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TITLE: THE ASSOCIATION BETWEEN FOOD INSECURITY AND OVERWEIGHT/OBESITY AMONG WOMEN LIVING WITH HIV IN RURAL ESWATINI

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RESEARCH QUESTION:

Is food insecurity significantly associated with overweight/obesity among women living with HIV in rural Eswatini?

SIGNIFICANCE:

In sub-Saharan Africa (SSA), rising prevalence of overweight/obesity co-exists with increasing rates of nutrition-related noncommunicable diseases (NR-NCDs) [1]. Studies have shown that people living with human immunodeficiency virus (HIV) are just as susceptible to overweight/obesity as non-infected individuals, and are significantly impacted by the adverse effects of these heath conditions [2]. Yet, data on overweight/obesity and associated risk factors among HIV-positive individuals are limited. As developing countries undergo shifts in dietary intake from traditional diets high in grains and fiber to western-influenced diets high in fats and sugars, this nutrition transition has been associated with increased rates of overweight/obesity in these regions [1,3,4].

The rising prevalence of NR-NCDs as a result of the nutrition transition poses additional stress to already-weakened immune systems of HIV-infected individuals, thereby increasing the risk of morbidity and mortality among this population [2]. Eswatini is currently impacted by these health challenges. In addition to undergoing a nutrition transition, the country has been faced with a drastic increase in prevalence of overweight (28%) and obesity (23%), particularly among

women [4]. In conjunction with high rates of overweight/obesity, Eswatini suffers from an extremely high prevalence of HIV (27%) [5] and malnutrition [6]. This increased risk of overweight/obesity may be further impacted by childhood experiences of undernutrition and recurrent infections, which are linked to increased risk of numerous NR-NCDs, including cardiovascular diseases, type 2 diabetes mellitus, and hypertension [2,7,8].

While the prevalence of overweight/obesity in the general adult population has been documented, no known studies have addressed overweight/obesity among women living with HIV in Eswatini, who are currently the country's most vulnerable to HIV infection and poor health [9–11]. To our knowledge, this is the first study to investigate the prevalence of overweight/obesity and its association with food insecurity among women living with HIV in rural Eswatini. In addition, our study generated important data regarding variations in prevalence by food insecurity status, thereby providing us with a glimpse of potential risk factors of overweight/obesity in this population.

SPECIFIC AIMS

Aim 1: To assess the prevalence of overweight/obesity among women living with HIV in rural Eswatini.

Hypothesis 1: This aim is exploratory in nature; therefore, we do not have a definitive hypothesis about the outcome.

Aim 2: To assess the association between household food insecurity and overweight/obesity among women living with HIV in rural Eswatini.

Hypothesis 2: Overweight/obesity will be significantly associated with household food insecurity among women living with HIV in rural Eswatini.

METHODS

Study Design and Setting

Data from this study were obtained from a mixed-methods study investigating barriers to antiretroviral therapy (ART) adherence among women living with HIV in rural Eswatini. The study was conducted in four rural communities located in the Lubombo and Shiselweni regions between October and November, 2017. This analysis reports on the prevalence of overweight/

obesity and its association with household food insecurity among women living with HIV in rural Eswatini. Detailed information about the study population and setting is presented in our previous publication [12].

Inclusion Criteria: The study population consists of Swazi women who were HIV-positive and receiving ART. Women were eligible to participate in the study if they had been on ART for at least one month (at the time of the survey), resided in a rural area, were 20 years of age or older, and were willing to provide written informed consent.

Exclusion Criteria: Women were excluded from the study if they were HIV-negative, resided in an urban area, or were under 20 years of age.

Recruitment

Participants were recruited in collaboration with local health facilities and community health workers or expert clients. The research team, which consisted of the Principal Investigator (PI) and two research assistants, visited the health facilities and worked with community health workers to identify target communities. Once target communities were identified, the research team attended community outreach activities and support group meetings in those communities where they introduced the study to potential participants. Women who were interested were invited to participate in a survey. In addition, participants were recruited through invitation notices that were posted in public locations (e.g., health facilities, community centers, constituency buildings, churches, and neighborhood care points) within the respective communities. Participants were compensated 100 Rands for travel expenses and time taken to participate in the study.

Data Collection

Data were collected using an interviewer-administered survey questionnaire. Participants were interviewed in their native language of siSwati by trained research assistants. The surveys were conducted in a central location within respective rural communities, such as local constituency buildings, churches, and neighborhood care points. The survey questionnaire included the following items: 1) Household Food Insecurity Access Scale [13], 2) CASE Adherence Index

[14], and 3) a structured questionnaire including demographic information and anthropometric measurements (age, weight, height). Weight was measured in kilograms (kg) using a digital bathroom scale, and height was measured in meters (m) using a stadiometer. Weight measurements were taken with participants wearing light clothing and barefoot.

Outcome

Overweight and obesity were determined by using Body Mass Index (BMI), calculated by dividing weight in kilograms by height in meters squared (kg/m^2). BMI was categorized as underweight (<18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2), overweight (25–29.9 kg/m^2), and obese (≥ 30 kg/m^2) [15]. The outcome was modeled as a dichotomous variable: normal weight versus overweight/obese.

Exposure

Data on household food insecurity was collected using the Household Food Insecurity Access Scale(HFIAS) [13]. Participants were asked to provide information on their household food status in the month before the survey. Food security data was used to assess two of the three HFIAS domains, in particular, household food insufficiency. Women were classified as food insufficient if they answered "yes" to one or more of the questions about food insufficiency. Household food insufficiency was modeled as a dichotomous variable: women that were food sufficient versus women that were food insufficient. This food insufficiency variable was used to create a Household Food Insecurity Index which consisted of three categories: 1) women who were from households that were food insufficient; 2) women who skipped taking medication due to hunger; and 3) those who missed doses due to hunger-related side effects from taking their medication. Next, composite scores were calculated for each participant. Study participants received a composite score of 0, 1, 2, or 3, with 0 being the least food insecure and 3 being the most food insecure. Cronbach's alpha was used to assess the reliability of items in the household food insecurity index; the reliability coefficient was 0.80, which is regarded as acceptable [16].

Potential Confounders

As part of the survey questionnaire, participants were also asked, "In the past month, have you ever skipped taking your pills because of any of the following reasons: hunger, hunger-related

side effects, poor treatment, forgetfulness, stress, clinic too far, no money for transport, etc." Responses to these questions were identified as barriers to ART adherence and modeled as dichotomous variables (e.g., hunger: yes/no). In the questionnaire, participants were also asked about travel time, transportation costs, and mode of transportation to and from the health facility. Travel time and transportation costs were modeled as continuous variables, while mode of transport was modeled as a dichotomous variable (walking versus bus). Survey questionnaires were pilot tested prior to conducting this study.

Sample Size

Based on previous literature, we estimated that approximately 60% of women living with HIV in our target communities would be overweight or obese. Using an alpha of 0.05 and a statistical power of 80%, 103 participants were determined to be the minimum sample required to effectively assess association between overweight/obesity among women living with HIV in our study sample. With this sample size we will be able to significantly detect a risk ratio of 2.

DATA ANALYSES

Data will be analyzed using STATA version 17 (College Station, TX: StataCorp LP). Data analyses will be conducted at the descriptive, bivariate, and multivariable levels. Continuous variables will be presented as means with standard deviations, and categorical variables were presented as frequencies and percentages. Pearson's chi square test of significance will be performed to examine associations between the outcome variable (overweight/obesity) and independent variables. Differences in characteristics between women who were overweight/obese versus those who were normal weight will be assessed using the chi square test for categorical variables, and the t-test for continuous variables. The Fischer exact test will be used whenever an expected cell count is less than 5. Variables that will be significantly associated with overweight/obesity at a significance level of 25% were selected and included in multivariable log-binomial regression models. Multivariable log-binomial regression models will be used to assess the relationship between overweight/obesity and household food insecurity while controlling for potential confounders in the model. Variables will be considered statistically significant when $p<0.05$.

ETHICAL CLEARANCE

Study approval was obtained from the University of Massachusetts Amherst Institutional Review Board and the Eswatini National Health Research Review Board. Permission to conduct the study was also obtained from the Eswatini Ministry of Health and participating health facilities. Written informed consent was obtained from all individual participants included in the study.

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