Mediation Effect of Physical Activity on Obesity in Black Women

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Grant Support: Department of Defense, DOD.

Conflict of interest: None.

Abstract: Background and objective: Sociodemographic and lifestyle factors, physical activity, diet, and nutrients are important in the understanding of obesity. The possibly direct or indirect nature of the associations among these factors and the eventual link to obesity is not well understood. In this study, we assess the indirect association between socio-demographic factors and obesity.

Design: A case-control study involving African American women conducted at Howard University Cancer Center.

Participants and methods: One hundred ninety eight participants gave information on anthropometric measurements, intake of dietary supplements and nutrients, socio-demographic factors (age, marital status, income and education) and physical activity. Path analysis was utilized to assess associations between socio-demographic factors and obesity through physical activity, dietary supplements and nutrients, smoking or alcohol consumption.

Main results: The mean age of the participants was (55 ± 12 years), with 50% being obese (BMI $\geq$ 30 kg/m^2). Obesity level decreased by approximately 7% for every one level increase in education via its prior effect on vigorous physical activity. Age had a significant positive indirect effect on obesity through vigorous physical activity – with obesity levels increasing by approximately 6% for every one year increase in age via its prior effect on vigorous physical activity.

Conclusions: Vigorous physical activity mediates the association between education and age on obesity.

Keywords: Mediators■Path coefficients■Fit indices

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https://doi.org/10.1016/j.jnma.2018.01.002

INTRODUCTION

Most Americans today are overweight or obese, and the gradual weight gain of the population that created the obesity epidemic continues.[1,2] Despite significant efforts, obesity continues to be a major public health problem, and there are surprisingly few effective strategies for its prevention and treatment.[3] Other than being a disease in itself, obesity is also known to be a risk factor for other chronic diseases including diabetes, cardiovascular diseases, osteoporosis and some types of cancer.

A study by Mokdad et al[4] indicated a continuing increase in obesity in both men and women of all ages, races and educational levels. Socioeconomic status is associated with obesity, especially in women.[5,6] Increasing physical activity, improving diet, and sustaining these lifestyle changes can reduce body weight,[4] and consequently reduce obesity. It has also been claimed that education is associated with physical activity, with well educated individuals more likely to engage in physical activity, especially women.[7] Some studies in Canada indicated that lower household income was inversely associated with fat intake and smoking, and that certain dietary habits, such as consumption of junk food, were associated with fat intake among low-income people.[8,9]

Socio-demographic and lifestyle factors, physical activity, diet, and nutrients are important in the understanding of obesity. The possibly direct or indirect nature of the associations among these factors and the eventual link to obesity is not well understood. For example, it might be proposed that income influences diet and physical activity and each of these factors in turn influences obesity. That is, diet and physical activity are mediators of the relationship between income and obesity. At the same time, income might have a direct effect on obesity without intermediate factors. Therefore, there is lack of consensus on the nature of association between obesity and socio-demographic factors. Understanding the nature and direction of association between these factors is crucial in reversing obesity trends in the United States. In this study, we examine the complex interplay among these factors that are involved in the etiology of obesity using structural equation models (SEM).

METHODS

Data

Approval for this study was obtained from the Institutional Review Board through the Georgetown University Medical Center, Washington, DC and Howard University, Washington, DC. All cases and controls included in the study were African-American women. After the initial identification of the cases from the surgical schedules, and the confirmation of diagnosis via pathology reports, consent was obtained from the surgeon to contact the subjects. This was followed by contacting the patient by a formal letter and a follow-up telephone call to discuss the willingness to participate in the study and schedule an appointment. The participation rate was 70%. On the day of interview a formal consent form was signed, anthropometric measurements taken, blood sample drawn and a survey questionnaire was completed.

Cases and controls

All cases recruited in this study were African American women born in the U.S., residing in Washington, D.C. metro area and diagnosed with breast cancer at the Howard University Hospital, Washington, DC within 6 months prior to interview. All women had a working telephone at home and able to communicate in English. Severely ill or institutionalized women were excluded from the study as were those diagnosed with HIV or Hepatitis. Also excluded were women suffering from drug abuse or unable to give informed consent. Women who had received chemotherapy or radiation treatment were not included in this study as these treatments can affect mutagen sensitivity.

The controls for our study were randomly selected from Washington, D.C. Voters Registration List obtained from the D.C. Board of Election. The prospective controls were contacted by a letter followed by telephone calls to discuss the study and willingness to participate. On the day of interview the participants were requested to sign the consent form and complete a set of questionnaires after which a blood sample was drawn. Eligibility criteria were the same as those for cases except that the controls must have had no personal history of breast cancer. Approximately 52% (115/221) of the control women successfully contacted enrolled in the study, 48% (n = 106) completed at least a portion of the study and 45.7% (101/221) completed the entire study.

Demographic, anthropometric and lifestyle factors

Using the same questionnaire, complete information on the participants was obtained on age, weight, height, family history of breast cancer, education and household income. BMI was defined as weight in kilograms divided by height is square meters. Interviewers administered an FFQ designed by.[10] The physical activity data assessed were the responses to questions on a questionnaire how many hours per week the participants spent on vigorous physical activity (e.g., basketball, swimming, running, and aerobics) during the past year. The response categories were: None, <1, 1, 2, 3−4, 5−6, 7−9, 10 + hours per week.[11] The participants were also asked how much time they spent per day during the past year in walking for exercise. The responses were also given as none, <1, 1, 2, 3−4, 5−6, 7−9, 10 + hours per day.

Statistical analysis

Basic descriptive statistics were presented in the form of means (and standard deviations) for continuous data, and frequencies (and percentages) for categorical data. To obtain a better understanding of the pathways through which socio-demographic factors influence obesity, we utilized path analysis. This technique allows us to specify the causal sequence of events between independent (or exogenous) variables (sociodemographic factors), intermediate variables and outcome (or endogenous) variables (physical activity, nutrients, dietary supplements, smoking, alcohol and obesity). This facilitates our understanding of the direct and indirect effects of independent variables on dependent variables, allowing for the independence assumption to be relaxed.

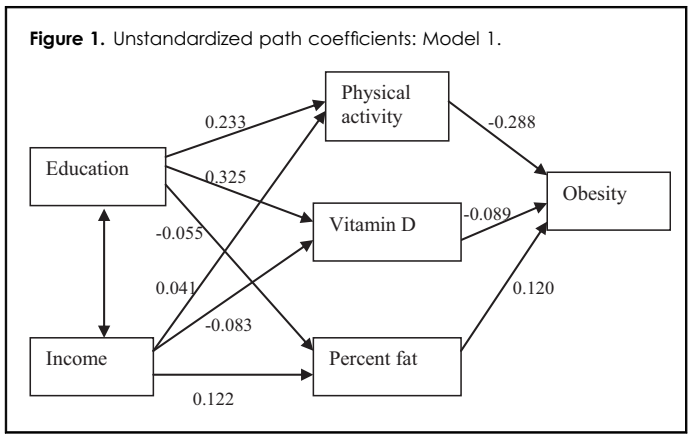

Figure 1. Unstandardized path coefficients: Model 1.

To gauge the significance of indirect effects, we will use the rule of thumb by Cohen and Cohen[12] that if all components unstandardized path coefficients are significant, then the whole indirect effect can be taken to be significant at a given level of significance. Two hypotheses were tested in this study. First, we hypothesize that the pathway from education and income to obesity (as measured by BMI) is through nutrients (vitamin D and percent fat) and physical activity (Figure 1).

Secondly, we hypothesize that the pathway from age and marital status to obesity is both direct and indirect and mediated by physical activity, smoking and alcohol (Figure 2).

Because the variables under consideration are of mixed nature (categorical and numeric variables), PRELIS program was used to adjust the analysis for multivariate non-normality. The ensuing asymptotic covariance matrices are analyzed using weighted least squares estimation. Assessment of model fit was based on the chi-square test corrected for nonnormality, χ^2. Other indices used to evaluate adequacy of model fit include the root mean square error of approximation (RMSEA) and comparative fit index (CFI). The RMSEA is a measure of the error of approximation of the model covariance structure to the covariance structure in the population.[13] Alternatively, the RMSEA estimates the lack of fit in a model compared to a saturated model. As a rule of thumb,