, the statistical procedure applied was running SEM and Confirmatory Factor Analysis (CFA) to reveal the hidden (secondary) effect of socioeconomic factors on feeding practice, and, ultimately, the weight status of the children, and to assess the validity model. The structural model assessed in this study suggested that the socio-economic status of parents is directly related to feeding practice (coefficient=0.39, and p-value=0.031), as well as weight

status of children (coefficient= -0.38, and p-value=0.001) and physical activity (coefficient=0.41, and p-value=0.001). In addition, the results indicate that parental feeding practice and physical activity are also directly related to the weight status of children (coefficient=0.36, and p-value=0.000), (coefficient= -0.29, and p-value=0.000), respectively. Moreover, the results suggest that parental feeding practice and physical activity are mediators in the structural model. In conclusion the model fit to the data well, and all the hypotheses linked to the conceptual framework were found to be significant.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk Ijazah Master Sains

STRUKTUR PERMODELAN MEMPENGARUHI FAKTOR YANG MEMBERI KESAN KEPADA MASALAH BERAT BADAN KANAK KANAK SEKOLAH RENDAK DI SELANGOR, MALAYSIA

Oleh

MARYAM KHEIROLLAHPOUR

Julai 2014

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Kajian ini bertujuan untuk mengenal pasti dan membangunkan sebuah model komprehensif yang akan menjangka dan meramal faktor-faktor yang mempengaruhi masalah berat badan dalam kalangan kanak-kanak. Bagi tujuan tersebut, pengkaji telah mengaplikasikan Model Persamaan Struktur *(Structural Equation Model)* (SEM) yang lengkap dan fleksibel. Pengaplikasian model ini sesuai untuk menguji dan menjangkakan hubungan sebab-akibat dengan menggunakan kombinasi antara unjuran statistik dengan hipotesis penyebab kualitatif. Model struktur yang dibangunkan melalui kajian ini akan mempamerkan saling hubungan antara setiap faktor peningkatan berat badalan dalam kalangan kanak-kanak. Hasil penelitian konsisten mendapati bahawa tahap sosioekonomi keluarga, amalan pemakanan dan aktiviti fizikal memainkan peranan penting. Model cadangan ini menghubungkaitkan kesemua pembolehubah berdasarkan definisi pembolehubah laten. Enam model sturktural diuji untuk mengenal pasti hubungan langsung dan tidak langsung antara faktor sosioekonomi dengan amalan pemakanan serta tahap aktiviti fizikal dan berat badan kanak-kanak.

Model struktur diuji untuk mendapatkan keesahan dan kebolehpercayaan dalaman. Uji kaji ini melibatkan 390 kanak-kanak sekolah rendah berusia antara tujuh hingga sembilan tahun di sekitar Selangor dan Kuala Lumpur beserta ibu bapa mereka. Indeks Jisim Badan *(Body Mass Index)* (BMI) sampel kajian diambil sementara data amalan pemakanan diambil menggunakan CFPQ. Kajian ini menggunakan prosedur pengiraan SEM dan Analisis Pengesahan Faktor *(Confirmatory Factor Analysis)* (CFA) untuk menilai tahap kewajaran model selain bertujuan merungkai kesan sekunder faktor sosioekonomi terhadap amalan pemakanan dan berat badan anak-anak.

Hasil penilaian terhadap model uji kaji mencadangkan bahawa tahap sosioekonomi berkadar langsung dengan amalan pemakanan (pekali=0.39, dan nilai-p=0.031), dan BMI (pekali= -0.38, dan nilai-p =0.001) serta aktiviti fizikal (pekali=0.41, dan nilai-p=0.001). Amalan pemakanan dan aktiviti fizikal juga berkadar langsung dengan berat badan anak-anak yang dapat dibuktikan melalui nilai pekali =0.36, dan nilai-p=0.000 bagi amalan pemakanan, dan pekali= -0.29, nilai-p=0.000) bagi aktiviti fizikal. Hasil daripada dapatan ini menemukan bahawa amalan pemakanan dan aktiviti fizikal perlu menjadi perantara dalam model struktural. Kajian ini bukan sahaja mendapati model yang dicadangkan terbukti bersesuaian dengan data, malah hipotesis berhubung kerangka kajian juga berjaya diketengahkan.

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I certify that a Thesis Examination Committee has met on 18 July 2014 to conduct the final examination of Maryam Hamouleh Kheirollah Pour on her thesis entitled "Structural Modelling of Influential Factors Affecting Weight Problem of Primary School Children in Selangor, Malaysia" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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DECLARATION

Declaration by student

I hereby confirm that:

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This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
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LIST OF ABBREVIATIONS

AMOS	Analysis Of Moment Structure
AVE	Average Variance Extracted
BMI	Body Mass Index
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CFPQ-M	Malay Comprehensive Feeding Practice Questionnaire
CMIN	Normal Chi-Square Fit Index
CR	Construct Reliability
FFQ	Food Frequency Consumption
GFI	Goodness-Of-Fit Index
GLM	General linear modeling
NFI	Normed Fit Index
NHMS	National Health And Morbidity Survey
PA	Physical Activity
PAQ-C	Physical Activity Questionnaire for Children
RMSEA	Root Mean Square Of Approximation
SES	Socio-Economic Status
SEM	Structural Equation Modeling
SPSS	Statistical Package for Social Science
TLI	Tucker Lewis Index
vs.	Versus
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background of Study

Structural Equation Modeling is a powerful statistical technique that combines factor analysis and mathematical modeling to test the hypotheses consisting of interacting variables and pathways with reference to substantive theory. This method is widely employed in psychological, social, educational, management and community health fields in which indicator variables, such as parental feeding practices cannot be readily measured and have to be derived from questionnaires (Geng et al., 2009; Lampard et al., 2008).

Being overweight has clearly become one of the most important public health problems of the late twentieth-century. Childhood over weight is an unhealthy body condition that is mostly caused by gaining more weight than usual which is now being recognized as a serious threat to society due to its increasing prevalence (Budd et al., 2008; Chu, 2010).

The increase in childhood weight problems worldwide has garnered much recent attention from healthcare professionals, health policy experts, children's advocates, and parents (Prentice, 2006). Studies have shown that socio-economic status of parents, parental feeding practice and children's physical activity are the most important factors affecting children's weight status (Andrews et al., 2010; Ball et al., 2012; Frenn et al., 2011; Norimah et al., 2009; Quah et al., 2010; Shrewsbury et al., 2012; Towns et al., 2009). Hence, the estimation and measurement of these factors has constituted an important topic for studies in recent decades.

Previously, different regression models have been used to estimate the factors that affect children's weight status (Crouch et al., 2007; Finucane et al., 2011; Maddah et al., 2010; Ogden et al., 2012; Topham et al., 2010). In studying the models, it is apparent that they do not present a comprehensive model that assesses all the factors concerning children's obesity, and, therefore, they cannot be applied for comprehensive evaluation.

In consideration of children's weight problems and its direct effect on community health, the availability of an appropriate and executive model that has the ability to evaluate all factors involved in children's weight seems necessary. Therefore, this study is an attempt to develop a comprehensive model that can be used to estimate and evaluate all the main factors that contribute to childhood weight status.

The new model presents the overall effects of both the observed and the unobserved factors that lead to weight gain in children. In addition, the proposed model in this study could be helpful for researchers seeking to estimate the dependent variable based on definitions of the latent variables.

1.2 Statement of Problem

Determining and clarifying childhood weight problems indicators have been controversial subjects among researchers over the last two decades and it is still open to debate. There are certain problems in estimating the factors that affect the weight status of children. Most studies achieved a substantial link between the variables of interest. In fact, they have clearly defined the association between socioeconomic factors and childhood weight status, as well as physical activity, and parental feeding practice (Crouch et al., 2007; Finucane et al., 2011; Ogden et al., 2012)

In most studies on children obesity, the first indicators and constructs were carefully identified based on theories, and then each of the indicators of weight status were examined separately using different regression models. However, there was no comprehensive model to assess all the indicators and variables together simultaneously. In other words, no model was available that was capable of considering the interaction (covariance, homogenous) that exists among the variables. Clearly, the flaw found in previous models is the inability to measure all the impacts at once.

The previous studies that have assessed the prevalence of overweight and obesity and weight status of children according to the economic variables have considered these variables along with other internal variables, such as feeding practice, food consumption, and physical activity. In other words, feeding practice, physical activity and frequency of food consumption variables have been considered as indicators with other factors, such as socioeconomic status, as independent variables.

(Socioeconomic factors + feeding practice+ physical activity)→BMI of children

The use of this type of data (considering all the variables together in the same position) for analysis is not scientific and could lead to unrealistic results. One of the main reasons for rejecting this way is the presence of collinearity and the strong correlation between the variables of interest. As the mentioned variables are usually significantly correlated, and co linearity exists among them, it is not statistically possible to include them within the same regression equation.

Although multicollinearity does not decrease the predictive power of the regression model, it affects individual predictors. In other words, although a multiple regression model with correlated predictors may indicate that the entire model is good fitted, it may not provide valid results about any individual predictor. Fortunately, Structural Equation Modeling can handle multicollinearity problems. Hence, the lack of a comprehensive model that covers this weakness motivated us to conduct this study to overcome the problem by taking mediation analysis into consideration.

Figure 1.1 shows Influence of socioeconomic status on feeding practice and weight status of children in the structural model. However in the regression model all the variables are in one line, but in the structural model the variables have different weight and their associations are not linear as seen through the regression model.

1-1: Influence of socioeconomic status on feeding practice and weight status of children

Although, to date, no model has been specifically designed for children's weight gain with respect to obesity indicators such as socioeconomic status, parental feeding practice, physical activity level, structural equation modeling (SEM) provides estimates of the direct and indirect relationship. In addition SEM link these variables as well as providing the covariance and correlation between the constructs (variables).

Consequently, one model could provide an overall assessment of the constructs by using a combination of the four indicators (socioeconomic status of parents, parental feeding practice, physical activity, and weight status of children). Thus, the current research intends to fill the gap through the introduction of latent variables instead of measurement variables.

Table 1-1: Previous studies regarding regression model

Study	Dependent variable	Independent variable	Method
Maddah (2010)	Weight status of children	Education level of mother, weight status of parent	Logistic Regression
Crouch (2007)	Weight status of children	Mothers' education, maternal child feeding practices (restriction, pressure and	Multiple Regression Analysis

		monitoring)	
Topham (2010)	Weight status of children	Income level and feeding practice (pressure, permissive, restriction)	Logistic Regression Analyses

1.3 Research Questions

This study contains two research questions and four objectives. The following are the research questions that are addressed in this study:

1. Is there a significant statistical model that link among socioeconomic status, parental feeding practice, physical activity, and the weight status of children?
2. Is there any significant effect of gender and ethnicity on the relationships among socioeconomic status, parental feeding practice and the weight status of children?

1.4 Research Objectives

General objective

To identify a comprehensive statistical model that covers the relationship among feeding practice, socioeconomic factors, physical activity, frequency of food consumption, and weight status of children.

Specific objective

1. To identify the relationship among the socioeconomic status of parents (independent variable), parental feeding practice, physical activity level (latent variable), and the weight status of children (dependent variable).
2. To test the parental feeding practice and physical activity as the mediators of the structural model, while the relation between socioeconomic status and weight status of children is investigated.
3. To determine the role of gender and ethnicity, as moderators, on the relationship among socioeconomic status, parental feeding practice, physical activity and BMI.

1.5 Null Hypothesis

1. There is a significant statistical model to link among socioeconomic status, parental feeding practice, physical activity, and the weight status of children.
2. There is a significant effect of gender and ethnicity on the relationships among socioeconomic status, parental feeding practice and the weight status of children.

1.6 Significance of Study

The proposed study is one of the first to apply structural Equation Modeling to test the hypothesized structural model of weight status indicators. According to Byrne (1994), a researcher would be able to study the relations among the latent variables by using Structural Equation Modeling (SEM) with cross-sectional data (Byrne, 1994).

This study analyzed theoretically and statistically the internal causal path between the constructs of the socioeconomic status, parental feeding practice, and physical activity and weight status of children. The significance and strength of each factor and their indicators are specified. One of the important aspects of testing the causal model includes application of the construct measurements. Therefore, this study highlights the usefulness of the constructs and related indicators in estimating the weight status of children.

In summary two major implications of this study are:

1) Theoretical implications, that helps bridge the gap between the established obesity indicators and the emerging community of computational (using statistics) and complexity theories.
2) Practical implications that depend on the perception and understanding of children's weight status and the factors related to obesity that lead to more effective change-intervention decisions.

In addition, the method used in this study can be helpful for researchers seeking a new way to estimate the factors that affect childhood obesity. The availability of updated information in this field would able the researcher to find the new way in order to prevent the obesity in children, especially about children in the state of Selangor in Malaysia.

1.7 Organization of the Study

The present study concentrates on the current influential factors on obesity. This research includes five chapters; a brief description of each is presented below:

The current chapter is the introductory chapter to this thesis and provides an overview and introduction to the issues concerned in the research. The chapter is organized in the following order: the first section presents a background to the study and an introduction to obesity in children. Then, an overview of the research, detailed background of the study, problem statement relating to the indicators of obesity in children, purpose of the study, objectives, significance of the research, and definition of the expressions are presented in the following sections.

Chapter two provides a background of structural equation modeling, the measures, indicators, and theoretical foundation. In addition the relations between the variables are reported in Chapter two. In Chapter 3, methodology and the materials in current study is explained. The variables, their structure, and the relationships among them are defined and elaborated upon in chapter four. Furthermore, Chapter four provides relevant discussion on the data analysis based on SEM methodology. Finally, in Chapter five, a summary of the major findings is provided along with some suggestions for improvement of children's lifestyle and possible ideas for future research on the topic.

1.8 Conceptual Framework

The most important purpose of this study is to develop a comprehensive model that can estimate the factors that are related to childhood obesity. In this model, the latent variables are a combination of parental feeding practice and physical activity level. The independent variable is socioeconomic status. Hence, the model includes four constructs – one independent construct, three latent construct and one exogenous.

Clarifying the role of other variables, such as gender and ethnicity as moderator in the model, is the other goal of this study. Regarding the potential impact of gender and ethnicity in moderating the relationship, this study tries to illustrate the ability of these variables to control the connection of the socioeconomic status with other outcomes in the research model (weight status of children). Hence, the model contains independent, mediator, moderator, and dependent latent variables. Structural Equation Modeling (SEM) with a latent variable was used to estimate the overall impact of factors that affect children's weight. These statistical methods are often intended for data analysis and in assisting firms and companies to decide and plan in more effective ways. Multi-stage stratified sampling was used in data collection.

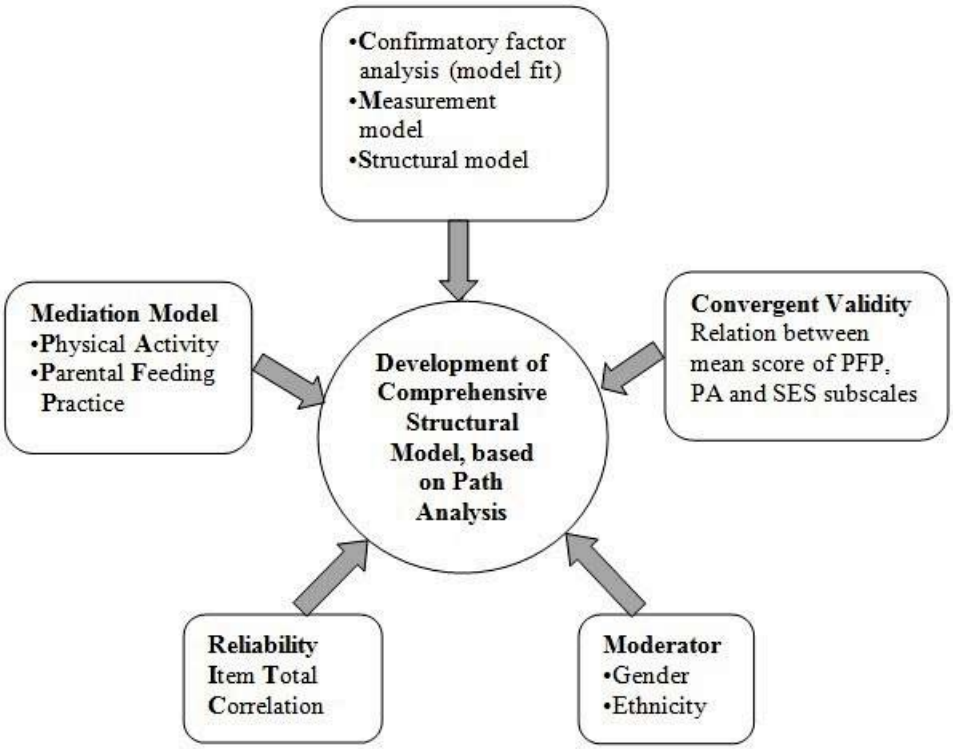

Figure 1-2: Conceptual framework

PFP: Parental feeding practice, PA: Physical activity, SES: Socioeconomic status

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