Determinants of Fruits and Vegetables Consumption among Primary School Students: A Path Analysis Evidence

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ABSTRACT

Background: Around 3.9 million deaths worldwide in 2017 were caused by a lack of fruit and vegetable consumption. Consumption of fruits and vegetables in Indonesia is still less than recommended by World Health Organization. This study aimed to examine determinants of fruits and vegetables consumption among primary school children.

Subjects and Method: This was an analytic observational study with a cross sectional design. The study was conducted at 25 elementary schools in Tegal, Central Java, from April to May 2019. A sample of 200 primary schools was selected by simple random sampling. The dependent variable was fruits and vegetables consumption. The independent variables were gender, knowledge, economic status, fruits and vegetables availability, sources of information, food preference, food selection, and parental role. The data were collected by food frequency questioner (FFQ) and questionnaire. The data were analyzed by path analysis.

Results: Fruit consumption was directly influenced by male gender (b=-0.99; 95% CI= -1.86 to -0.12; p=0.025), knowledge (b= 0.92; 95% CI= 0.04 to 1.79; p=0.039), economic status (b=1.96; 95% CI= 1.09 to 2.83; p<0.001), fruits and vegetables availability (b= 0.92; 95% CI= 0.07 to 1.76; p= 0.034), source of information (b= 0.92; 95% CI= 0.01 to 1.82; p= 0.047), food selection (b= 1.77; 95% CI= 0.01 to 3.54; p= 0.049), and parental role (b= 1.19; 95% CI= 0.27 to 2.13; p=0.012). Vegetables consumption was directly influenced by male gender (b= -0.71; 95% CI= -1.37 to -0.05; p= 0.035), economic status (b= 0.81; 95% CI= 0.05 to 1.56; p=0.036), fruits and vegetables availability (b=0.98; 95% CI= 0.33 to 1.64; p=0.003), and parental role (b= 0.95; 95% CI= 0.19 to 1.69; p= 0.013). Fruit and vegetable consumption was indirectly influenced by gender, food preference, and economic status.

Conclusion: Fruit consumption is directly influenced by male gender, knowledge, economic status, fruits and vegetables availability, source of information, food selection, and parental role. Vegetables consumption is directly influenced by male gender, economic status, fruits and vegetables availability, and parental role. Fruit and vegetable consumption is indirectly influenced by gender, food preference, and economic status.

Keywords: consumption, fruits and vegetables, path analysis

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BACKGROUND

Fruits and vegetables were one of the important components in a healthy diet. Around 3.9 million deaths worldwide in 2017 were caused by inadequate consumption of fruits and vegetables. This is related to the increase in non-communicable diseases (PTM) (Hartley et al., 2013). The lack of consumption of fruits and vegetables is one of the 10 risk factors for death in the world (FAO, 2017).

Fruits and vegetables were part of food that must be consumed every day because it can help prevent weight gain and

reduce the risk of obesity (Hartley et al., 2013). Increased consumption of carotenoid-rich fruits and vegetables can maintain cholesterol levels in the blood and can reduce the risk of colon, thyroid, pancreastic, and lung cancers (Pem and Jeewon, 2015).

WHO recommends to consume 400 grams or more fruits and vegetables every day to improve overall health. The recommendations for fruit and vegetable consumption consist of 250 grams of vegetables and 150 grams of fruit (WHO, 2003 in the Indonesian Ministry of Health, 2014).

The consumption of fruits and vegetables in Indonesia in 2016 was less than half the consumption recommended by WHO. Most Indonesians consume 173 g of fruit and vegetables per day, which is smaller than the recommended Nutrition Adequacy Rate (RDA). Fruit and vegetable consumption shows a downward trend over the past five years (Central statistics agency, 2017).

Noia and Byrd-Bredbenner (2013) and Rachman et al. (2018) concluded that the availability of fruits and vegetables in the home and school environment, the influence of the family and school environment, and the role of the mass media also affected the consumption of fruits and vegetables.

Wati et al. (2017) found a relationship between the prevalence of obesity and low consumption of fruits and vegetables. Tegal City is the area that the highest prevalence of obesity in Central Java Province with the age group of 5-12 years which amounted to 15.9% with Central Java number at 7.9% (Central statistical agency, 2017). This study aimed to analyze the determinants of fruit and vegetable consumption behavior in primary school children.

SUBJECT AND METHOD

a. Study Design
This was a cross sectional study conducted in 25 elementary schools in Tegal, Central Java, from April-May 2019.

b. Population and Sample
The target population of this study was all elementary school students in Tegal. A sample of 200 elementary school students was selected by simple random sampling.

c. Study Variables
The dependent variable was fruits and vegetables consumption. The independent variables were gender, knowledge, economic status, fruits and vegetables availability, source of information, food preference, food selection, and parental role.

d. Operational Definition of Variables
Gender. Gender was a difference in sex acquired from birth that was distinguished between men and women. The measurement scale was categorical.

Knowledge. Knowledge was information about nutrition related to fruit and vegetable consumption of the respondents. The measurement scale was continous.

Economic status. Economic status was a situation that shows the family's financial capabilities. The measurement scale was continous.

Fruits and vegetables availability. Fruits and vegetables availability was the availability of fruits and vegetables every day at home and around it. The measurement scale was continous.

Food preference. Food preference was the preference of respondents of fruits and vegetables. The measurement scale was continous.

Source of information. Source of information was the amount of information media both print and electronic to get information about fruits and vegetables. The measurement scale was continous.

Food selection. Food selection was a form of food that is often consumed by children and its intensity. The measurement scale was continous.

Parental role. Parental role was the habit of parents to consume fruits and vegetables everyday. The measurement scale was continous.

Fruits consumption. Fruits consumption was the frequency and portion of fruit consumed every day. Measuring instrument using a sheet of Food Frequency Questioner (FFQ).

Vegetables consumption. Vegetables consumption was the frequency and portion of vegetables consumed every day. The data were measured by food frequency questionnaire. The measurement scale was continous.

e. Data Analysis

Univariate analysis described sample characteristics. Bivariate analysis in the study was conducted to determine the relationship between the independent variables and the dependent variable using the chi square test. Path analysis was conducted to determine factors influencing fruits and vegetables consumption directly and indirectly.

f. Research Ethic

The study ethics in this study include informed consent, anonymity, and confidentiality. Ethical research was obtained from Research Ethics Committee in Dr. Moewardi Hospital, Surakarta, Central Java, with number: 498/ IV/ HREC/ 2019.

RESULTS

1. Univariate Analysis

Table 1 and 2 present data on sample characteristics in continous and categorical data. Table 1 and table 2 showed that as many as 57% sample were male. Most of them were dominated by students with high economic status (72.5%). 94.0% students were exposed to media about information on fruits and vegetables, 79.0% had good sources of information, 94.5% had good food preference, and 74.0% had good parental role.

Table 1. Sample characteristics (continuous data)

Variables	(n)	Mean	SD	Min	Max
Knowledge	200	5.89	1.84	2	9
Economic status	200	2,133,000	993,350.25	1,000,000	8,000,000
Fruits and vegetables availability	200	9.25	2.58	5	15
Source of information	200	2.48	1.29	0	5
Food selection	200	30.28	2.99	20	35
Influence of parents	200	10.75	2.88	5	15
Fruit consumption	200	3.14	1.26	1.0	6.4
Vegetable consumption	200	0.55	0.49	0	1.0

2. Bivariate Analysis

Table 3 showed the results of bivariate analysis of fruit consumption behavior in children. Table 4 showed the results of bivariate analysis of fruit consumption behavior in children.

3. Path Analysis

a. Model Specifications

Model specifications described the relationship between the variables in this study included gender, knowledge, economic status, fruits and vegetables availability, source of information, food preference, food selection, parental role, fruits and vegetables consumption.

b. Model Identification

The degree of freedom (df) in this study is:
1. Total of measured variable : 10
2. Exogenous variable   : 6
3. Endogenous variable   : 4

The formula for degree of freedom (df) is:

df = number of measured variables x (number of measured variables + 1) / 2 - (endogenous variable + exogenous variable number of parameters)

df = (10 x (11) / 2) − (4 + 6 + 10)

df = 55 − 20= 35

Table 2. Sample characteristics (categorical data)

Variables	(n)	(%)
Gender		
Female	114	57.0
Male	86	43.0
Knowledge		
Good	91	45.5
Poor	109	54.5
Family economic status		
High	145	72.5
Low	55	27.5
The availability of fruits and vegetables		
Good	105	52.5
Poor	95	47.5
Media exposure		
Yes	188	94.0
No	12	6.0
Source of information		
Good	158	79.0
Poor	42	21.0
Preferences		
Yes	178	89.0
No	22	11.0
Food selection		
Good	189	94.5
Poor	11	5.5
Influence of parents		
Good	148	74.0
Poor	52	26.0
Fruit consumption		
Adequate	150	75.0
Poor	50	25.0
Vegetables consumption		
Adequate	109	54.5
Poor	91	45.5

Path analysis can be done if df ≥ 0. The results of the degree of freedom calculation in this study were 35, and it was over identified so that path analysis can be done.

Table 5 showed the results of path analysis on the determinants of fruits consumption. Tabel 5 showed that male was directly and negatively associated with fruit consumption (b= -0.99; 95% CI= -1.86 to -0.12; p= 0.025). Male had logodd to consume fruits 0.99 units lower than female.

Good knowledge was directly and positively associated with fruit consumption (b= 0.92; 95% CI= 0.04 to 1.79; p= 0.039). Good knowledge increased logodd to consume fruits by 0.92 units.

High economic status was directly and positively associated with fruit con-

sumption (b= 1.96; 95% CI= 1.09 to 2.83; p<0.001). High economic status increased

logodd to consume fruit 1.96 units.

Table 3. The results of bivariate analysis of fruit consumption behavior in children

Independent Variable	Fruit Consumption				Total		OR	p
	Poor		Adequate					
	n	%	n	%	n	%		
Gender								
Female	19	38	95	63	114	57	0.35	0.002
Male	31	62	55	37	86	43		
Knowledge								
Poor	37	74	72	48	109	54.5	3.08	0.001
Good	13	26	78	52	91	45.5		
Family economic status								
Low	30	60	25	16.7	55	27.5	7.50	<0.001
High	20	40	125	83.3	145	72.5		
The availability of fruits and vegetables								
Poor	37	74	58	38.7	95	47.5	4.52	<0.001
Good	13	26	92	61.3	105	52.5		
Media exposure								
Yes	5	10	7	4.7	12	6	2.27	0.169
No	45	90	143	95.3	188	94		
Source of information								
Poor	20	40	22	14.7	42	21	3.88	<0.001
Good	30	60	128	85.3	158	79		
Preferences								
No	9	18	13	8.7	22	11	2.31	0.068
Yes	41	82	137	91.3	178	89		
Food selection								
Poor	8	16	3	2	11	5.5	9.33	<0.001
Good	42	84	147	98	189	94.5		
Parents influence								
Poor	20	40	32	21.3	52	26	2.46	0.009
Good	30	60	118	78.7	148	74		

Fruits and vegetables availability was directly and positively associated with fruit consumption (b= 0.92; 95% CI= 0.07 to 1.76; p= 0.034). Fruits and vegetables availability increased logodd to consume fruit 0.92 units.

Good sources of information was directly and positively associated with fruit consumption (b= 0.92; 95% CI= 0.01 to 1.82; p= 0.047). Good sources of information increased logodd to consume fruit 0.92 units.

Good food selection was directly and positively associated with fruit consump-

tion (b= 1.77; 95% CI= 0.01 to 3.54; p= 0.049). Good food selection increased logodd to consume fruit 1.77 units.

Foods consumption was indirectly affected by food preference through food selection.

Table 6 showed the results of path analysis on the determinants of vegetables consumption. Table 6 showed that male gender was directly and negatively influenced vegetables consumption (b= -0.71; 95% CI= -1.37 to -0.05; p= 0.035). Male decreased logodd for consuming vegetables by 0.71 units than female.

Table 4. The results of bivariate analysis of vegetables consumption behavior in children

Independent Variables	Vegetables Consumption				Total		OR	p
	Poor		Adequate					
	n	%	n	%	n	%		
Gender								
Female	42	46.2	72	66	114	57	0.44	0.005
Male	49	53.8	37	34	86	43		
Knowledge								
Poor	58	63.7	51	46.8	109	54.5	1.99	0.017
Good	33	36.3	58	53.2	91	45.5		
Family economic status								
Low	36	39.6	19	17.4	55	27.5	3.10	<0.001
High	55	60.4	90	82.6	145	72.5		
Fruits and vegetables availability								
Poor	59	64.8	36	33	95	47.5	3.74	<0.001
Good	32	35.2	73	67	105	52.5		
Media exposure								
Yes	6	6.6	6	5.5	12	6	1.21	0.747
No	85	93.4	103	94.5	188	94		
Source of information								
Poor	28	30.8	14	12.8	42	21	3.02	0.002
Good	63	69.2	95	87.2	158	79		
Food preference								
No	15	16.5	7	6.4	22	11	2.88	0.024
Yes	76	83.5	102	93.6	178	89		
Food selection								
Poor	10	11	1	0.9	11	5.5	13.33	0.002
Good	81	89	108	99.1	189	94.5		
Parental role								
Poor	32	35.2	20	18.3	52	26	2.41	0.007
Good	59	64.8	89	81.7	148	74		

Knowledge was directly and positively associated with vegetables consumption (b= 0.55; 95% CI= -0.10 to 1.20; p= 0.101). Knowledge increased logodd for consuming vegetables by 0.55 units.

High economic status was directly and positively associated with vegetables consumption (b= 0.81; 95% CI= 0.05 to 1.56; p= 0.036). High economic status increased logodd for consuming vegetables by 0.81 units.

Fruits and vegetables availaibility was directly and positively associated with vegetables consumption (b= 0.98; 95% CI= 0.33 to 1.64; p= 0.003). Fruits and vegetables availaibility increased logodd for consuming vegetables by 0.98 units.

Source of information was directly and positively associated with vegetables consumption (b= 0.72; 95% CI= -0.10 to 1.54; p= 0.087). Source of information increased logodd for consuming vegetables by 0.72 units.

Parental role was directly and positively associated with vegetables consumption (b= 0.95; 95% CI= 0.19 to 1.69; p= 0.013). Strong parental role increased logodd for consuming vegetables by 0.95 units.

Good food selection was directly and positively associated with vegetables consumption (b= 2.23; 95% CI= -0.06 to 4.52; p= 0.056). Good food selection increased

logodd for consuming vegetables by 2.23 units.

Vegetables consumption was in-directly affected by gender, food preference, and socio economic status.
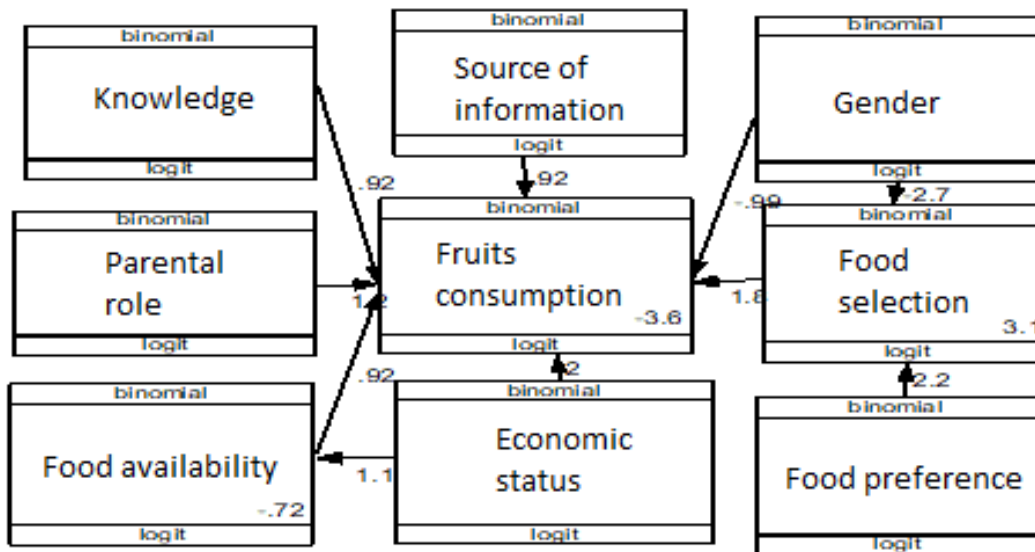

Figure 1. Structural model on the determinants of fruits consumption

Table 5. The results of path analysis of fruit consumption behavior in children

Dependent Variable	Independent Variable	b	CI (95%)		p
			Lower Limit	Upper Limit	
Direct Effect					
Fruit consumption (Adequate)	← Gender (Male)	-0.99	-1.86	-0.12	0.025
	← Knowledge (Good)	0.92	0.04	1.79	0.039
	← Family economic status (tinggi)	1.96	1.09	2.83	<0.001
	← Fruits and vegetables availability (good)	0.92	0.07	1.76	0.034
	← Source of information (Good)	0.92	0.01	1.82	0.047
	← Food selection (Good)	1.77	0.01	3.54	0.049
	← Parental role (Good)	1.19	0.27	2.13	0.012
Indirect Effect					
Food selection	← Gender (Male)	-2.74	-4.85	-0.62	0.011
	← Food Preferences (Yes)	2.18	0.79	3.57	0.002
Fruits and vegetables availability	← Family economic status (High)	1.13	0.47	1.78	0.001
N observation: 200					
Log likelihood: -239.97					

DISCUSSION

1. The effect of fruit and vegetables availability on fruits and vegetables consumption

Fruits and vegetables availability was directly and positively associated with fruits consumption (b= 0.92; 95% CI= 0.07 to 1.76; p= 0.034). Fruits and vegetables availability increased fruits consumption 0.92 units.

Fruit and vegetables availability was directly and positively associated with vegetables consumption (b= 0.98; 95% CI= 0.33 to 1.64; p= 0.003). Fruits and vegeta-

bles availability increased vegetables consumption 0.98 units.

Wolnicka et al. (2015) showed that that the consumption of fruits and vegetables of 9 years old children was influenced by parental eating behavior, parental support, and the availability of fruits and vegetables at home (p= 0.001).

2. The effect of source of information on fruit and vegetables consumption

Source of information directly and positively associated with fruits consumption (b= 0.92; 95% CI= 0.01 to 1.82; p= 0.047). Source of information increased fruits consumption 0.92 units.
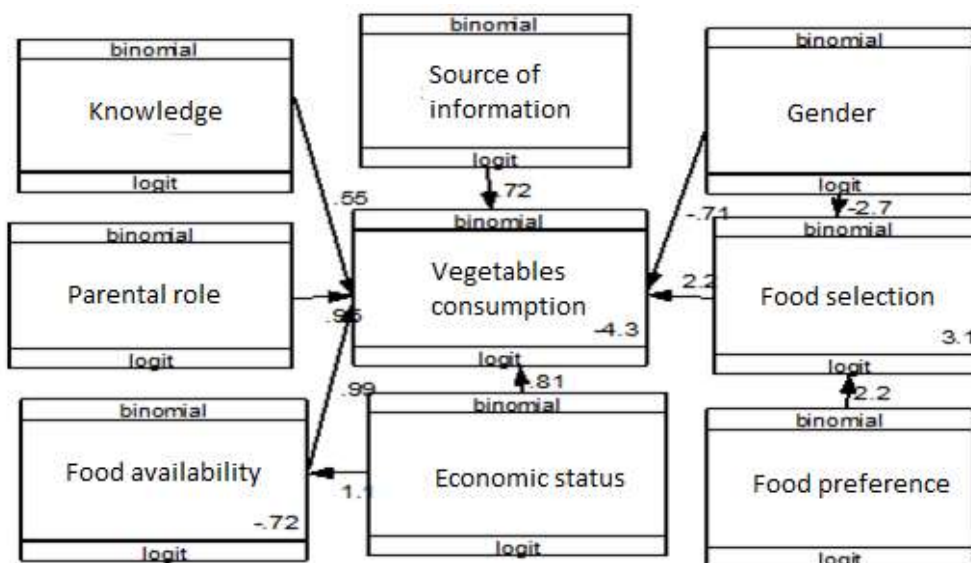
Figure 2. Structural model on the determinants of vegetables consumption

Table 6. The results of path analysis on the determinants of vegetables consumption

| Dependent Variable | Independent Variable | b | CI (95%) | | p |
			Lower Limit	Upper Limit	
Direct Effect					
Vegetables Consumption (Adequate)	← Gender (Male)	-0.71	-1.37	-0.05	0.035
	← Knowledge (Good)	0.55	-0.10	1.20	0.101
	← Family economic (High)	0.81	0.05	1.56	0.036
	← The availability of fruit and vegetables (Good)	0.98	0.33	1.64	0.003
	← Source of information (Good)	0.72	-0.10	1.54	0.087
	← Food selection (Good)	2.23	-0.06	4.52	0.056
	← Parents influence (Good)	0.95	0.19	1.69	0.013
Indirect Effect					
Food selection	← Gender (Male)	-2.74	-4.85	-0.62	0.011
	← Preferences (Yes)	2.18	0.79	3.57	0.002
Fruits and vegetables availability	← Family economic status (High)	1.13	0.47	1.78	0.001
N observation: 200					
Log likelihood: -276.43					

3. The effect of gender on fruits and vegetables consumption

Male was directly and negatively associated with fruits consumption (b= -0.99; 95% CI= -1.86 to -0.12; p= 0.025). Male had logodd 0.99 units lower to consume fruits than female.

Male was directly and negatively associated with vegetables consumption (b= -0.71; 95% CI= -1.37 to -0.05; p= 0.035). Male had logodd 0.71 units lower to consume vegetables than female.

Arganini et al. (2012) reported that men ate less fruits, vegetables and low-fat foods. Women choose foods that they consider healthy such as fruits, vegetables, high-fiber, and low-fat foods.

4. The effect of knowledge on fruits and vegetables consumption

Good knowledge was directly and positively associated with fruits consumption and it was statistically significant (b= 0.92; 95% CI= 0.04 to 1.79; p= 0.039). Good knowledge increased logodd to consume fruits 0.92 units than poor knowledge.

The results of this study were in line with Awuni et al. (2017), who stated that the low level of knowledge influenced fruit and vegetable consumption, and it was related to someone's awareness to consume healthy foods.

5. The effect of economic status on fruits and vegetables consumption

The results of this study showed that high economic status directly and positively associated with fruit consumption (b= 1.96; 95% CI= 1.09 to 2.83; p<0.001). High economic status increased logodd to consume fruit 1.96 units than low economic status.

High economic status directly and positively associated with vegetables consumption (b= 0.81; 95% CI= 0.05 to 1.56; p= 0.036). High economic status increased logodd to consume vegetables by 0.81 units.

Konttinen et al. (2013) found that there was a relationship between high income and fruits and vegetables intake (p <0.001).

Utami et al. (2017) reported that energy intake was influenced by maternal education and family income (p= 0.005). Landais et al. (2015) stated that women with high economic status ate more fruits. Vegetable consumption was more related to behavioral factors, while fruit consumption was influenced by economic status.

This study showed a positive and direct effect of information sources on vegetable consumption (b= 0.72; 95% CI= -0.10 to 1.54; p= 0.087). Good source of information increased logodd to consume vegetables by 0.72 units.

Elda and Kusharisupeni (2018) stated that healthy eating behavior was positively related to peer eating behavior and a good source of information.

Exposure to sources of information on nutritional information provided by the internet, magazines, posters, television, etc. provided a great influence on children. The interest in trying to see what was seen increased the chances of children to eat fruits and vegetables. Media in the form of audio-visual information proved to be statistically and positively related to fruit and vegetable intake among adolescents (Freisling et al., 2010).

6. The effect of food selection on fruit and vegetables consumption

Food selection was directly and positively associated with fruit consumption (b= 1.77; 95% CI= 0.01 to 3.54; p= 0.049). Good food selection increased logodd to consume fruit by 1.77 units.

Good food selection was directly and positively with vegetables consumption (b= 2.23; 95% CI= -0.06 to 4.52; p= 0.056). Good food selection increased logodd to consume vegetables by 2.23 units.

Good food selection was influenced by various factors. Habits were preferences formed by past choices. Imitation behavior in children still dominated. Children were vulnerable to eating habits of peers and their parents. Once there was a habit, food preferences and choices were formed which have been influenced by various factors (Leng et al., 2016).

7. The effect of parental role on fruit and vegetables consumption

Strong parental role was directly and positively associated with fruit consumption (b= 1.19; 95% CI= 0.27 to 2.13; p= 0.012). Strong parental role increased logodd to consume fruit by 1.19 units higher than lack of parental influence.

Strong parental role was directly and positively associated with vegetable consumption (b= 0.95; 95% CI= 0.19 to 1.69; p= 0.013). Strong parental role increased logodd to consume vegetables by 0.95 units.

Pearson et al. (2009) found a positive relationship between parental intake and consumption of fruits and vegetables in children. Parents' preferences and eating habits provide opportunities for children to imitate good eating habits.

Healthy eating behavior of parents has been shown to have a positive relationship with children's food intake and preference for fruits and vegetables. Children are aware of their parents' eating behavior and imitate it. Parents have a great opportunity to become role models for children's eating beavior (Draxten et al., 2014).

8. The Effect of food Preference on Fruit and Vegetables Consumption

Food preferences was indirectly associated with fruits and vegetables consumption through food selection (b= 2.18; 95% CI= 0.79 to 3.57; p= 0.002). Food preference increased logodd to consume fruits and vegetables by 2.18 units.

The study of Groele et al. (2018) reported that the types and portions of fruit consumed by parents affect the eating behavior of children. Exposure to fruit types was important to allow children to like and consume. The development of children's food preferences involved complex interactions between genetic, family, and environmental factors.

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