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## FOOD PRICES AND PREVALENCE OF OVERWEIGHT AND OBESITY IN ESWATINI

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## ABSTRACT

Food pricing policies in many developing countries often provide stronger protection for energy-dense commodities such as edible oils, milk products, processed foods with sweeteners and additives, cereals and their derivatives, and livestock products, while offering weaker support for nutrient-dense foods like fruits and vegetables. This policy orientation has contributed to shifts in consumption patterns, encouraging higher intake of inexpensive, calorie-rich foods at the expense of healthier dietary options. Such dynamics are strongly associated with the rising prevalence of overweight and obesity, which are emerging as major public health challenges in sub-Saharan Africa. Understanding whether food price interventions can improve dietary behaviour is therefore critical. This study examined whether changes in food price policy in Eswatini could alter food consumption and consequently affect the prevalence of overweight and obesity. Data were obtained from the 2006–07 Eswatini Demographic and Health Survey (DHS) and World Food Programme (WFP) market price reports covering the period 2005–2017. To explore the relationships between food prices, household characteristics, and nutritional outcomes, the study employed econometric analysis using Ordinary Least Squares (OLS) regression models, with Body Mass Index (BMI) serving as the main indicator of nutritional status. The results revealed that BMI was negatively correlated with the price of cooking oil, indicating that reductions in oil prices are associated with higher BMI values and an increased probability of overweight or obesity. Furthermore, socio-demographic factors including age, household size, urban residence, and household wealth were found to exert positive and statistically significant effects on both BMI and overweight/obesity risk. These findings demonstrate the combined influence of price dynamics and socio-economic conditions in shaping dietary outcomes in Eswatini. The study concludes that food price policy can be leveraged as an important instrument for promoting healthier diets and reducing nutrition-related health burdens. Specifically, fiscal or trade measures that discourage excessive consumption of oils and processed foods, while enhancing the affordability and availability of fruits and vegetables, may reduce the prevalence of overweight and obesity and contribute to addressing the growing incidence of non-communicable diseases in Eswatini.

**Key words:** Obesity, Overweight, Nutrient-dense Food, Energy-dense Food, Eswatini

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## INTRODUCTION

The prevalence of overweight and obesity among adults is an emerging health challenge in several developing countries. This problem, which emanates from developed countries, is spreading to developing countries because of excessive consumption of energy-dense food items and adoption of sedentary lifestyles [1, 2]. Like in other developing nations, the rates of overweight and obesity have increased in sub-Saharan Africa (SSA) over the past 30 years [3]. An analysis of demographic and health survey data from 32 SSA countries indicates that the prevalence of overweight in the region is 15%. Madagascar has the lowest percentage (5.6%), whereas Eswatini has the highest percentage (27.7%). Additionally, the prevalence of female obesity is lowest in Madagascar (1.1%) and highest in Eswatini (23%) [2]. A major implication of the emerging spread of obesity and overweight is the risk of diet-related, chronic, noncommunicable diseases such as diabetes, hypertension and cardiovascular disease [4].

Despite the prevalence of the twin problems of overweight and obesity in the country, nationwide research studies have yet to be performed on the determinants. However, evidence from several country case studies suggests that these problems can be traced to bad eating habits, a lack of health-conscious culture, access to fast food outlets and supermarkets, and government food subsidy programmes on relative price policy [5 – 7]. According to the World Health Organization (WHO), a diet rich in fruit and vegetables has the potential to save the lives of approximately 2.7 million people worldwide [10]. However, the overall intake of fruit and vegetables in Eswatini is significantly low across all age groups and is worst among women [11]. The consumption of fruit and vegetables in sufficient quantities may reduce the risk of cardiovascular disease, gastrointestinal cancer, heart disease and stroke [11]. In contrast to the wave of World Bank-led market price liberalization across different countries in Africa in the 1980s, the prices of selected food items in Eswatini have been largely regulated [12]. Based on the Control of Cereals Act of 1959 and the Dairy Act of 1968, the minister in charge of agriculture reserves the right to fix the maximum or minimum prices at which any cereals (maize, sorghum and rice) and dairy products (milk, butter, cheese, creams and margarines) are sold in Eswatini. The Government of Eswatini established three institutions to coordinate its agricultural pricing policies: the National Marketing Board, National Maize Corporation (NMC) and Swaziland Dairy Board (SDB) [13]. The basic functions of the National Agricultural Marketing Board (NAMBOARD) are to issue import licences and regulate agricultural markets, whereas the NMC's main responsibility is to oversee the nation's maize marketing reforms. The functions of the SDB include organizing dairy product production and regulating dairy product distribution and marketing. The board plays a significant advisory role to the minister in setting the

prices of dairy products. These three institutions are the basic price policy instruments for setting commodity prices and promoting increased production and import, and hence consumption, of energy-dense food items in the nation. The ultimate goal of institutions is to ensure the security of food items. The same protection is not used for fruits or vegetables.

Each of the three institutions has other specific responsibilities for improving the availability of energy-dense food items in the country. The NMC provides extension and marketing advisory services to maize farmers to increase their income and improve the nation's access to maize and its food products. The NMC is the sole importer of commercial maize into the country. Similarly, the dairy industry is under the control of the SDB. The SDB, in conjunction with Parmalat (the processing company in charge of marketing and sales of milk) and the government, sets the prices of dairy products [12]. The specific responsibility of NAMBOARD is to regulate the import of all agricultural products, including maize, rice, wheat, poultry, fresh vegetables and fruit [13].

The major concern in this study is that the current agricultural pricing policies favour the importation and production of food items that contribute to the increase in the rates of overweight and obesity in the country. The policies provide better protection for energy-dense food items, including high-fat oil and milk products, processed foods with sweeteners and additives, maize and other cereals and their products, and livestock products, than for nutrient-dense food items, such as fresh fruit and vegetables. Therefore, the major concern of this study is to establish whether a change in food price policy in Eswatini can be used to alter dietary intake, which would lead to significant effects on the prevalence of overweight. The specific objective is to analyse the effects of food prices on the prevalence of overweight and obesity in Eswatini

## MATERIALS AND METHODS

### Theoretical and Empirical Review

At the micro level, theoretically, in the short run, an individual's health status can be viewed as the outcome of a production process that uses inputs such as medical care, dietary practices, and food prices, with health itself representing the resulting output [14, 15]. In the long run, however, health may be conceptualized as a form of capital stock—often termed health human capital. Under this perspective, individuals or households are assumed to possess an initial stock of health that can be increased or depleted through investments and behaviours, with improved health representing the ultimate outcome [16]. In this study, the focus was on the production of health in the short run, and the standard approach was to model health as a production function. The inputs can be classified into three categories, namely, goods that affect both health and utility directly, goods that affect health only, and

unobservable health endowments. It is possible to derive a reduced-form demand model for health inputs and outcomes by maximizing the utility subject to the health production function and budget constraints. The health demand model will depend on prices, money income and health endowments [14, 15, 17].

Mathematically, let preferences be defined over health  $H$  and other consumption goods  $Z$ , where  $Z$  represents goods that do not directly affect health, and let  $X$  denote goods that influence health. Individual or household preferences can therefore be expressed as:

$$U = U(H, Z) \quad (1)$$

Health itself is not exogenous but produced through a health production process. Specifically, health status is generated according to:

$$H = f(X, \theta) \quad (2)$$

where  $X$  represents health-related inputs that may not directly enter the utility function, and  $\theta$  denotes individual or household-specific health endowments such as genetic traits or baseline physiological conditions. Individuals or households face a budget constraint:

$$Y = P_Z Z + P_X X \quad (3)$$

where  $Y$  denotes income, and  $P_Z$  and  $P_X$  represent prices of non-health and health-related goods respectively. The household chooses  $X$  and  $Z$  to maximize utility (Equation 1) subject to the health production function (Equation 2) and the budget constraint (Equation 3). Solving this constrained optimization problem yields a reduced-form demand function for health inputs:

$$X = g(P_X, P_Z, Y, \theta) \quad (4)$$

Substituting Equation (4) into the health production function gives a reduced-form health demand equation:

$$H = h(P_X, P_Z, Y, \theta) \quad (5)$$

Equations (4) and (5) show that observed health outcomes depend on prices, income, and endowments. However, estimating these reduced-form equations alone does not identify the causal relationship between specific inputs and health outcomes, because the structural link between inputs and health is embedded within unobserved behavioural choices. To address this limitation, a hybrid health production framework is often employed. In this approach, health outcomes depend directly on observable inputs  $X$  as well as indirectly through behavioural and environmental pathways:

$$H = \phi(X, W, \theta) \quad (6)$$

where  $W$  represents additional observable factors affecting health, such as socioeconomic characteristics or environmental conditions. This hybrid formulation forms the basis of most empirical health production studies because it allows estimation of the partial association between observable inputs and health outcomes. Guided by the theoretical framework above, the empirical model treats observed health status as a function of measurable health inputs, socioeconomic characteristics, and other control variables capturing environmental and demographic influences. Accordingly, the estimating equation is specified as:

$$H_i = \beta_0 + \beta_1 X_i + \beta_2 W_i + \beta_3 S_i + \varepsilon_i \quad (7)$$

where  $H_i$  denotes the health outcome for individual or household  $i$ ;  $X_i$  represents key health inputs of interest;  $W_i$  captures additional observable determinants derived from the theoretical model;  $S_i$  includes socioeconomic controls; and  $\varepsilon_i$  is an error term reflecting unobserved endowments and measurement error. This specification represents an estimable counterpart of the structural health production function and allows empirical assessment of how observable inputs relate to health outcomes.

The health production function in Equation 2, the reduced-form production function in Equations (4) to (6) and the hybrid health production function in Equation (7) form the framework for most empirical studies on the production of individual/household health. On the basis of this framework, several researchers have developed empirical models for the relationships among diet, food prices and BMI as health outcomes [18]. An important aspect of the framework is that health status can be represented by the degree of overweight and obesity. A comprehensive review of the causes and consequences of obesity has been documented in the literature [19]. Obesity is generally caused by an imbalance between caloric intake and caloric expenditure. This imbalance has been shown to depend mainly on technological changes, which reduce the relative prices of mass-produced calorie-dense foods, increase the value of time and reduce expenditures on calorie-dense foods [20, 21, 22]. The reduction in the relative prices of such food commodities has led to an increase in the consumption of carbohydrates and fast and fatty foods in terms of size and frequency. At the same time, an increase in real wages has led to a substitution of exercise time for working. Finally, the use of labor-saving devices at work has reduced energy expenditure in the workplace by moving away from manual labour [23, 24, 25].

Several empirical studies have investigated the relationship between food and restaurant prices or taxes on weight outcomes. Several studies have combined national cross-sectional data such as demographic household surveys (DHSs), monitoring future surveys (MFSs) and rural household surveys (RHSs) with food price data [5, 26, 27, 28]. Food price data for food items were collected from

restaurants, fast-food restaurants, national statistics services, and the American Chamber of Commerce Researchers Association (ACCRA). Data on BMI, overweight and obese individuals, and personal characteristics were obtained from national household health surveys. The results show mixed relationships. The prices of fruits and vegetables were positively associated with obesity and overweight, suggesting that a decline in the retail prices of fruits and vegetables could reduce the rates of overweight and obesity. In contrast, the prices of energy-dense foods such as fast food, sugar, oil, egg, and carbohydrate food items were negatively associated with obesity and overweight.

The available empirical evidence on the link between food prices and the prevalence of overweight and obesity in Africa is limited. However, several studies have investigated the determinants of noncommunicable disease (NCD) risk factors in the region, especially in South Africa, where the majority of Eswatini food items are imported [29, 30]. These studies identify excess consumption of energy-dense food items; physical inactivity; and sociodemographic characteristics such as age, sex, education, occupation, ethnic origin, and distance to supermarkets and fast food restaurants as the main drivers of overweight and obesity in African countries. There is a consensus among scholars that policies that alter food consumption patterns have the potential to change human body weight outcomes.

### Data collection

Data for the study were sourced from the 2006–07 Eswatini Demographic and Health Survey (DHS) (<https://dhsprogram.com/what-we-do/survey/survey-display-259.cfm>) conducted by the Eswatini Central Statistical Office (CSO) and the 2006–2020 World Food Programme (WFP) market report data. The DHS contains information on the nutritional status of women, men and young children and their sociodemographic characteristics. The survey is a nationally representative survey of 4,843 households, comprising 4,987 women aged 15–49 and 4,156 men aged 15–49. The survey also included individual interviews with boys and girls aged 12–14 years and older adults aged 50 years and over. In this study, the analysis was restricted to men and women who were between 15 and 49 years old. For the women, those who were pregnant were excluded from the data used for the analysis to avoid unnecessary weight shocks. The survey provides information on health and demographic indicators at the national level for urban–rural areas and for the four Eswatini regions of Manzini, Hhohho, Lubombo and Shiselweni. Generally, DHS data do not include information on the prices of food items. These data were obtained from the World Food Programme (WFP) market reports on Eswatini and averaged over the period of 2006–2020. The average food prices between 2006 and 2020 were used as independent variables. The interest of the study is structural long-term exposure, not short-term effects. The research question is whether regions with persistently high

prices over time exhibited higher baseline obesity in 2007. Food prices are proxies for long-term environmental context instead of direct causes of obesity or overweight at a particular point in time.

### Empirical Model Specification

Theoretically, food prices may influence BMI through the consumption of food items. Higher prices of healthy foods such as fruits and vegetables are hypothesized to reduce their consumption. Conversely, lower prices for energy-dense and unhealthy food items (including fast food, saturated oil, sugars and soft drinks) are expected to cause an increase in the consumption of such food items, leading to greater weight. The basic model for this study is as follows:

$$BMI_{ij} = \beta_0 + \beta_1 P_{ij} + \beta_2 Y_{ij} + \beta_3 X_{ij} + \mu_i + \mu_{ij} \quad (8)$$

The regression model is an empirical counterpart of Equation (8), where BMI is used as the observable proxy for health status. In this formulation:  $BMI_{ij}$  represents the health outcome of individual  $j$  in group  $i$  and corresponds to  $H$  in the theoretical model.  $P_{ij}$  represents price-related variables derived from the budget constraint in Equation (4).  $Y_{ij}$  denotes income, also originating from the budget constraint.  $X_{ij}$  represents observable health inputs corresponding to the input vector in the production function (Equation 2).  $\mu_{ij}$  captures unobserved individual or group-specific endowments analogous to  $\theta$  in the theoretical framework.  $e_{ij}$  is the idiosyncratic error term reflecting unobserved factors and measurement error. The parameters  $\beta_1 - \beta_3$  therefore represent reduced-form effects of prices, income, and health inputs on health outcomes, consistent with the reduced-form representation derived from the theoretical optimization model.

On the basis of the variables defined in Table 1, we estimated Equation 7 via the ordinary least squares (OLS) regression method. The price variables are constructed on the basis of knowledge of how food is prepared and consumed in the country. Maize, meat and vegetables are the main food sources in Eswatini. Maize is often roasted or boiled and eaten without oil. It can be incorporated into meals and consumed with a certain amount of oil, beef or goat meat, with or without vegetables. As cooking oil has the highest number of calories of all food items, four relative oil prices are used separately in the regression model while controlling for the prices of other food items and differences in sociodemographic characteristics. The BMI, price variables and household size in the regression equations are log-transformed to be able to interpret the coefficients as price elasticities directly. In the regression analysis, a robust standard error was used to correct for the presence of heteroscedasticity. In these price-effect models, other food items are considered complementary to each other. The basic hypothesis of interest is that the calories of food consumed are directly proportional to their free market prices.

## RESULTS AND DISCUSSION

### Descriptive Statistics

A summary of the descriptive statistics of the various determinants of BMI is presented in Table 2. The results show that the mean BMI for the whole sample was 24.48. Food prices offer a comprehensive view of the cost of each food item in Eswatini. The average prices show that beef is the most expensive, with an average price of 1.06 Emalangeneni per 100 calories. This is followed by the average price of oil (0.29). The least expensive is maize, which costs approximately 0.12 Emalangeneni per 100 calories.

### The Regression Results

Tables 3, 4, 5, and 6 present the effects of cooking oil prices relative to the prices of maize, beef and vegetables on the BMIs of all respondents, as well as disaggregation by urbanization. In all the models, the combined effect of all the variables, as indicated by the F statistic, is statistically significant at the 1% level. The adjusted  $R^2$  varies from approximately 20% to 28%. This implies that approximately 20–28% of the variation in BMI is explained by the explanatory variables in the models.

For all three models (all respondents, urban respondents and rural respondents) in Table 3, the coefficient of the price of oil is negative and statistically significant at the 1% level. A 1% increase in the oil price will lead to a decrease in the body mass index. The results confirm the hypothesis that an increase in the price of oil (energy dense) will lead to a decrease in BMI. This result is similar to the findings of Ng, Zhai and Popkin [23] and Lu and Goldman [24]. Similar to the results shown in Table 3, the effects of the oil price relative to the maize and beef prices in Tables 4 and 5 are negative. A 1% increase in the ratio of the oil price to the maize price will lead to an approximately 0.20% decrease in BMI for all respondents. The decline in BMI among rural residents is slightly lower than that of urban dwellers. Table 6 shows the effect of the price of oil relative to the price of vegetables. Unlike other relative oil prices, the coefficient is positive and significant for all respondents. These findings affirm the importance of vegetables in reducing the rates of overweight and obesity.

Similar to the results of Asfaw [5], the BMI for all respondents increases with age at a decreasing rate. The coefficient of the urban variable is also positive and statistically significant at the 1% probability level. This implies that people living in urban areas have a higher BMI than those living in rural areas do. The coefficient of the wealth status variable is also positive and significantly related to BMI. This means that a tendency toward overweight and obesity is greater among rich individuals than among poor individuals, as they have a higher BMI. In contrast to Winkleby, Kraemer, Ahn and Varady [25], who reported that higher education reduces BMI, the coefficient of illiterate as a variable is negative and significant at the 1% level.

## CONCLUSION AND RECOMMENDATIONS FOR DEVELOPMENT

This study investigates the effects of food prices on BMI in Eswatini using 2007 DHS data. The analysis was disaggregated into rural and urban subsamples. The reduced-form price–effect models revealed that the BMI of individuals is affected by food prices and socioeconomic characteristics. When the relative price of cooking oil is reduced, obesity and overweight, as measured by BMI, increase. The effects are statistically significant and persistent across all the models, whether they are rural or urban. In contrast to a priori expectations, BMI is positively related to the price of vegetables and fruit as well as subsidized maize. The coefficient of maize becomes negative when it is measured relative to the price of cooking oil. Therefore, the relative price of cooking oil is the major policy concern. On the basis of these findings, some policy recommendations are suggested.

The government and private sector in Eswatini should promote sustainable procurement policies for locally produced fruits and vegetables, including contractual arrangements similar to the NMC maize scheme to ensure stable and affordable prices through partnerships between farmers and retailers. To mitigate the negative effects of oil prices on BMI, authorities could raise customs duties on imported cooking oils and channel the revenue into subsidies for healthy foods, public health campaigns, exercise infrastructure, and rural development programs. Public institutions, universities, parastatals, and NGOs should also strengthen support for fruit and vegetable growers through training, financing, research, and marketing assistance. At the household level, older adults should manage calorie intake and exercise regularly, while urban residents should improve diets, use physical activity infrastructure, and benefit from government policies promoting walking, cycling, recreational facilities, and nutrition education.

### Conflict of interest statement

The authors declare that they have no conflicts of interest.

### Data availability statement

The data supporting the findings of this study are available in the Demographic and Health Survey (DHS) for Eswatini at <https://dhsprogram.com/what-we-do/survey/survey-display-259.cfm>

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**Table 1: Definition of variables**

| Variable                                           | Definition                                                                                         |
|----------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Body mass index(BMI <sub>ij</sub> )                | Weight in kg/m <sup>2</sup> BMI ≤ 24.9, underweight 25 ≤ BMI ≤ 29.9, overweight BMI ≥ 30, obese.   |
| Sociodemographic characteristics(X <sub>ij</sub> ) |                                                                                                    |
| Age                                                | Years                                                                                              |
| Education                                          | No formal education = 0, elementary education = 1, secondary education = 2, tertiary education = 3 |
| Household size                                     | Number                                                                                             |
| Family wealth                                      | If within highest wealth quantile 1, otherwise 0                                                   |
| Urbanization                                       | If area is urban 1, if area is rural, 0                                                            |
| Price indicators(P <sub>ij</sub> )                 |                                                                                                    |
| Vegetables price per 100 calories                  | Local currency (Emalangeni)                                                                        |
| Price of fruit per 100 calories                    | Local currency (Emalangeni)                                                                        |
| Price of maize per 100 calories                    | Local currency (Emalangeni)                                                                        |
| Price of beef per 100 calories                     | Local currency (Emalangeni)                                                                        |
| Price of oil per 100 calories                      | Local currency (Emalangeni)                                                                        |

**Table 2: Description of regression variables**

| Variable                               | N    | Mean  | Stdev | Minimum | Maximum |
|----------------------------------------|------|-------|-------|---------|---------|
| Obese %                                | 9903 | 0.14  | 0.35  | 0.00    | 1.00    |
| Overweight %                           | 9903 | 0.21  | 0.41  | 0.00    | 1.00    |
| Overall (BMI in kg/m <sup>2</sup> )    | 9903 | 24.48 | 5.31  | 12.98   | 57.04   |
| Obese (BMI in kg/m <sup>2</sup> )      | 1390 | 34.70 | 4.34  | 30      | 57.04   |
| Overweight (BMI in kg/m <sup>2</sup> ) | 2113 | 27.10 | 1.40  | 25      | 29.98   |
| Age in year                            | 9903 | 27.40 | 9.66  | 15.00   | 49.00   |
| Illiterate (dummy)                     | 9903 | 0.08  | 0.28  | 0.00    | 1.00    |
| Family size (number)                   | 9903 | 6.48  | 4.08  | 1.00    | 34.00   |
| Wealth quantile (dummy)                | 9903 | 0.22  | 0.41  | 0.00    | 1.00    |
| Urban (dummy)                          | 9903 | 0.34  | 0.47  | 0.00    | 1.00    |
| Price of food items in Emalangeni      |      |       |       |         |         |
| Maize                                  | 9903 | 0.12  | 0.01  | 0.11    | 0.12    |
| Beef                                   | 9903 | 1.06  | 0.14  | 0.87    | 1.21    |
| Oil                                    | 9903 | 0.29  | 0.05  | 0.22    | 0.35    |
| Veg                                    | 9903 | 0.18  | 0.05  | 0.12    | 0.23    |
| Fruit                                  | 9903 | 0.25  | 0.11  | 0.08    | 0.39    |

Source: Authors' compilation from the SDHS survey and WFP/Market Reports

**Table 3: Effect of staple oil price on BMI**

| Variable                         | Dependent variable, Log(BMI) |                         |                         |
|----------------------------------|------------------------------|-------------------------|-------------------------|
|                                  | All respondents              | Urban respondents       | Rural respondents       |
| Price variable                   |                              |                         |                         |
| Log(staple oil)                  | -0.217***<br>(0.018)         | -0.230***<br>(0.029)    | -0.219***<br>(0.022)    |
| Log(maize)                       | 0.935***<br>(0.037)          | 0.904***<br>(0.062)     | 0.968***<br>(0.046)     |
| Log(vegetables + fruit)          | 0.056***<br>(0.004)          | 0.050***<br>(0.008)     | 0.059***<br>(0.005)     |
| Sociodemographic characteristics |                              |                         |                         |
| Log(family size)                 | 0.016***<br>(0.003)          | 0.017***<br>(0.005)     | 0.012***<br>(0.003)     |
| Age                              | 0.024***<br>(0.001)          | 0.021***<br>(0.002)     | 0.026***<br>(0.002)     |
| age2                             | -0.0002***<br>(0.00002)      | -0.0002***<br>(0.00004) | -0.0003***<br>(0.00003) |
| Illiterate                       | -0.044***<br>(0.007)         | -0.023*<br>(0.012)      | -0.045***<br>(0.008)    |
| Urban                            | 0.025***<br>(0.004)          |                         |                         |
| Richer                           | 0.011***<br>(0.004)          | -0.033***<br>(0.007)    | 0.037***<br>(0.005)     |
| Constant                         | 4.565***<br>(0.078)          | 4.541***<br>(0.132)     | 4.620***<br>(0.096)     |
| Observations                     | 9,903                        | 3,319                   | 6,584                   |
| Adjusted R <sup>2</sup>          | 0.260                        | 0.223                   | 0.273                   |
| F-Statistic                      | 386.564***                   | 120.286***              | 310.343***              |

Note: \* p \*\* p \*\*\* p<0.01

**Table 4: Effects of the cooking oil price relative to the maize price on BMI**

|                            | Dependent variable      |                         |                         |
|----------------------------|-------------------------|-------------------------|-------------------------|
|                            | All respondents         | Urban respondents       | Rural respondents       |
| Price variable             |                         |                         |                         |
| Log(oil/maize)             | -0.199***<br>(0.018)    | -0.222***<br>(0.030)    | -0.194***<br>(0.023)    |
| Log(beef)                  | 0.001<br>(0.019)        | -0.010<br>(0.032)       | 0.014<br>(0.024)        |
| Log(vegetables + fruit)    | 0.038***<br>(0.005)     | 0.035***<br>(0.009)     | 0.038***<br>(0.006)     |
| Sociodemographic variables |                         |                         |                         |
| Log(family size)           | 0.017***<br>(0.003)     | 0.019***<br>(0.005)     | 0.012***<br>(0.004)     |
| Age                        | 0.025***<br>(0.001)     | 0.021***<br>(0.002)     | 0.027***<br>(0.002)     |
| age2                       | -0.0003***<br>(0.00002) | -0.0002***<br>(0.00004) | -0.0003***<br>(0.00003) |
| Illiterate                 | -0.039***<br>(0.007)    | -0.016<br>(0.012)       | -0.041***<br>(0.008)    |
| Urban                      | 0.024***<br>(0.004)     |                         |                         |
| Richer                     | 0.009**<br>(0.004)      | -0.033***<br>(0.007)    | 0.034***<br>(0.005)     |
| Constant                   | 2.973***<br>(0.035)     | 3.070***<br>(0.063)     | 2.941***<br>(0.043)     |
| Observations               | 9,903                   | 3,319                   | 6,584                   |
| R <sup>2</sup>             | 0.229                   | 0.194                   | 0.242                   |
| Adjusted R <sup>2</sup>    | 0.228                   | 0.192                   | 0.241                   |
| F-Statistic                | 326.417***              | 99.442***               | 262.733***              |

Note: \*p\*\*p\*\*\*p<0.01

**Table 5: Effects of oil price relative to beef price on BMI**

|                            | Dependent variable, log(BMI) |                         |                         |
|----------------------------|------------------------------|-------------------------|-------------------------|
|                            | All respondents              | Urban respondents       | Rural respondents       |
| Price variable             |                              |                         |                         |
| Log(oil/beef)              | -0.176***<br>(0.015)         | -0.176***<br>(0.024)    | -0.186***<br>(0.018)    |
| Log(maize)                 | 0.976***<br>(0.039)          | 0.933***<br>(0.065)     | 1.023***<br>(0.048)     |
| Log(vegetables + fruit)    | 0.027***<br>(0.003)          | 0.019***<br>(0.006)     | 0.030***<br>(0.003)     |
| Sociodemographic variables |                              |                         |                         |
| Log(family size)           | 0.017***<br>(0.003)          | 0.019***<br>(0.005)     | 0.011***<br>(0.003)     |
| Age                        | 0.025***<br>(0.001)          | 0.021***<br>(0.002)     | 0.027***<br>(0.002)     |
| age2                       | -0.0003***<br>(0.00002)      | -0.0002***<br>(0.00004) | -0.0003***<br>(0.00003) |
| Illiterate                 | -0.049***<br>(0.007)         | -0.033***<br>(0.012)    | -0.048***<br>(0.008)    |
| Urban                      | 0.024***<br>(0.004)          |                         |                         |
| Richer                     | 0.013***<br>(0.004)          | -0.031***<br>(0.007)    | 0.040***<br>(0.005)     |
| Constant                   | 4.596***<br>(0.079)          | 4.553***<br>(0.133)     | 4.670***<br>(0.097)     |
| Observations               | 9,903                        | 3,319                   | 6,584                   |
| R <sup>2</sup>             | 0.261                        | 0.224                   | 0.276                   |
| Adjusted R <sup>2</sup>    | 0.260                        | 0.222                   | 0.275                   |
| F-Statistic                | 387.650***                   | 119.526***              | 312.988***              |

**Note:** \* p \*\* p \*\*\* p<0.01

**Table 6: Effects of oil prices relative to vegetable prices on BMI**

|                            | Dependent variable, Log(BMI) |                         |                         |
|----------------------------|------------------------------|-------------------------|-------------------------|
|                            | All respondents              | Urban respondents       | Rural respondents       |
| Price variable             |                              |                         |                         |
| Log(oil/vegetable)         | 0.572***<br>(0.045)          | 0.592***<br>(0.073)     | 0.587***<br>(0.057)     |
| Log(maize)                 | 1.004***<br>(0.040)          | 0.958***<br>(0.065)     | 1.052***<br>(0.049)     |
| Log(beef)                  | -0.337***<br>(0.037)         | -0.369***<br>(0.061)    | -0.332***<br>(0.046)    |
| Log(vegetables + fruit)    | 0.118***<br>(0.010)          | 0.115***<br>(0.016)     | 0.121***<br>(0.012)     |
| Sociodemographic variables |                              |                         |                         |
| Log(family size)           | 0.016***<br>(0.003)          | 0.018***<br>(0.005)     | 0.011***<br>(0.003)     |
| Age                        | 0.024***<br>(0.001)          | 0.021***<br>(0.002)     | 0.027***<br>(0.002)     |
| age2                       | -0.0003***<br>(0.00002)      | -0.0002***<br>(0.00004) | -0.0003***<br>(0.00003) |
| Illiterate                 | -0.045***<br>(0.007)         | -0.026**<br>(0.012)     | -0.045***<br>(0.008)    |
| Urban                      | 0.024***<br>(0.004)          |                         |                         |
| Richer                     | 0.012***<br>(0.004)          | -0.033***<br>(0.007)    | 0.038***<br>(0.005)     |
| Constant                   | 4.919***<br>(0.092)          | 4.884***<br>(0.152)     | 5.003***<br>(0.114)     |
| Observations               | 9,903                        | 3,319                   | 6,584                   |
| R <sup>2</sup>             | 0.263                        | 0.227                   | 0.277                   |
| Adjusted R <sup>2</sup>    | 0.262                        | 0.225                   | 0.276                   |
| F-Statistic                | 352.288***                   | 108.055***              | 280.251***              |

Note: \*p\*\*p\*\*\*p<0.01

## REFERENCES

1. **Amin F, Fatima SS, Islam N and AH Gilani** Prevalence of obesity and overweight, its clinical markers and associated factors in a high-risk South-Asian population. *BMC Obes.* 2015; **2(1)**: 16.
2. **Neupane S, Prakash KC and DT Doku** Overweight and obesity among women: Analysis of Demographic and Health Survey data from 32 Sub-Saharan African countries. *BMC Public Health.* 2015; **16(1)**: 30.
3. **Steyn NP and ZJ Mchiza** Obesity and the nutrition transition in Sub-Saharan Africa. *Ann N Y Acad Sci.* 2014; **1311(1)**: 88-101.
4. **World Health Organization.** 2016 Annual Report of the World Health Organization. Geneva: WHO; 2016.
5. **Asfaw A** The role of food price policy in determining the prevalence of obesity: Evidence from Egypt. *Rev Agric Econ.* 2006; **28(3)**: 305-312.
6. **Galal OM** The nutrition transition in Egypt: Obesity, undernutrition and the food consumption context. *Public Health Nutr.* 2002; **5(1A)**: 141-148.
7. **Khan LK, Harrison GG, Galal OM, Ritenbaugh C, Shaheen FM, Kirksey A and NW Jerome** Prevalence and functional correlates of obesity in an Egyptian village. *Ecol Food Nutr.* 1996; **34(4)**: 311-325.
8. **Powell LM and FJ Chaloupka** Food prices and obesity: Evidence and policy implications for taxes and subsidies. *Milbank Q.* 2009; **87(1)**: 229-257.
9. **Viola D, Arno PS, Maroko AR, Schechter CB, Sohler N, Rundle A and J Maantay** Overweight and obesity: Can we reconcile evidence about supermarkets and fast food retailers for public health policy? *J Public Health Policy.* 2013; **34(3)**: 424-438.
10. **World Health Organization.** 2005 Annual Report of the World Health Organization. Geneva: WHO; 2005.
11. **World Health Organization.** 2013 Annual Report of the World Health Organization. Geneva: WHO; 2013.

12. **Dlamini T and M Mohammed** Determinants of choice of credit sources by Eswatini SMEs: A focus on the Agriculture Sector. Annual Conference, September 25-27, Cape Town, South Africa 284776, Agricultural Economics Association of South Africa (AEASA) 2018.  
<https://ideas.repec.org/p/ags/aeas18/284776.html> Accessed May 2025.
13. **National Agricultural Marketing Board.** Annual Report. Mbabane, Swaziland; 2012.
14. **Grossman M** The human capital model. In: Culyer AJ, JP Newhouse editors. *Handbook of Health Economics*. **Vol. 1**. Amsterdam: Elsevier; 2000. p. 347-408.
15. **Rosenzweig MR and TP Schultz** Estimating a household production function: Heterogeneity, the demand for health inputs, and their effects on birth weight. *J Polit Econ*. 1998; **96(5)**: 723-746.
16. **Grossman M** On the concept of health capital and the demand for health. *J Polit Econ*. 1972; **80(2)**: 223-255.
17. **Mwabu G** Health economics for low-income countries. In: Schultz TP, and JA Strauss editors. *Handbook of Development Economics*. **Vol. 4**. Amsterdam: Elsevier; 2007. p. 3305-3374.
18. **Huffman WE** Household production theory and models. In: Lusk JL, Roosen J, and JF Shogren, editors. *The Oxford Handbook of the Economics of Food Consumption and Policy*. Oxford: Oxford University Press; 2011. p. 17-40.
19. **Finkelstein EA, Ruhm CJ and KM Kosa** Economic causes and consequences of obesity. *Annu Rev Public Health*. 2005; **26**: 239-257.
20. **Cutler DM, Glaeser EL and JM Shapiro** Why have Americans become more obese? *J Econ Perspect*. 2003; **17(3)**: 93-118.
21. **Lakdawalla D, Philipson T and J Bhattacharya** Welfare-enhancing technological change and the growth of obesity. *Am Econ Rev*. 2005; **95(2)**: 253-257.
22. **Philipson T and R Posner** The long-run growth in obesity as a function of technological change. *Perspect Biol Med*. 1999; **42(3)**: S87-S107.

23. **Ng SW, Zhai F and BM Popkin** Impacts of China's edible oil pricing policy on nutrition. *Soc Sci Med.* 2008; **66(2)**: 414-426.
24. **Lu Y and D Goldman** The relative effects of relative food prices on obesity: Evidence from China. *J Health Econ.* 2010; **29(5)**: 855-864.
25. **Winkleby MA, Kraemer HC, Ahn DK and AN Varady** Ethnic and socioeconomic differences in cardiovascular disease risk factors: Findings for women from the Third National Health and Nutrition Examination Survey, 1988-1994. *JAMA.* 1997; **280(4)**: 356-362.
26. **Chou SY, Grossman M and H Saffer** An economic analysis of adult obesity: Results from the Behavioral Risk Factor Surveillance System. *J Health Econ.* 2002; **21(5)**: 871-891.
27. **Suzuki E** Time changes, so do people. *Soc Sci Med.* 2011; **72(8)**: 1374-1380.
28. **Fajobi DT, Ajetomobi JO, Raufu MO, Fajobi MO and P Paramasivam** Effects of food price on nutrition outcomes among women in Nigeria. *Food Sci Nutr.* 2023; **12(1)**: 94-104.
29. **Joubert J, Norman R, Lambert EV, Groenewald P, Schneider M, Bull F and D Bradshaw** Estimating the burden of disease attributable to physical inactivity in South Africa in 2000. *S Afr Med J.* 2007; **97(8)**: 725-731.
30. **Malhotra R, Hoyo C, Østbye T, Hughes G, Schwartz D and L Tsolekile** Determinants of obesity in an urban township of South Africa. *S Afr J Clin Nutr.* 2008; **21(4)**: 315-322.