Factors Influencing Fruits and Vegetable Consumption among Pregnant Women: Evidence from Enugu State, Nigeria

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Abstract

Despite fruits and vegetables' importance and nutrient composition, their consumption is still below the world's recommended threshold in Nigeria, even among pregnant women. Therefore, this study examined pregnant women's critical socioeconomic and demographic factors associated with fruit and vegetable consumption. Multistage sampling techniques and a semi-structured questionnaire were employed to collect data from 100 pregnant women from the study area. The descriptive statistics show that the majority (91%) of the respondents belong to the age bracket of 20 to 36 years. Also, most (56%) of the respondents were in their third trimester, while 30% and 14% were in the second and first-trimester, respectively. The study employed descriptive and inferential statistics to analyse the data. The results indicate that Education, Trading, first-trimester, income, and nutrition advice positively influenced expenditure on fruits and vegetables. On the other hand, age, second-trimester, third-trimester, attending ante-natal, and distance from home to market have an inverse relationship with expenditure on fruits and vegetables. Likewise, education, nutrition advice, trading, first-trimester positively influence the frequency of fruits and vegetable consumption. The study recommended that policymakers, government, and NGOs should be focused on the significant socioeconomic factors to encourage fruit and vegetable consumption among pregnant women.

Article info

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Introduction

Fruits and vegetable consumption are indispensable for pregnant women's health and fetal growth as it provides sufficient nutrients that help through the antenatal and postnatal periods (Loy *et al*., 2011). It also improves immunity healthiness and provides sufficient nutrients to the mother. Fruits and vegetables are important because, during pregnancy, the fetus depends totally on the mother for energy and nutrient intake. The mother needs to gain weight and maintain an optimal intake of essential nutrients that fruits and vegetables provide (Murphy *et al*., 2014). According to Valmórbida & Vitolo (2014), pregnancy is a critical and delicate period during which good maternal nutrition is a key factor influencing the health of both mother and child. There is evidence that antenatal nutrition has a life-long health effect on the unborn child, even predisposing the child to risks associated with micronutrient deficiencies, diabetes and cardiovascular risk factors (Musaiger, 1993; Okubo *et al*., 2014; Toemen *et al.,* 2016). Thus, the following research questions necessitate the study:

i.   what are the socioeconomic and maternal factors that influence the expenditures on fruits and vegetables among pregnant women?
ii. What socioeconomic and maternal factors influence the frequency of fruits and vegetable consumption among pregnant women?

This study aims to:

i.   profile the pregnant women based on their socioeconomic characteristics;
ii. examine the socioeconomic and maternal related factors that influence expenditures on fruits and vegetables among pregnant women;
iii. examine the socioeconomic and maternal related factors that constrain and promote the frequency of fruits and vegetable consumption among pregnant women.

1. Background

Maternal nutrition has continued to receive international debate worldwide, including in low-income countries like Nigeria (Shole, 2015). This may be because pregnancy is influenced by an increase in the physiologic, metabolic, and nutritional needs necessitated by the baby (Ugwa, 2016). Consumption of fruits provides adequate health, gives instant energy to the body, and provides vitamins and minerals beneficial to body functioning (Organic Facts, 2018). Fruits and vegetables are an excellent source of many well-known vitamins and minerals, in addition to fibre and antioxidants. They provide vital nutrients, such as ascorbate, carotenoids, folate, and magnesium, all contribute to one's baby's growth and development (Raaijmakers *et al*., 2018).

Vegetables are also important as they help improve overall health, protect the body's vital organs, assist in weight control, and promote healthy skin and hair. According to Hillesund *et al*. (2014), maternal diet pre-conception and during pregnancy may influence pregnancy outcome and the future health of mother and child.

Pregnant women require more energy and nutrients to meet the demands of the developing fetus (Verbeke & Bourdeaudhuij, 2007; Koletzko *et al*., 2019). Thus, their nutrient intake is indispensable or a key factor to the success of fetus development, growth, smooth delivery, and good health of the child and the mother before and after given birth (Koletzko *et al*., 2019). Consumption of fruits and vegetables is promoted as part of a nutrient-dense diet and for chronic disease prevention, displace high saturated fats, sugar, or salt. The consumption of fruits and vegetables among pregnant women is imperative for developing the child and crucial lifecycle phase as it can improve the health of the offspring who, depends on the level of intake by the mother. In contrast, low fruit and vegetable consumption are responsible for micro-nutrient deficiencies. Pregnant women are nutrient vulnerable because of the high nutrient demands and socioeconomic constraints (Lee *et al*., 2012).

Despite multiple benefits attributable to fruits and vegetable intake, their consumption is still below the usual recommendation by WHO (WHO, 2003). In fact, the intake in developing countries, for example, Nigeria, is typically lower than recommended levels, including intake among pregnant women, particularly among the low-income class (WHO, 2003; Kuche, 2014; Murphy *et al*., 2014). In most pregnant women, the consumption of fruits and vegetables is far below the minimum recommended level of 400g per capita per day (Ruel *et al*., 2004; Lee, 2016). This is undoubtedly a precarious situation among pregnant women in Nigeria, particularly those who may be socio-economically constrained. Although fruits and vegetables are important for pregnant women, they are faced with challenges of different socioeconomic and demographic factors (Murphy *et al*., 2014).

Pregnant women of lower socioeconomic groups have been identified as being especially at risk of nutrient deficiency due to low consumption of fruits and vegetables. Poor consumption of fruits and vegetables is one of the main factors responsible for non-communicable diseases (NCDs) worldwide (WHO, 2003; Valmorbia & Vitolo, 2014). Therefore, considering the importance of fruits and vegetable consumption to the health of pregnant women, it is essential to know the critical socioeconomic and maternal related factors that may promote its consumption.

This is expedient for Nigeria, where poor nutrition has been recognised as a major public health problem, particularly in pregnant women and children, contributing significantly to the high maternal and infant mortality (Maziya-

Dixon *et al.*, 2006). The vitamin A content of human breast milk is strongly affected by maternal nutrition during pregnancy and lactation (William *et al.*, 2009). Research evidence shows that 7.4 per cent of Nigerian women of reproductive age were malnourished, and 3.7 per cent were severely malnourished (National Nutrition and Health Survey (NNHS), 2015). The causes include inadequate food intake, poor nutritional quality of diets, frequent infections, and short inter-pregnancy intervals. The consequence of poor maternal nutritional status is reflected in low pregnancy weight gain, high maternal morbidity, and mortality (Onyeji and Sanusi, 2018). Consumption of calcium 96.2 per cent, sodium 79.4 per cent, zinc 26.6 per cent, magnesium 80.2 per cent, and Vitamin C 83.1 per cent was inadequate in Southeast Nigeria (Onyeji and Sanusi, 2018), and this is reflected in the inadequate consumption of essential food groups such as fruits and vegetables. While in the Enugu state, there is inadequate consumption of sodium 86.8%, zinc 27.2%, Iron 5.3%, Vitamin C (mg) 85.6%, which is a reflection of inadequate consumption of fruits and vegetables (Achikanu *et al.*, 2013). The poor quality diet of women found in the Southeast could result from low socioeconomic status and low educational status. This is because 39.4 per cent and 71.4 per cent were on low socioeconomic status and low educational status, respectively (National Bureau of Statistics (NBS), 2018).

Improving maternal nutrition status in Nigeria requires a good knowledge of the consumption of fruits and vegetables by pregnant women and the socioeconomic drivers. Thus, it is important to analyse the socioeconomic and maternal factors that influence pregnant women's fruit and vegetable consumption. Knowledge of the socioeconomic factors that drive the consumption of fruits and vegetables is vital in promoting healthiness among pregnant women.

2. Consumer behaviour theory

The consumer economic theory links preferences to consumer demand curves and consumption expenditures (Solomon, Russell-Bennett & Previte, 2012). It explains why individuals make certain choices and argue that this depends on the prices of goods and services as well as the amount of disposable income they have (Solomon, Russell-Bennett & Previte, 2012). The consumer economic theory suggests that individuals have unlimited and infinite demand, but the resources to meet them are limited; hence must decide on what to consume based on certain factors. According to Stancu, Haugaard, & Lähteenmäki (2016), these factors vary from one individual to another and could be similar among individuals with common socioeconomic traits. This suggests that the tendency to consume a good or service could

be determined by analysing the socioeconomic status and demography of a population. Švecová & Odehnalová (2019) highlighted three categories of factors that might influence consumer behaviour, these include:

i. Psychological factors: these are factors that describe individuals' perceptions and attitude about a good or service. It depends on what motivates an individual, the level of information they know about the goods or service, and how they feel the product is important for them.
ii. Personal factors: these include traits such as age, financial situation, gender, background, occupation, culture and location.
iii. Social factors: Social relations and influences from friends, work or school community, or groups and associations might also determine consumer behaviour.

3. Materials and methods

3.1. *Study Area*

Enugu is one of the six states belonging to the southeast geopolitical zone in Nigeria. It consists of seventeen Local Government Areas (LGAs) of which Nsukka is one of them. These 17 Local Government areas have similar socioeconomic attributes. This opines that findings from one Local Government Area can be a representation of other Local Government Areas. The study was carried out in Nsukka LGA, a town that accommodates the University of Nigeria. Nsukka has a population of 309,633 (NPC, 2010). Nsukka LGA alone was selected because of the financial challenge. However, the findings from this study can be representative of other LGAs based on the similar socioeconomic and cultural characteristics they share. The area comprises moderately rolling plains and a group of hills. It lies within the derived savannah vegetation zone, characterised by incomplete canopy cover, which affects soil moisture (Ozor *et al*., 2015). The major commercial activities in the area are trading and farming.

3.2. *Sampling procedure and data collection*

This study was carried out among pregnant women in Nsukka Local Government Area in Enugu State. The study employed multistage sampling techniques to select respondents (pregnant women) for the study. First, ten (10) communities were randomly selected from the LGA study. Secondly, one government public hospital/health centre was randomly selected from each of the ten communities to make a total of ten (10) hospitals/health

centres/maternity for the study. During the preliminary survey, we visited the selected hospital/health centres to intimate the management of our study's purpose and sought their support and cooperation in the data collection. With the help of the hospital/health centre management, we randomly selected ten (10) pregnant women each from the ten selected hospital/health centres to make a total of 100 respondents for the study. The consent of pregnant women who participated in the study was sought through the management of the hospitals/health centres selected for the study.

The data for the study was obtained through the use of semi-structured questionnaires. The questionnaires were administered individually to pregnant women during ante-natal meetings days. Each respondent was interviewed separately without interference from the other respondents to avoid any influence that could bias the results.

3.3. *Multiple Linear Regression Model and Quantile regression*

To measure the consumption level and frequency of fruits and vegetables among pregnant women, Linear regression and Count model were employed. Ordinary Least Squares (OLS) was used to measure the expenditure of fruit and vegetables in a separate regression model, while the Count model measured the number of times fruits and vegetables that are consumed.

Ordinary Least Square analysis was used to determine factors that affect fruit and vegetable consumption expenditure since the expenditure is a continuous variable. The classical regression explicit form is specified below:

$$LogY = b_o + b_1 logX_1 + b_2 logX_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + b_8 X_8 + b_9 X_9 + b_{10} X_{10} + b_{11} X_{11} + b_{12} X_{12} + b_{13} logX_{13} + b_{14} X_{14} + b_{15} X_{15} + e \qquad (1)$$

Where *Y* is consumption expenditure which is the total amount spent on fruits and vegetables per week, at the same time, $X_1 - X_{15}$ are the explanatory vectors in the equation, such as socioeconomic and demographic factors.

Due to the shortcoming of partial or average conditional mean impact between explanatory variables and dependent variable in ordinary least square, quantile regression analysis was further employed to assess the full impact of explanatory variables on the dependent variable. Quantile regression is characterised by a comprehensive relationship between dependent and explanatory variables, and it provides a robust estimate in the presence of data sets with outliers (Conyon & He, 2017). Quantile regression is used to measure the full conditional mean function and a conditional median on the dependent variable of a change in an explanatory variable (Koenker & Hallock, 2001; Powell, 2016). It provides an opportunity

for covariates to express themselves at different levels on the dependent variable. For instance, an important covariate that may not be significant at a particular level may be significant in another level on the dependent variable. The dependent variable was analysed at different qth quantiles such as 10th, 25th, 40th, 55th, 70th, 85th. It allows measuring the impact of explanatory variables of a range of distribution of the dependent variable.

A linear relationship was assumed for the quantile regression model between the explanatory variables and dependent variable $Q_q(Y/X)$.

Following Marrocu *et al.* (2015) and Conyon & He (2017), we specified our model as follows:

$$Q(Y_i/X_i) = X_i' \beta_i + \text{\pounds} \tag{2}$$

Where Y is the consumption expenditure, X is the socioeconomic factors, and $\text{\pounds}$ is the standard error.

Consider the real-valued random variable of Y that is characterised by the following distribution:

$$F(y) = Pr(Y \le y)$$

Where q is any quantile considered with $0 < q < 1$ and X as the covariates. The qth quantile of Y is defined as:

$$Q(q) = inf \, [y : F(y) \ge q]$$

The estimator for $\widehat{\beta_q}$ is derived by minimising function equation (3) by applying linear programming method:

$$Q(\beta_q) = \Sigma_{i:y_i \ge X_i'\beta}^N \, q \, |y_i - X_i'\beta_q| + \Sigma_{i:y_i \ge X_i'\beta}^N (1-q) \, |y_i - X_i'\beta_q| \tag{3}$$

3.4. *Zero Truncated Negative Binomial model*

Considering a situation where the event $y_i = 0$ cannot be observed under the assumption of unobserved heterogeneity, the count probabilities gives the Zero Truncated NB regression model (Moon *et al.*, 2001; Cruff *et al.*, 2008). Given the importance of fruits and vegetables to pregnant women, it is expected that fruit and vegetables must be consumed at least once a week. Besides, the responses from the study subject show that fruits and vegetables are consumed at least once a week. Thus, there is no zero in the responses.

According to micro-econometrics using STATA by Cameron & Trivedi (2005) and following the equation can be specified as:

$$P_r^{(NB)}(Y_i = y_i|y_i > 0, \mu, \alpha) = \frac{P_r^{(NB)}(Y_i = y_i|\mu_i}{1 - P_r^{(NB)}(Y_i = 0|\mu_i)} \quad (4)$$

Where $P_r^{(NB)}(Y_i = 0|\mu_i, \alpha) = (1 + \alpha\mu_i)^{-\alpha-1}$ and the conditional expected value of y_i is given by;

$$E(y_i|y_i > 0, \mu_i, \alpha) = \frac{E(y_i|\mu_i, \alpha)}{[1 - P_r^{(NB)}(y_i = 0)|\mu_i, \alpha]} \quad (5)$$

Thus,

$E(y_i|y_i > 0, \mu_i, \alpha) = 1, 2, 3, 4, 5,\text{...} n$

$E(y_i|y_i > 0, \mu_i, \alpha) =$ The number of times fruit/vegetables are consumed per week among pregnant women.

The above equations show the positivity of ZTNB model.

Table 1 - Description of the explanatory variable

S/N	Explanatory variables	Unit of measurement	Scale
1	Age of the pregnant women	Years	Continuous
2	Marital status	1 if married or 0 otherwise	Discrete
3	Number of years spent in school	Years	Continuous
4	First trimester	1 if yes or 0 otherwise	Discrete
5	Second trimester	1 if yes or 0 otherwise	Discrete
6	Third trimester	1 if yes or 0 otherwise	Discrete
7	First pregnancy	1 if yes or 0 otherwise	Discrete
8	Nutritional advice	1 if yes or 0 otherwise	Discrete
9	Income	Naira/month	Continuous
10	Civil servant	1 if yes or 0 otherwise	Discrete
11	Trader	1 if yes or 0 otherwise	Discrete
12	Household size	Number	Discrete continuous
13	Consumption time	Number/month	Continuous
14	Unemployed	1 if not employed or 0 otherwise	Discrete

Table 1 - continued

S/N	Explanatory variables	Unit of measurement	Scale
15	Antenatal	1 if attend antenatal or 0 otherwise	Discrete
16	Have children before	1 if yes or 0 otherwise	Discrete
17	Distance from home to market	Kilometre	Continuous

4. Results

4.1. *Socioeconomic characteristics of the pregnant women*

Table 2 shows the socioeconomic characteristics of pregnant women sampled for the study. The majority (91%) belong to the age bracket of 20 to 36 years, depicting that most of the pregnant women studied are young. Likewise, the majority (97%) of pregnant women are married. Regarding education, 36% of the respondents attained secondary education, while 62% attained tertiary education. Regarding their occupation, the result shows that the highest proportion (42.4%) of the respondents are civil servants, 30.3% are not employed, while 17.2%, 6.1%, 2%, and 2% are traders, artisans, farmers, and house wives respectively. Regarding the stage of pregnancy, the result shows that most (56%) of the respondents are in their third trimester, while 30% and 14% were in the second and first trimester, respectively. The average monthly income of the respondents is ₦ 54,438.24. The pregnant women walk an average distance of 2.94 kilometres to the market to purchase fruits and vegetables. Also, 33% of the respondents indicated that they were pregnant for the first time, and the majority (87%) indicated that they received nutrition advice.

Table 2 - Socioeconomic characteristics of the pregnant women

Characteristics	Percentage (%)	Mean (Standard deviation)
Age of the pregnant women		29.04(0.54)
>= 19	2.0	
20-36	91.0	
37 and above	7.0	
Marital status		
Single	3.0	
Married	97.0	

Table 2 - continued

Characteristics	Percentage (%)	Mean (Standard deviation)
Education		
Primary education	2.0	
Secondary education	36.0	
Tertiary education	62.0	
Primary Occupation		
Civil servant	42.4	
Farmers	2.0	
Trading	17.2	
Artisan	6.1	
Housewife	2.0	
Unemployed	30.3	
Stage of Pregnancy		
First trimester	14.0	
Second trimester	30.0	
Third trimester	56.0	
Household Size		
Less than 4	44	4.06(0.19)
4-6	45	
7 and above	1.0	
Monthly Income		
>= ₦ 50,000	55.9	38966.32(4412.45)
₦50,001 – ₦100,000	30.9	
₦100,001 – ₦150,000	11.8	
₦150,001 and above	1.5	
Distance to Market		
>= 5	86.5	
6-8	6.3	
9-12	6.3	
13 and above	1	
First pregnancy		
Yes	33	
Nutritional advice		
Yes	87	
Ante-natal	77	
Having children before		
Yes	61	

Source: Field survey, 2019.

Table 3 shows the common fruits and vegetables consumed among pregnant women in the study area and where they source them. The source of fruits they consumed varied across fruits, although the majority sourced their fruits from the market. For example, the result shows that most (98.0%) indicated that they sourced apples from the market. Also, the majority (90%) obtained the banana they consumed from the market. This finding suggests that the respondents spent money buying fruits and vegetables rather than growing them themselves.

Table 3 - Common fruit and vegetables consumed among pregnant women and their sources in the study area

Fruits and Vegetables (multiple responses)	Source of Fruit and Vegetables (%)		
	Homestead garden	Farm	Market
Common fruits consumed by pregnant women			
Apple (*Pyrus malus*)	2.0	–	98.0
Banana (*Musa balbisiana*)	10.0	–	90.0
Watermelon (*Citrullus lanatus*)	2.0	–	98.0
Orange (*Citrus sinensis*)	27.0	–	74.0
Mango (*Mangifera indica*)	14.0	1.0	84.0
Guava (*Psidium guajava*)	18.0	1.0	81.0
Pineapples (*Ananas comosus*)	5.0	1.0	93.0
Cashew (*Anacardiun occidentale*)	6.0	2.0	91.0
Avocado pear (*Persea Americana*)	10.0	2.0	88.0
Plantain (*Musa spp*)	9.0	3.0	88.0
Tangerine (*Citrus tangerina*)	8.0	1.0	89.0
African cherry (*Chrysophyllum albidum*)	9.0	3.0	86.0
Coconut (*Cocos nucifera*)	12.0	1.0	87.0
Paw paw (*Carica papaya*)	28.0	–	73.0
Soursop (*Amnona muricata*)	14.0	1.0	83.0
Pumpkin (*Cucurbita pepo*)	11.0	3.0	84.0
Bush allowance (*Velvet tamarine*)	9.0	2.0	86.0
Egg plant (*Solanum melongena*)	6.0	3.0	89.0
Jack fruit (*Artocarpus heterophyllus*)	6.0	1.0	91.0
Fruit (*Terminalia catapa*)	12.0	2.0	83.0
Important vegetables consumed by pregnant women (multiple responses)			
Fluted pumpkin (*Teifairia occidentalis*)	30.0	5.0	67.0
Bitter leaf (*Vernonia amygdalina*)	25.0	7.0	70.0

Table 3 - continued

Fruits and Vegetables (multiple responses)	Source of Fruit and Vegetables (%)		
	Homestead garden	Farm	Market
Water leaf (*Talinum triangulare*)	17.0	7.0	76.0
Oha leaf (*Delissearivularis*)	8.0	3.0	89.0
Onions (*Allium cepa*)	4.0	2.0	94.0
Tomato (*Lycopersican esculentum*)	6.0	2.0	92.0
Scent leaf (*Ocimum gratissimum*)	20.0	4.0	76.0
African rosewood leaves (*Hagenia abyssinia*)	12.0	2.0	82.0
Green (*Amaranthus hybridus*)	22.0	5.0	72.0
Jute leaves (*Corchorus spp*)	13.0	2.0	80.0
Wild spinach (*Gnetum africanum*)	14.0	3.0	79.0
Bush buck (*Gongronema latifolium*)	14.0	3.0	80.0
Lemon grass (*Cymbopogon martinil*)	17.0	6.0	74.0
Garden egg leaf (*Solanum melongena*)	16.0	4.0	80.0

Source: Field survey, 2019.

4.2. *Determinants of expenditure on fruits and vegetables consumption*

The multiple regression and quantile regression result in Table 4 shows the influence of socioeconomic and demographic factors on the fruits and vegetable consumption expenditure among pregnant women in the study area. The model shows that the variations in the independent variables explained 48% of the pregnant women's expenditure on fruits. Likewise, 39% of the expenditure on vegetables by pregnant women was explained by the variations in the independent variables. Firstly, the multiple regression results show that the age of pregnant women negatively and significantly (at 5% level of probability) influenced the expenditure on fruits. Also, expenditure on fruits was negatively and significantly (at a 1% probability level) influenced by being in the second trimester and third-trimester stages of pregnancy. The multiple regression results also show that the expenditure on fruits increases significantly (at 5% probability level) with an increase in income of pregnant women. This indicates that respondents with low income are faced with the challenge of low fruits consumption. Likewise, younger respondents will likely spend more on fruit consumption. The consumer's theory explains that personal factors such as age, income, and occupation are among the critical drivers of food consumption, as reflected in our findings (Švecová & Odehnalová, 2019). In terms of pregnancy, respondents perceived the second

and third trimester as an advanced stage which to them the importance of fruit consumption is minimal. However, the first trimester which is the early stage of development of the fetus was perceived as very important, and they may likely spend more on fruit consumption. Regarding expenditure on vegetables, factors like trading and income are important drivers of vegetable consumption as respondents may likely spend more on vegetables if they have more income and more had probably engaged in trading as their occupation.

The result from the quantile regression shows more robust effects as more variables significantly influenced the consumption of fruits and vegetables by pregnant women. The result shows that education positively and statistically (at 5% and 1%) influenced the fruit consumption expenditure of pregnant women under 55th and 75th and 85th percentiles, respectively. This indicates that knowledge of the nutrition composition of fruits will likely influence the expenditure of pregnant women. The result also shows that unemployment inversely and significantly (at a 1% probability level) affected fruit consumption expenditure. This means that respondents with no job may likely not have constant income sources, thereby limiting expenditure on fruits. The result shows that Trading and civil servants are positively and significantly associated with expenditure on fruit consumption. However, pregnant women in their first trimester positively and significantly (at a 1% probability level) influenced expenditure on fruit consumption at all the percentiles. This is expected from our apriori because the first trimester is the early stage of fetus development and requires more minerals and vitamins that may be derived from fruits. This may likely prompt the respondents to spend more on fruits. Nutritional advice is positively and significantly (at a 5% probability level) associated with expenditure on vegetables at the 25th percentile. On the other hand, the result shows that attending ante-natal does not necessarily translate to more expenditure on vegetables. It is inversely and significantly (at a 5% probability level) associated with expenditure on the vegetable. Psychological factors such as the attitude of consumers is reflected in Nutritional advice as one of the factors that influence consumers' behaviour (Stancu, Haugaard & Lähteenmäki, 2016). The result shows that distance from home to market is negatively and significantly (at 5% probability level) influenced expenditure on vegetables at all the percentiles. This shows that pregnant women do not see the distance to the market as a barrier to vegetable consumption. Across the percentiles for both fruits and vegetables, factors such as trading, first trimester, and income are important as they positively associate with fruits and vegetable expenditure. However, education is significant in expenditure on fruits but not with vegetables. Likewise, nutritional advice is significant in vegetable consumption but not in fruits.

Table 4 - OLS and Quantile regression on determinants of expenditure on fruits and vegetables consumption

Parameters	Fruits							Vegetables						
	OLS	Qq10	Qq25	Qq40	Qq55	Qq70	Qq85	OLS	Qq10	Qq25	Qq40	Qq55	Qq70	Qq85
Age of the pregnant women	-1.538** (0.6050)	-2.704*** (0.829)	-1.748** (0.691)	-0.407* (0.782)	-1.488** (0.691)	-1.952*** (0.649)	-1.359*** (0.431)	0.271 (0.601)	-0.785 (0.627)	-0.081 (0.786)	0.494 (0.736)	0.784 (0.728)	0.755 (0.621)	0.420 (0.620)
Number of years spent in school	1.433 (0.726)	1.919 (0.990)	1.605 (0.824)	1.308 (0.934)	1.949** (0.825)	2.076*** (0.775)	1.725*** (0.514)	-0.496 (0.703)	0.278 (0.732)	-0.370 (0.919)	-1.286 (0.860)	-0.486 (0.851)	-1.272* (0.725)	-0.432 (0.724)
Unemployed	-0.432 (0.658)	-0.374 (0.897)	-0.002 (0.747)	-0.258 (0.846)	0.364 (0.748)	-1.201* (0.702)	-1.637*** (0.466)	0.593 (0.639)	0.796 (0.666)	1.201 (0.835)	0.995 (0.782)	1.063 (0.773)	0.907 (0.659)	0.402 (0.658)
Trading	0.281 (0.299)	1.163*** (0.408)	0.933*** (0.339)	0.654** (0.385)	0.798*** (0.340)	0.278 (0.319)	-0.291 (0.211)	0.801** (0.291)	1.042*** (0.303)	0.681* (0.381)	0.985*** (0.356)	1.137*** (0.352)	0.926*** (0.301)	1.208*** (0.300)
Civil servant	-0.365 (0.306)	-0.121 (0.418)	-0.051 (0.347)	-0.057 (0.394)	-0.0793 (0.348)	-0.336 (0.327)	-0.960*** (0.217)	0.261 (0.297)	0.035 (0.310)	-0.232 (0.389)	0.281 (0.364)	0.570 (0.360)	0.459 (0.307)	0.826*** (0.306)
First-trimester	—	1.093*** (0.354)	0.993*** (0.295)	1.024*** (0.334)	0.893*** (0.295)	1.192*** (0.277)	0.984*** (0.184)	0.394 (0.282)	0.748*** (0.264)	0.929*** (0.331)	0.611* (0.310)	0.297 (0.307)	0.504** (0.261)	0.562** (0.261)
Second-trimester	-0.966*** (0.291)	0.266 (0.260)	0.166 (0.216)	0.027 (0.245)	0.101 (0.216)	0.031 (0.203)	0.086 (0.135)	—	0.165 (0.195)	0.167 (0.245)	0.159 (0.229)	0.023 (0.227)	0.137 (0.193)	0.055 (0.193)
Third-trimester	-1.112*** (0.260)	—	—	—	—	—	—	-0.186 (0.187)	—	—	—	—	—	—
Household size	0.059 (0.061)	0.011 (0.082)	-0.041 (0.068)	0.001 (0.078)	0.064 (0.068)	0.051 (0.064)	0.067 (0.042)	0.026 (0.066)	-0.131* (0.068)	0.058 (0.086)	0.090 (0.080)	0.038 (0.079)	0.036 (0.068)	-0.035 (0.068)
First pregnant	-0.103 (0.381)	-0.231 (0.520)	-0.172 (0.443)	0.025 (0.491)	-0.128 (0.433)	0.234 (0.407)	0.262 (0.270)	-0.192 (0.372)	-0.575 (0.388)	-0.488 (0.486)	-0.728 (0.455)	-0.174 (0.451)	-0.144 (0.184)	0.412 (0.383)
Nutritional advice	0.161 (0.296)	0.325 (0.403)	0.457 (0.336)	0.343 (0.381)	0.550 (0.336)	-0.236 (0.316)	-0.248 (0.209)	0.153 (0.291)	0.281 (0.303)	0.768** (0.381)	0.382 (0.356)	-0.030 (0.352)	-0.038 (0.301)	-0.182 (0.300)
Antenatal	-0.283 (0.214)	-0.154 (0.292)	-0.158 (0.243)	-0.246 (0.275)	-0.272 (0.243)	-0.423* (0.228)	-0.436*** (0.151)	-0.378 (0.221)	-0.641*** (0.230)	-0.612** (0.289)	-0.328 (0.271)	-0.157 (0.267)	-0.216 (0.228)	-0.331 (0.227)
Income	0.341** (0.145)	0.387* (0.197)	0.315* (0.164)	0.342* (0.186)	0.179 (0.165)	0.234 (0.154)	0.315*** (0.102)	0.332** (0.142)	0.327** (0.149)	0.479** (0.186)	0.456** (0.175)	0.363** (0.173)	0.381** (0.147)	0.191 (0.147)
Have children before	-0.261 (0.383)	-0.609 (0.522)	-0.145 (0.434)	-0.082 (0.492)	-0.264 (0.435)	0.139 (0.409)	0.098 (0.271)	-0.495 (0.381)	-0.750* (0.397)	-0.602 (0.498)	-0.813* (0.467)	-0.275 (0.461)	-0.885 (0.393)	0.233 (0.393)
Distance from home to market	0.012 (0.031)	0.070* (0.042)	0.023 (0.034)	0.024 (0.039)	0.018 (0.034)	-0.011 (0.032)	0.025 (0.021)	-0.049 (0.030)	-0.072** (0.031)	-0.060 (0.039)	-0.045 (0.037)	-0.079** (0.037)	-0.785** (0.031)	-0.100*** (0.031)
Cons_	5.374** (2.079)	5.476** (2.790)	4.086** (2.322)	3.572 (2.632)	3.768 (2.326)	5.618** (2.185)	4.273*** (1.448)	3.214 (2.066)	5.033** (2.136)	1.983 (2.680)	2.774 (2.509)	0.710 (2.481)	3.069 (2.116)	3.983 (2.112)
Pseudo R^2		0.389	0.382	0.373	0.334	0.313	0.383		0.341	0.338	0.350	0.293	0.304	0.257

$F_{(14, 51)} = 3.43$, Prob > 0.0006, R-squared = 0.48. Adj R-squared = 0.34 $F_{(14, 49)} = 2.33$, Prob > 0.0149, R-squared = 0.39. Adj R-squared = 0.22
*** indicates 1%, ** indicates 5% and * indicates 10%

4.3. *Determinants of frequency of fruits and vegetable consumption*

The result in Table 5 shows the endogenous variables that explain the frequency of fruits and vegetable consumption among pregnant women in the study area. Regarding fruit consumption, the result from Table 5 shows that education and nutritional advice positively and significantly (at 5% probability level) influenced the frequency of fruit consumption among pregnant women. It depicts that respondents who have higher education and receive advice on nutrient components of fruits may likely consume fruits regularly. Occupation (civil servant) negatively and significantly (at 5% probability level) influenced the frequency of fruit consumption. This implies that respondents with formal jobs may be less likely to consume fruits regularly. This is not in line with our apriori expectation as it is expected that such a category of respondents would have more knowledge about the importance of fruits. However, these relationships may also depend on the stage of the pregnancy of the respondents. From our findings, pregnant women in second and third trimesters are less likely to consume fruits. Attendance to antenatal negatively and significantly (at 5% probability level) influenced the frequency of fruit consumption. This indicates that attendance to ante-natal may not necessarily translate to an increment in the frequency of fruit consumption.

Regarding the frequency of vegetable consumption among pregnant women, occupation (trading) positively and significantly (at a 5% probability level) influenced the frequency of vegetable consumption. This indicates that respondents who are traders may likely consume vegetables regularly. This may be due to respondents' proximity to the market environment where vegetables are sold regularly. The result also showed that first-trimester positively and significantly (at 1% probability level) influenced the frequency of vegetable consumption. This agrees with our apriori expectation that pregnant women in their early stage of pregnancy will likely consume vegetable regularly because this is a crucial stage for fetus development and require a high level of minerals, iron and vitamins that they can obtain from vegetable.

Table 5 - Zero truncated negative binomial regression of determinants on the frequency of Fruits and vegetable consumption

Parameters	Fruits		Vegetables	
	Coefficient	Standard error	Coefficient	Standard error
Age	-0.1431	0.4995	0.4599	0.4994
Number of years spent in school	1.5901**	0.6401	0.4023	0.6444
Unemployed	-0.9618	0.6481	0.4763	0.5863
Trading	-0.1181	0.2368	0.5900**	0.2732
Civil servant	-0.6474**	0.2593	0.1726	0.2809
First-trimester	0.3501*	0.2113	0.5684***	0.2137
Second-trimester	0.1968	0.1491	0.0050	0.1647
Household size	-0.0759	0.0485	-0.0405	0.0502
First pregnant	0.1284	0.3129	-0.0128	0.3334
Nutritional advice	0.6890***	0.2568	0.1652	0.2572
Antenatal	-0.3763**	0.1738	-0.3140*	0.1818
Income	-0.0133	0.1203	0.0919	0.1244
Has children before	0.2552	0.3269	0.0263	0.3338
Distance from home to market	0.0329	0.0239	-0.0371	0.0288
Cons_	-1.4721	1.8535	-1.5172	1.8774
Inalpha	-2.0073	0.3448	-1.8645	0.3505
Alpha	0.1343	0.0463	0.1549	0.0543
	LR test of alpha = 0: chibar2 (01) = 23.37, LR chi^2 (14) = 27.83, Prob > chi^2 = 0.015, Pseudo R^2 = 0.0683, Log likelihood = -189.673		LR test of alpha = 0: chibar2 (01) = 23.44, LR chi^2 (14) = 18.99, Prob > chi^2 = 0.165, Pseudo R^2 = 0.048, Log likelihood = -187.106	

*** indicates 1%, ** indicates 5% and * indicates 10%.

5. Discussion and conclusion

5.1. *Discussion*

Given the psychological and personal characteristics, the findings suggest that older pregnant women spend less on fruit consumption than young pregnant women who spend more on buying fruits. This finding suggests that older women show less concern for fruit consumption. It agrees with the findings of Zamanian *et al.* (2013) & Goryakin *et al.* (2015) that increases

in age are associated with less consumption of fruits. The educational level shows that having an education makes pregnant women understand the importance of fruit consumption during pregnancy, thereby increasing the consumption frequency. This was reflected both in the expenditure and frequency of consumption. The result shows that education enlightens pregnant women on the nutrients component of fruits and their importance during pregnancy for both mother and child. This agrees with Riediger *et al*. (2007) findings that education increases fruit and vegetable consumption among adolescents. This finding is similar to receiving nutritional advice, which was also found to be a positive and significant determinant of fruit and vegetable consumption. According to Saha *et al*. (2020), receiving nutrition advice can enlighten individuals on the importance and nutrient composition of fruit. Surprisingly, this was not the case in antenatal attendance, suggesting that antenatal has less influence on the expenditure on fruit consumption; perhaps advice in this regard is not emphasised during antenatal sessions.

Unlike civil servants, pregnant women that are traders spend more money buying fruits (Table 3). This may be because they can easily find it and buy where they do their trading. This result agrees with the findings of Amo-Adjei & Kumi-Kyereme, (2015) that occupation such as trading influences fruit consumption. This invariably means that those pregnant women into official employment spent less on fruit consumption (Laverde-Rojas *et al*., 2017; Terin *et al*., 2019). However, at the 85th percentile, a civil servant was positively significant, suggesting that a civil servant with a high salary may have more money to spend buying fruits and vegetables even if she is not close to the trading sites. This means that expenditure and frequency of consumption are not unrelated to the amount of money these pregnant women get from their occupation. The finding shows that pregnant women with higher income may consume more vegetables. This agrees with our apriori expectation and supports the findings of Nogueira *et al*. (2018) that income influences vegetable consumption in adolescents. Just like income, unemployment significantly affected expenditure on fruits and vegetables. This is in line with the consumer demand theory that suggests that the disposable income of individuals predicts their level of expenditure (Solomon *et al*., 2012). This depicts that unemployed, pregnant women spent less on fruit consumption as they might lack money to buy fruit most times.

Finally, an important factor to consider in engendering fruit and vegetable consumption among pregnant women is the stage of pregnancy. Pregnant women in their first trimester consume vegetables more frequently. This means that pregnant women recognise the first trimester as a developmental stage for the fetus. This consequently affects their expenditure on fruit consumption at all the percentiles. This is in line with a report in Ghose &

Yaya (2018), who identified that pregnant women took the first trimester as an important stage of their pregnancy that requires more nutrient intake for the fetus. The negative influence observed at the second and third trimesters shows that pregnant women spend less on fruit consumption in their second and third trimesters of pregnancy. This may be because of the perception of pregnant women that a fetus needs more nutrient foods at the early stage of development. Tus they and not worried about it when they are fully formed in the womb.

5.2. *Conclusion*

The study has identified and examined important socioeconomic and maternal factors that influence pregnant women's fruit and vegetable consumption. Different pregnant women have different budgets on fruits and vegetable consumption during the gestation period; however, these differences have been adduced to different socioeconomic statuses and maternal conditions at a particular period. The study has confirmed that socioeconomic status and maternal conditions are important factors to consider when budgeting and determining the frequency of fruits and vegetable consumption among pregnant women. There are connections between fruits and vegetable consumption and the socioeconomic status of this category of people. This suggests that socioeconomic characteristics and maternal conditions should be considered when examining fruits and vegetable consumption among pregnant women. Even though there have been different studies on fruits and vegetable consumption, most of these studies are yet to showcase the importance of interconnections of socioeconomic status and fruits and vegetable consumption, particularly about pregnant women who are vulnerable health-wise. In line with the consumer economic theory, it is glaring that it is the personal (maternal conditions) and psychological factors that significantly determine the expenditure on fruit and vegetable consumption as well as the frequency of consumption. More so, this study also examines the influence of these factors at different levels of expenditures to avoid the omission of important factors that may be significant at a particular level of expenditures. The following socioeconomic factors: income, occupation, education, and distance from home to market and maternal conditions: first-trimester, second-trimester, third-trimester, nutritional advice have been found to be important factors and essential stages in promoting fruits and vegetable consumption among pregnant women. To increase fruits and vegetable consumption among pregnant women, policymakers and development practitioners should consider the different socioeconomic and maternal status/conditions of pregnant

women in their policy interventions. This study suggests further research into perceptions and effects of income distribution on fruits and vegetable consumption among pregnant women. Financial constraints limited this study as there was no special funding.

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References

Achikanu, C.E., Eze-Steven, P.E., Ude, C.M., & Ugwuokolie, O.C. (2013). Determination of the vitamin and mineral composition of common leafy vegetables in south eastern Nigeria. *Int. J. Curr. Microbiol. App. Sci*, *2*(11): 347-353.

Amo-Adje, J., & Kumi-Kyereme, A. (2015). Fruit and vegetable consumption by ecological zone and socioeconomic status in Ghana. *J. Biosoc. Sci*, *47*: 613-631.

Cameron, A.C., & Trivedi, P.K. (2005). *Microeconometrics, Methods and Applications*. New York: Cambridge University Press, p. 345.

Conyon, M.J., & He, L. (2017). Firm performance and boardroom gender diversity: A quantile regression approach. *Journal of Business Research*, *79*: 198-211.

Cruyff, M.J.L.F., & van der Heijden, P.G.M. (2008). Point and Interval Estimation of the Population Size Using a Zero-Truncated Negative Binomial Regression Model. *Biometrical Journal*, *50*(6): 1035-1050. doi: 10.1002/bimj.200810455.

Ghose, B., & Yaya, S. (2018). Fruit and vegetable consumption and anemia among adult non-pregnant women: Ghana demographic and health survey. *PeerJ*, *6*: e4414.

Goryakin, Y., Rocco, L., Suhrcke, M., Roberts, B., & McKee, M. (2015). Fruit and vegetable consumption in the former Soviet Union: the role of individual- and community-level factors. *Public Health Nutrition*, p. 1. doi: 10.1017/S1368980015000105.

Hillesund, E.R., Øverby, N.C., Engel, S.M., Klunsøyr, K., Harmon, Q.E., Haugen, M., & Bere, E. (2014). Associations of adherence to the New Nordic Diet with the risk of preeclampsia and reterm delivery in the Norwegian Mother and Child Cohort Study (MoBa). *European journal of epidemiology*, *29*(10): 753-765.

Koenker, R., & Hallock, K.F. (2001). Quantile regression. *Journal of Economic Perspectives*, *15*(4): 143-156.

Koletzkoa, B.K.M. Godfrey-Postonc, L.H., Johannes, S.B., Marita de, G., Brigitte, W, Rosalie, B.M., Andrea, G.R., Jodie, D.M., Patro-Golabd, D.B., & Zalewskid, B.M. (2019). Nutrition During Pregnancy, Lactation and Early Childhood and its Implications for Maternal and Long-Term Child Health: The Early Nutrition Project Recommendations. *Ann Nutr Metab*, 74: 93-106.

Kuche, D. (2014). *Factors associated with dietary practices and nutritional status among pregnant women in Wondo Genet district.* -- Retrieved June 20, 2017

from www.ephi.gov.et/images/mcn/Factors%20associated%20with%20Dietary%20 Practices%20and %20Nutritional.pdf.

Laverde-Rojas, H., Lis-Gutierrez, J., & Moros, A. (2017). Determinants of vegetable and fruit consumption in Colombia. *Journal of Engineering and Applied Sciences*, *12*(11): 2842-2845.

Lee, A. (2016). Affordability of fruits and vegetables and dietary quality worldwide. *The Lancet Global Health*, *4*(10): e664-e665. doi: 10.1016/s2214-109x(16)30206-6.

Lee, S.E., Talegawkar, S.A., Merialdi, M., & Caulfield, L.E. (2012). Dietary intakes of women during pregnancy in low- and middle-income countries. *Public Health Nutrition*, *16*(8): 1340-1353. doi: 10.1017/S1368980012004417.

Loy, S., Marhazlina, M., Nor Azwany, Y., & Hamid Jan, J.M. (2011). Higher intake of fruits and vegetables in pregnancy is associated with birth size. *Southeast Asian J Trop Med Public Health*, *42*(5), September.

Marrocu, E., Paci., R., & Zara, A. (2015). Micro-economic determinants of tourist expenditure: A quantile regression approach. *Tourism Management*, *50*: 13-30.

Maziya-Dixon, B., Akinyele, I.O., Sanusi, R.A., Oguntona, T.E., Nokoe, S.K., & Harris, E.W. (2006). Vitamin A deficiency is prevalent in children less than 5 years of age in Nigeria. *J. Nutr.*, *136*: 2255- 2261.

Moon, W., Florkowski, W.J., Beuchat, L.R., Paraskova, P., Resurreccion, A.V.A., Chinnan, M.S., & Jordanov, J. (2001). Hurdle count-data models of meat consumption in Bulgaria. *European Review of Agricultural Economics*, *28*(1): 37-56.

Murphy, M.M., Barraj, L.M., Herman, Bi, X., Cheatham, R., & Randolph, K. (2012). Phytonutrient Intake by Adults in the United States in Relation to Fruit and Vegetable Consumption. *Journal of the Academy of nutrition and dietetics*, *112*(2): 222-229. doi: 10.1016/j.jada.2011.08.044.

Murphy, M.M., Stettler, N., Smith, K.M., & Reiss, R. (2014). Associations of consumption of fruits and vegetables during pregnancy with infant birth weight or small for gestational age births: a systematic review of the literature. *International Journal of Women's Health*, *6*: 899-912. doi: 10.2147/IJWH.S67130.

Musaiger, A.O. (1993). Socio-Cultural and Economic Factors Affecting Food Consumption Patterns in the Arab Countries, Journal of the Royal Society of Health. *The Journal of the Royal Society for the Promotion of Health*, *113*: 68. doi: 10.1177/146642409311300205, 68-74.

National Bureau of Statistics (NBS) (2018). Report on the nutrition and health situation of Nigeria, in Report, Abuja Nigeria.

National Nutrition and Health Survey (NNHS) (2015). "Women nutrition", The Nutrition and Health Situation in Nigeria November, p. 18.

National Population Commission (NPC) (2010). "Population distribution by sex, state, L.G.A and senatorial district for 2006", Nigeria, Priority Table, 3, 1-60.

Nogueira, L.R., Fontanelli, M.D.M., Aguiar, B.S.D., Failla, M.A., Florindo, A.A., Barrozo, L.V., & Fisberg, R.M. (2018). Access to Street Markets and Consumption of Fruits and Vegetables by Adolescents Living in São Paulo, Brazil. *International journal of environmental research and public health*, *15*(3): 517.

Okubo, H., Crozier, S.R., Harvey, N.C., Godfrey, K.M., Inskip, H.M., & Cooper C. (2014). Maternal dietary glycemic index and glycemic load in early pregnancy

are associated with offspring adiposity in childhood: the Southampton women's survey. *Am J Clin Nutr*, *100*: 676-683.

Onyeji, G.N., & Sanusi, R.A. (2017). Diet quality of women of childbearing age in South-east Nigeria, *Nutrition & Food Science*, *48*(2): 348-364. doi: 10.1108/NFS-06-2017-0134.

Organic Facts (2018). Benefits of Vegetables. -- Available from www.organicfacts. net/health-benefits/vegetable.

Ozor, N., Ozioko, R., & Acheampong, E. (2015). Rural-Urban Interdependence in Food Systems in Nsukka Local Government Area of Enugu State, Nigeria. *Journal of Agricultural Extension*, *19*(2): 157-183.

Powell, D. (2016). Estimation of quantile treatment effects in the presence of covariates. *Rand Corporation*.

Raaijmakers, I., Snoek, H., Maziya-Dixon, B., & Achterbosch, T. (2018). Drivers of Vegetable Consumption in Urban Nigeria: Food Choice Motives, Knowledge, and Self-Efficacy. *Sustainability*, *10*, 4771: 1-14, doi: 10.3390/su10124771.

Riediger, N.D., Shooshtari, S., & Moghadasian, M.H. (2007). The Influence of Sociodemographic Factors on Patterns of Fruit and Vegetable Consumption in Canadian Adolescents. *Journal of the American dietetic association*, *107*(9): 1511-1518.

Ruel, M.T., Minot, N., & Smith, L. (2004). Pattern and determinant of fruit and vegetable consumption in sub-sahara Africa: a muiltcountry comparism, international food policy resaerch institute, Joint FAO/WHO Workshop on fruit and vegetable for health 1-3 Sept, Kobe, Japan.

Saha, S., Dawsonb, J., Murimib, J.M., Dodd, S. & Oldewage-Theronb, W. (2020). Effects of a nutrition education intervention on fruit and vegetable consumption-related dietary behavioural factors among elementary school children. *Health Education Journal*, *79*(8): 963-973.

Shole, R.N. (2015). An Impact of Socio-Cultural Practices on Maternal Mortality in Masasi District, Tanzania. Malaysian. *Journal of Medical and Biological Research*, *2*(3): 45-78.

Solomon, M., Russell-Bennett, R., & Previte, J. (2012). *Consumer behaviour*. Pearson Higher Education AU.

Stancu, V., Haugaard, P., & Lähteenmäki, L. (2016). Determinants of consumer food waste behaviour: Two routes to food waste. *Appetite*, *96*: 7-17.

Švecová, J., & Odehnalová, P. (2019). The determinants of consumer behaviour of students from Brno when purchasing organic food. *Review of Economic Perspectives*, *19*(1): 49-64.

Terin, M., Birinci, A., Bilgic, A., & Faruk Urak, F. (2019) Determinants of Fresh and Frozen Fruit and Vegetable Expenditures in Turkish Households: A Bivariate Tobit Model Approach. *Journal of Food Products Marketing*, *25*(2): 137-158. doi: 10.1080/10454446.2018.1500327.

Toemen, L., de Jonge, L.L., Gishti, O., van Osch- Gevers, L., Taal, H.R., & Steegers, E.A. (2016). Longitudinal growth during fetal life and infancy and cardiovascular outcomes at school-age. *J Hypertens*, *34*: 1396-1406.

Ugwa, E. (2016). Nutritional practices and taboos among pregnant women attending antenatal care at general hospital in Kano, Northwest Nigeria. *Annals of Medical and Health Sciences Research*, *6*(2): 109-114.

Valmórbida, J.L., & Vitolo, M.R. (2014). Factors associated with low consumption of fruits and vegetables by preschoolers of low socioeconomic level. *Journal de pediatria*, *90*(5): 464-471.

Verbeke, W., & Bourdeaudhuij, I. (2007). Dietary behaviour of pregnant versus non-pregnant women. *Appetite*, *48*: 78-86.

Williams, I.O., Parker, R.S., & Swanson, J. (2009). Vitamin A Content of Southeastern Nigerian Vegetable Dishes, Their Consumption Pattern and Contribution to Vitamin A Requirement of Pregnant Women in Calabar Urban, Nigeria. *Pakistan Journal of Nutrition*, *8*(7): 1000-1004.

World Health Organization (2003). Report of a Joint WHO/FAO Expert Consultation. Diet, Nutrition and the Prevention of Chronic Diseases. Geneva, Switzerland.

Zamanian, M., Pak Seresht, M.R., Holakoei Naeini, K., Eshrati, B., & Rahimi Foroushani, A.M. Determinants of fruit and vegetable consumption among People in the Age Range of 18-70 Years in Arak, Iran. *Sjsph*, *11*(1): 85-98.

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