

Determination of Factors Affecting Fresh Fruit and Vegetable (FFV) Consumption Level during the Covid-19 Pandemic Period: The Case of Turkey

O. D. Bulut¹

ABSTRACT

Fresh Fruit and Vegetable (FFV) is indispensable for human health, as well as being an economically important sub-sector of agriculture. Especially with the Covid-19 pandemic, the importance given to FFV has increased. The aim of this study was to present the household FFV consumption rate by regions and the factors affecting FFV consumption level. A sample of 720 respondents was selected for online survey from the residents of all cities, in line with the population size of Turkey and the survey study was conducted in 2021. FFV consumption rates were calculated by regions and also ordinal logistic regression model was executed to determine affective factors. The study revealed that the highest FFV consumption rates by region were the Aegean (34.12%), Mediterranean (33.06%) and East Marmara (26.84%), while the lowest consumption rates were Central East Anatolia (18.60%). Also, according to result of Ordinal Logistic Regression (OLR) model, some explanatory variables such as age, marital status, education level and Covid status were found to have a significant effect on consumption level of FFV. The age older, probability of being in high consumption level increases ($P < 0.05$). Besides, married people's probability of being in high consumption level was higher than single ones ($P < 0.01$). People having university education level were more likely to be in high consumption level compared to those having primary education level ($P < 0.05$). People having had Covid-19 were more likely to be in high consumption level compared to those having not been Covid positive ($P < 0.01$). Individuals who were young, single/divorced, having not university education, or tested negative for Covid-19 should be encouraged to consume more FFV by governments' health care departments. In addition to informing about the benefits of FFV consumption, FFV food assistance can be provided to these individuals in cash or in kind.

Keywords: Food assistance, Household consumption level, Ordinal logistic regression.

INTRODUCTION

Since the Covid-19 pandemic broke out, there have been dramatic changes in the food consumption habits. In general, people have developed a health-oriented approach. For this reason, the importance of Fresh Fruits and Vegetables (FFV) has increased.

Fruit and vegetables are accepted as edible parts of plants, either cultivated or harvested wild, in their raw state or in a minimally processed form (FAO, 2021). In 2020, the world produced a total of 887 million tonnes of fruit and 1.148 million tonnes of

vegetables while Turkey produced 24 million tonnes of fruit, which is 2.7% of the world production, and 26 million tonnes of vegetables, which is 2.3% of the world production (FAOSTAT, 2022). Besides being a self-sufficient country in FFV production, Turkey is an exporter country.

FFV is of vital importance for humanity in terms of consuming foods with vegetable carbohydrates, proteins and vitamins, which are the basic needs of humanity. In literature, there are quite a lot of researches showing that consuming enough fruits and vegetables has many benefits, such as

¹ Department of Agricultural Economics, Faculty of Agriculture, Iğdir University, 76000, Iğdir, Turkey.
e-mail: dgnblt@gmail.com



healthy development of children, longevity, mental health, heart health, improved immunity, reducing the risk of cancer, and obesity (Aune *et al.*, 2017; Boffetta *et al.*, 2010; Chowdhury *et al.*, 2020; Collese *et al.*, 2017; Conner *et al.*, 2017; Maxner *et al.*, 2020; Leenders *et al.*, 2013). The optimum consumption depends on various factors, including age, sex, and level of physical activity. World Health Organization (WHO) recommends a combined consumption of at least 400 g of fruits and vegetables per day (WHO, 2019). However, consumption of fruits and vegetables is below the recommended amount in almost all countries (Micha *et al.*, 2015).

Low consumption of fruit and vegetables causes nearly 14% of deaths from gastrointestinal cancer worldwide (Afshin *et al.*, 2019). WHO recommends eating lots of fruits and vegetables to ensure a healthy lifestyle (WHO, 2010). In 2017, some 3.9 million deaths worldwide were attributable to not eating enough fruit and vegetables (WHO, 2019). Strong immune system is of great importance along with environmental measures to protect against the Covid-19 pandemic. Especially given the spread of the Covid-19 pandemic, it is important to keep the immune system strong to protect against the virus or alleviate the severity of the disease (MacGillivray and Kollman, 2014; Jawhara, 2020). The importance of protein, vitamin and mineral intake to combat Covid-19 has effect on consumers' preference for fresh and nutrition-rich foods (Galanakis, 2020; Jayawardena *et al.*, 2020; Wang *et al.*, 2020). In order to promote an increase in FFV consumption, it is important to identify factors affecting FFV consumption level.

Studies investigating consumer behavior without focusing on a particular product exists in the literature. Tien *et al.* (2021) stated that consumer behavior has changed to choose safer and less risky products. Pagnini *et al.* (2020) reported that quality is the factor affecting consumer behavior at most. Also, Li *et al.* (2020) found that severity of the Covid-19 pandemic had a positive effect on consumers' impulsive

consumption. Besides, some studies investigating consumer behaviours for food have indicated that some factors, including social, economic, cultural, and psychological, are statistically significant on food consumption (Akpınar *et al.*, 2009; Bagozzi and Dholakia 1999; Chikkamath *et al.* 2012; Deshingkar *et al.*, 2003; Eertmans *et al.*, 2001; Gindi *et al.* 2018; Goyal and Singh, 2007; Kuhar and Juvancic, 2010; Leibtag and Kaufman, 2003). Although some studies have indicated increased consumption level for fruit and vegetable consumption to cope with the Covid-19 (Ben Hassen *et al.* 2020; Cancellato *et al.*, 2020; Coulthard *et al.*, 2021; Lamarche *et al.*, 2021; Marty *et al.*, 2021; Pérez *et al.* 2020; Pulighe and Lupia 2020). Some other studies have found that people consume fewer fruits and vegetables (Giacalone *et al.*, 2020; Jia *et al.*, 2021) or consume at the same level (Di Renzo *et al.*, 2020; Poelman *et al.*, 2021; Rodríguez-Pérez *et al.*, 2020). Janssen *et al.* (2021) focused on changes in food consumption that occurred during the Covid-19 in Denmark, Germany, and Slovenia and reported that 15–42% of participants changed their consumption frequency depending on the type of food. Karaman and Kutlar (2021) investigated impact of Covid-19 on FFV Market's Equilibrium in Turkey and stated that the excessive variability of FFV' price may affect consumers adversely in periods of extraordinary situations such as the Covid-19.

Actual studies about FFV consumption for Covid-19 period in Turkey is inadequate. Therefore, it is crucial to find out consumption-related factors in order to develop suggestions that may increase FFV consumption in Turkey.

The present study aimed to achieve the following objectives during the Covid-19 pandemic period:

- a. To examine FFV consumption rate by NUTS-1 in Turkey.
- b. To examine affective factors on consumption level of FFV in Turkey.

MATERIALS AND METHODS

A specific survey was used to collect the research data. The survey was designed for the purpose of the research after reviewing the previous related studies. Final form was developed after the pilot test was conducted on the volunteers. Thus, questions developed for the targeted data were tested. The questionnaire was delivered to the participants through an online platform because of the Covid-19 pandemic and research costs. The survey lasted 2 months, which was from March to April 2021. The design of the questionnaire is highlighted in the following sections: socio-economic characteristics, demographics and FFV consumption situations, and health conditions. The sections were designed to determine some factors such as age, education, marital status, region of residence, Covid status, household size and income, and to find out the statistical relationship.

A total of 720 individuals, all of whom were recruited by snowball sampling method, participated in this study. Snowball sampling may be applied as a more formal methodology for making inferences about a population of individuals who have been difficult to enumerate through the use of descending methods such as household surveys (Snijders, 1992; Faugier and Sergeant, 1997). Snowball method is one of

non-probability sampling methods, as a useful choice of sampling strategy when the population is difficult to reach (Biernacki and Waldorf, 1981; Faugier and Sargeant, 1997). Mathematical theories on which probability-sampling methods are based do not exist in the non-probability sampling method (Baltacı, 2018). The sample size in the snowball sampling method is determined as the saturation level that the researcher considers sufficient (Strauss and Corbin, 2014). Sample size was determined after eliminating respondents for various reasons, such as extreme or the same answers in one chapter and failure to complete. The sample of participants was selected to be representative of the Turkey population by gender, age, and income level based on the Turkish Statistical Institute (TÜİK) and the Nomenclature of Territorial Units for Statistics (NUTS). NUTS-1, which is sub-level of NUTS, consists of 12 regions in Turkey. The distribution of the number of surveys by regions, which are classified by NUTS-1, is shown in the Table 1.

Research Hypotheses

The relationship between the FFV consumption rate by regions and the effects of some selected variables on FFV consumption level was tested according to the following hypotheses:

H₁: There is a statistically significant

Table 1. Distribution of the number of surveys by regions, NUTS-1.

| Region | Code | Number of surveys | Ratio (%) |
|------------------------------|------|-------------------|-----------|
| Istanbul Region | TR1 | 134 | 18.6 |
| West Marmara Region | TR2 | 30 | 4.2 |
| Aegean Region | TR3 | 92 | 12.8 |
| East Marmara Region | TR4 | 68 | 9.4 |
| West Anatolia Region | TR5 | 71 | 9.9 |
| Mediterranean Region | TR6 | 93 | 12.9 |
| Central Anatolia Region | TR7 | 38 | 5.3 |
| West Black Sea Region | TR8 | 40 | 5.6 |
| East Black Sea Region | TR9 | 23 | 3.2 |
| Northeast Anatolia Region | TRA | 21 | 2.9 |
| Central East Anatolia Region | TRB | 33 | 4.6 |
| Southeast Anatolia Region | TRC | 77 | 10.7 |
| Total | | 720 | 100.0 |



difference between FFV consumption rates by region.

H₂: Age, which belongs to the head of household, has a statistically significant effect on FFV consumption level of household.

H₃: Education level, which belongs to head of household, has a statistically significant effect on FFV consumption level of household.

H₄: Income level of the household has a statistically significant effect on FFV consumption level of household.

H₅: Marital status, which belongs to the head of household, has a statistically significant effect on FFV consumption level of household.

H₆: Residential area, which refers to rural or urban areas, has a statistically significant effect on FFV consumption level of household.

H₇: Covid-19 status, which refers to no one or at least one in the household, has a statistically significant effect on FFV consumption level of the household.

While H₁ hypothesis was tested with Kruskal-Wallis analysis, the rest of the hypotheses were tested by Ordinal Logistic Regression (OLR) model. Figure 1 presents the structure of OLR model.

Analysis Methods

Kruskal-Wallis test, which is a nonparametric test, was preferred. The test is used to compare more than two independent

samples (Ostertagová *et al.*, 2014). Since the assumptions of parametric statistics were not met, this analysis method was preferred. Kruskal-Wallis test was performed to determine the relationship between the FFV consumption ratio and the regions, which consist of 12 categories. If p-value is less than 0.05, it shows that there is a significant difference.

OLR model was performed to test research hypothesis in accordance with the purpose of the study and the variables. Chen *et al.* (2004) stated that the dependent variable has more than two categories and these categories are sortable in this model. Agresti (2010) stated that methods using the ordinal scale allow for a more comprehensible description of the data as well as allow stronger inferences about population characteristics. In all fields of study, ordinal scales arise when the values of continuous variables are measured or summarized by researchers by narrowing them into a set of categories. In order to reduce subjectivity in social sciences, it is useful to guide ordinal scales about what categories represent.

The application of linear logistics and OLR models largely depends on the dependent variable and the provision of model assumptions. Despite the prevalence of linear and logistic regression techniques, sequential logistic regression analysis is the only alternative technique in studies where the dependent variable is observed sequentially. Klæboe *et al.* (2003) states that there is a clear ordering between the levels in ordinal probability models, which

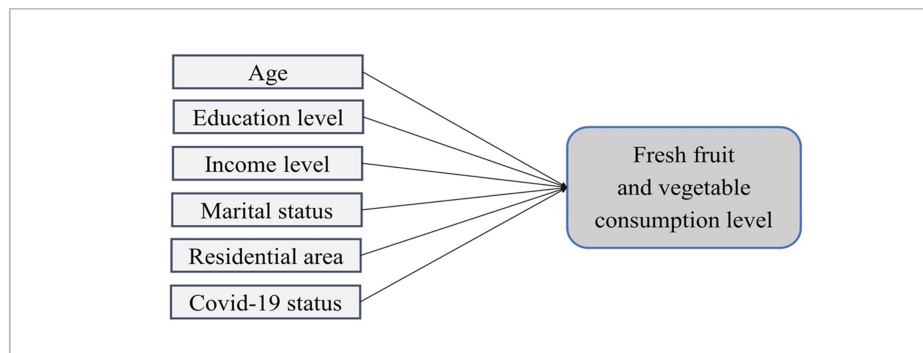


Figure 1. Structure of ordinal logistic regression model used in the study.

is a method developed when the dependent variable categories are more than two.

The model, which was developed by McCullagh (1980), is based on the assumption that there is an unobservable latent variable under an observable categorical variable. In this model, it is assumed that there is an unobservable latent variable that can take values between $-\infty$ and $+\infty$ under the observable ordered categorical dependent variable.

Five basic link functions are used to obtain the OLR model. The most used functions are logit, probit, and cloglog functions (Long, 1997). In the OLR model, there is usually no certain consideration of which link function to choose (Kılıçbay, 1980). The logit connection function was used in the OLR model in this study.

Classification of FFV Share in Total Food Consumption

A standardized scale of fruit and vegetable consumption is at least 400 g per day, according to quantitative studies (Agudo, 2004). However, because of the fact that people cannot figure out how much FFV they consume per day as quantitative, FFV share in total food consumption is asked to respondents.

FFV consumption shares were divided into 3 ordinal categories by using survey data. Category boundaries were determined by considering the distribution of the data (Table 2).

Variables Used in the Ordinal Logistic Regression Model

Dependent and explanatory variables used in the OLR model are shown in Table 3.

Dependent variable is consumption level consisted of 3 categories that are low, medium and high. Explanatory variables are age, marital status, education level, household income level, residential area kind, and covid-19 status.

Methodological Considerations and Limitations

Reliability is defined as consistency in results after repeated measurements (Taylor, 1999). This consistency is defined by the homogeneity of the results (Louangrath, 2018). The normal distribution of the dependent variable was tested with normality tests in which skewness and kurtosis value in the range between -1.5 and +1.5 is acceptable (Tabachnick and Fidell, 2013). These values for the dependent variable are 0.567 (skewness) and 0.202 (kurtosis). The normal distribution of the dependent variable gives information about the power of representation. Also, in order to ensure homogeneity, the units in the sample were selected according to NUTS. Besides, it was tested whether there was a problem of multicollinearity independent variables caused by highly inter correlation (Janadari *et al.* 2016). The absence of a multicollinearity problem is an indicator of construct validity. Allison (1999) and Hair *et al.* (2014) stated that Variance Inflation Factor (VIF) values below 2.5 indicate no multicollinearity, and this requirement was met for all independent variables. Units with missing values or outliers were not included in the study. Apart from these, confirmatory questions, which is FFV consumption per capita, were asked to ensure the accuracy and internal consistency of the study. FFV consumption per capita and the share of FFV in total food consumption were used to test

Table 2. Classification of FFV share in total food consumption.

| FFV share in total food consumption (%) | Consumption level |
|---|-------------------|
| 0 - 20 | Low |
| 21 - 35 | Medium |
| 36 + | High |



Table 3. Description of ordinal logistic regression model parameters.

| Variables | Type | Explanation |
|------------------------------|------------|---|
| Dependent variable | | |
| Consumption level | Dummy | 1: Low 2: Medium 3: High* |
| Explanatory variables | | |
| Age | Continuous | |
| Marital status: | Dummy | 1: Single 2: Married* |
| Education level | Dummy | 1: Primary school 2: Secondary school 3: University* |
| Household income level | Dummy | 1: Low (0-5000) 2: Middle (5001-10000) 3: High (10001≤)* |
| Residential area kind | Dummy | 1: Rural 2: Urban* |
| Covid-19 status | Dummy | 1: No individual in the household having Covid-19 2: At least one individual in the household having Covid-19* |

* Reference Category.

correlation and it was calculated that Pearson Correlation value of these two variables was $r > 0.7$ ($R = 0.761$; $P < 0.001$). Correlation measures the relationship between two variables and is, therefore, commonly used to assess relative reliability or validity. Correlations between the criterion and other measures are validity coefficients. A more positive correlation coefficient (closer to 1) is interpreted as greater validity or reliability (Odom and Morrow, 2006; Anonymous, 2022b).

However, several limitations are acknowledged. Steindorf and Schmidt (2006) stated that the use of correlation coefficients may fail to detect systematic bias. Also, due to the data feature (no items for Likert scale and no reference data) and one-time questionnaire application, other tests such as Cronbach's Alpha, Kuder-Richardson, test-retest and parallel-forms could not be used for reliability and validity. Because of the online survey in the research, it was not possible to interview individuals who were illiterate, did not have an internet connection, did not use technological devices, or did not volunteer for participation. Results are based on the self-reported data. Surveys having missing

values or outliers were not included in this study.

RESULTS AND DISCUSSION

Some Important Statistics of the Sample Group

Some important statistics of the respondents is presented in Table 4. The respondents had an average age of 34.28 years. The education level of the respondents was as follows: 47.1% had a secondary school degree, 21.4% had university degree, and 31.5% had a primary school degree. About 54.7% of respondents were female, and 64.2% were married. The average household income was 8,862.99 TL per month, USD/TL exchange rate for 2021 is 8.87. While 31.9% of respondents lived in rural area, the rest of them lived in cities. Although 66% of respondents stated that nobody had Covid-19, 34% of them stated at least one individual in the household had Covid-19. As for the FFV share in total food consumption, it was classified as 37.6% of respondent for low level, 39.6% of

respondent for medium level, and 22.8% of respondent for high level.

FFV Consumption Rates of Respondents by Regions, NUTS-1

Turkey has great diversity and potential in agricultural production thanks to its suitable geographical structure and climatic characteristics. Therefore, Turkey is in the position of producer and exporter of fresh fruit and vegetables. Due to climatic reasons, the agricultural production pattern in Turkey differs according to the regions. Sahingoz and Sanlier (2011) reported that Turkey is located in both Europe and Asia with the Mediterranean Sea to the south, thus it has Mediterranean nutritional influences on the coast side, and European and Asian influences in other parts of the country.

The production pattern of the region is thought to have an impact on the consumption of the people of the region. In line with this idea, the results of the research showed that FFV consumption rate is higher in the Aegean (34.12%) and Mediterranean (33.06%) regions compared to other regions (Figure 2). The regions with the least FFV consumption rate are Northeast Anatolia Region (18.95%) and Central East Anatolia Region (18.60%).

Table 5 presents test summary of the hypothesis of independent samples Kruskal-Wallis test. The p-value of this test was calculated as 0.000, showing that the null hypothesis of the Kruskal-Wallis test was rejected.

Kruskal-Wallis test was used to determine whether there is statistical significant differences in FFV consumption rates by regions. The result, as summarized by only significant regions in Table 6, indicate that between the various regions, FFV consumption rate differs significantly. There is a statistically significant difference between the Mediterranean region and some other regions, including Central Anatolia ($P < 0.01$), Istanbul ($P < 0.01$), West Anatolia

($P < 0.05$), Central East Anatolia ($P < 0.05$), Southeast Anatolia ($P < 0.05$), and East Black Sea ($P < 0.05$) regions. Similarly, there is a statistically significant difference between the Aegean Region and some other regions, including Central Anatolia ($P < 0.01$), Istanbul ($P < 0.01$), West Anatolia ($P < 0.01$), Central East Anatolia ($P < 0.05$), Southeast Anatolia ($P < 0.05$), East Black Sea regions ($P < 0.05$), and Northeast Anatolia Region ($P < 0.05$). Other binary combinations between regions were not significant ($P > 0.05$).

Factors Affecting FFV Consumption Level of Respondents Based on Ordinal Logistic Regression Model

Test of model fitting information was performed. This is useful for testing if there is a significant improvement in fit of the final model relative to the Intercept only model. In this analysis, it has been seen a significant improvement in fit of the final model over the null model [$\chi^2(8) = 153.598$, $P = 0.000$].

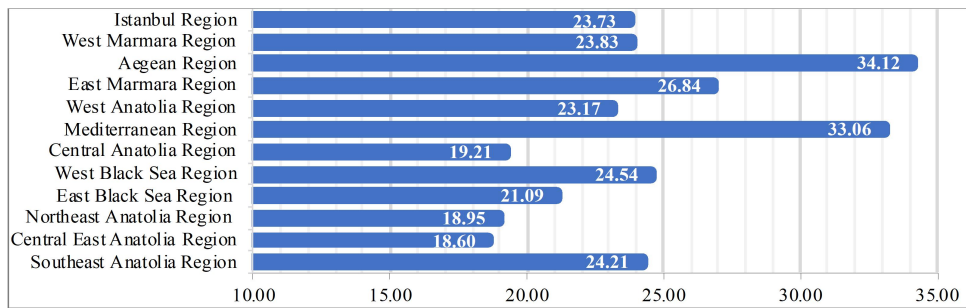
The goodness of fit was calculated. Non-significant test results are the indicators that the model fits the data well (Field, 2013; Petrucci, 2009). In this analysis, both the Pearson chi-square test [$\chi^2(1036) = 1076.839$, $P = 0.183$] and the deviance test [$\chi^2(1036) = 1095.762$, $P = 0.096$] are non-significant. These results suggest good model fit.

Pseudo-R-square values, which are used by some authors to assess model fit by determining the effect size of the model, were calculated. Pseudo R square statistics were as follows: Cox and Snell: 0.192; Nagelkerke: 0.218; and McFadden: 0.100. Hahs-Vaughn and Lomax (2012) and Pituch and Stevens (2016) stated that these values be treated as rough analogues to the R-square value in OLR.

The parallel lines assumption is based on the condition that the estimated values of the parameters pass through the same cut-off point for all categories of the dependent variable. When the result of the test of Parallel lines indicates non-significance, it means that assumption is satisfied (Akin and Şentürk, 2012). In this analysis, the Pearson

**Table 4.** Some important statistics of the sample group (n= 720).

| Variables | Categories | Frequency | Percentage (%) |
|--|--|-----------|----------------|
| Age (Mean: 34.28 years) (Std dev: 9.67 years) | ≤ 30 | 274 | 38.1 |
| | 31-40 | 286 | 39.7 |
| | 41≤ | 160 | 22.2 |
| Gender | Male | 326 | 45.3 |
| | Female | 394 | 54.7 |
| Education level | Primary school | 227 | 31.5 |
| | Secondary school | 339 | 47.1 |
| | University | 154 | 21.4 |
| Marital status | Single | 258 | 35.8 |
| | Married | 462 | 64.2 |
| Household income level (TL month ⁻¹) (Mean: 8,862.99TL) | Low (0-5000) | 227 | 31.5 |
| | Middle (5001-10000) | 262 | 36.4 |
| | High (10001≤) | 231 | 32.1 |
| Residential area kind | Rural | 230 | 31.9 |
| | Urban | 490 | 68.1 |
| Covid positive status for household | No individual in the household | 475 | 66.0 |
| | At least one individual in the household | 245 | 34.0 |
| FFV share in total food consumption | Low | 271 | 37.6 |
| | Medium | 285 | 39.6 |
| | High | 164 | 22.8 |

**Figure 2.** Fresh fruits and vegetables consumption rates by regions, NUTS-1.**Table 5.** Kruskal-Wallis hypothesis test summary.

| Chi-Square | Df | Asymp sig |
|------------|----|-----------|
| 75.398 | 11 | 0.000 |

Grouping Variable: Regions by NUTS-1.

chi-square test [$\chi^2(8) = 1210.126, P = 0.076$] was non-significant. Therefore, it is interpreted that the assumption is satisfied.

Results of the Ordinal Logistic Regression Model

In order to interpret the parameters of the ordinal logistic regression analysis, it is

necessary to find the odds ratio of the estimation values (β), as well as to determine the reference categories. Interpretations are made with the odds ratio according to the determined reference categories. The reference category allows the interpretation of other categories according to one of the categories of a variable. This analysis of parameter

significance is called as interpretation by the odds ratio (Garson, 2012; Yavuz *et al.* 2014).

In literature, factors associated with FFV consumption level are age, gender, race, education level, income, household size, perceptions of healthy food and shopping frequency (Casagrande *et al.*, 2007; Tamers *et al.*, 2009; Kimmons *et al.*, 2009; Azagba and Sharaf, 2011; Liese *et al.*, 2014). Apart from the factors used in the previous studies, marital status, Covid-19 status and residential area variables were examined. Thus, it was aimed to fulfil the gap in the literature.

OLR model was preferred in accordance with the research variables. FFV consumption level, which constitutes three categories of variable including consumption level 1 (low level), consumption level 2 (medium level) and consumption level 3 (high level), was used as the dependent variable. In addition, explanatory variables are age, education level, income level, marital status, residential area, Covid status. According to the findings, some explanatory variables such as age ($P < 0.05$), education level ($P < 0.05$), marital status ($P < 0.01$) and Covid-19 status ($P < 0.01$) variables were found to have a significant effect. The other explanatory variables in the model, i.e. household income level ($P > 0.01$) and residential area ($P > 0.01$), were found to be non-significant (Table 7).

Some studies also reported fresh food shopping frequency affects FFV consumption (Colby, 2015; Gustat, 2015). During Covid-19, frequency of grocery store trips was reduced because of the fact that people avoided exposure to Covid-19 (Sahahbandeh, 2022; Chenarides *et al.*, 2021; Litton and Beavers, 2021). This knowledge is important for understanding the reason of low FFV consumption. However, this factor was not taken into account for FFV consumption groups in this research.

Age is a significant positive predictor of FFV consumption level. An increase in age

(expressed in years) is associated with an increase in the odds of FFV consumption level, with an odds ratio of 1.020 (Wald $\chi^2 = 5.823$, $P = 0.016$). Based on this result, hypothesis H_2 can be accepted. This indicates that a person having higher age is more likely to be in high consume level for FFV. Previous studies show that FFV consumption decreases from childhood to adolescence, but increases when transitioning from adolescence to a higher age group. Lastly, FFV consumption decreases along with total consumption in the last stages of old age (Anonymous, 2022a; Kelder *et al.*, 1994; Lien *et al.*, 2001; Madhavan-Nambiar *et al.*, 2015; Te Velde *et al.*, 2007). Paralleled to previous studies conducted by Linchtenstein *et al.* (2008) and Nicklett and Kadell (2013), one possible reason of this is that younger adults may be more prone to junk food, but as age gets older the consumption of FFV increases thanks to increased health concerns.

Education level, of which reference category is education level 3, is a significant predictor of FFV consumption level. When the education level groups were examined according to the reference category, it was determined that the relationship between level 2 and 3 was non-significant (Wald $\chi^2 = 2.107$, $P = 0.147$), while there was a significant relationship between level 1 and level 3 (Wald $\chi^2 = 6.350$, $P = 0.012$). Based on this result, hypothesis H_3 can be partially accepted. The odds of education level 1 for being in high consumption level is 0.597 times that of education level 3. This indicates that a person having university education level is more likely to be in high consumption level for FFV compared to the one having primary education level. Likewise, a study conducted by Stea *et al.* (2020) in 21 European countries showed that high education was associated with increased consumption of fruit and vegetables. Similarly, a study in the Netherlands showed that participants within the group of lower educational level were more likely to have reduced their food intake since the beginning of the lockdown

**Table 6.** Statistically significant regions.

| Region 1 | Region 2 | Std | Std test | Adj sig |
|---------------|------------------------------|--------|----------|---------|
| Mediterranean | Central Anatolia Region | 39.799 | 4.789 | 0.000* |
| Mediterranean | Istanbul Region | 27.899 | -5.052 | 0.000* |
| Mediterranean | West Anatolia Region | 32.578 | -4.050 | 0.003* |
| Mediterranean | Central East Anatolia Region | 41.855 | 3.774 | 0.011* |
| Mediterranean | Southeast Anatolia Region | 31.850 | 3.412 | 0.043** |
| Mediterranean | East Black Sea Region | 48.139 | 3.405 | 0.044** |
| Aegean Region | West Anatolia Region | 32.655 | 4.615 | 0.000* |
| Aegean Region | Central Anatolia Region | 39.862 | 5.252 | 0.000* |
| Aegean Region | Istanbul Region | 27.989 | -5.706 | 0.000* |
| Aegean Region | Central East Anatolia Region | 41.945 | 4.216 | 0.002* |
| Aegean Region | Southeast Anatolia Region | 31.982 | 3.991 | 0.004* |
| Aegean Region | East Black Sea Region | 48.191 | 3.791 | 0.010** |
| Aegean Region | Northeast Anatolia Region | 49.993 | 3.693 | 0.015* |

Significance level: * P-value< 0.01; ** P-value< 0.05.

Table 7. Result of the ordinal logistic regression model.

| Variable | | Estimate (β) | Std error | Sig. (P) | Odds ratio (e^{β}) |
|------------------------------|---|-------------------------|-----------|----------|----------------------------------|
| Dependent variable | | | | | |
| Consumption level | 1: Low | -1.034 | 0.386 | 0.007 | 0.356 |
| | 2: Medium | 0.992 | 0.387 | 0.010 | 2.695 |
| | 3: High (<i>Reference</i>) | | | | |
| Explanatory variables | | | | | |
| Age | | 0.021 | 0.009 | 0.016** | 1.021 |
| Education level | 1: Primary school | -0.516 | 0.205 | 0.012** | 0.597 |
| | 2: Secondary school | -0.273 | 0.188 | 0.147 | 0.761 |
| | 3: University (<i>Reference</i>) | | | | |
| Income level | 1: Low (0-5000TL) | 0.045 | 0.189 | 0.813 | 1.046 |
| | 2: Middle (5000TL-10000TL) | 0.227 | 0.176 | 0.198 | 1.255 |
| | 3: High (10001≤) (<i>Reference</i>) | | | | |
| Marital status | 1: Single or separated | -1.558 | 0.189 | 0.000* | 0.210 |
| | 2: Married (<i>Reference</i>) | | | | |
| Residential area | 1: Rural | -0.316 | 0.163 | 0.052 | 0.729 |
| Covid-19 status | 2: Urban (<i>Reference</i>) | | | | |
| | 1: No individual tested positive for Covid-19 in household | -0.556 | 0.153 | 0.000* | 0.573 |
| | 2: At least one individual tested positive for Covid-19 in household (<i>Reference</i>) | | | | |

Significance level: * P-value< 0.01; ** P-value< 0.05.

(Poelman *et al.*, 2021). Also, Hong *et al.* (2012) and Stea *et al.* (2020) have stated that there is a clear association between educational attainment and FFV intake. However, some studies reported that there

was no significant effect for educational level on overall intake of FFV (Sidor *et al.*, 2020; Jordan *et al.*, 2021).

Marital status, of which reference category is marital status 2, is a significant predictor

of FFV consumption level. The odds of marital status 1 for being in high consumption level is 0.210 times that of marital status 2 (Wald $\chi^2 = 67.714$, $P = 0.000$), showing that hypothesis H_5 can be accepted. This indicates that a person identified as married is more likely to be in high consumption level for FFV compared to one identified as single. Likewise, Payette and Shatenstein (2005) have revealed that marriage is positively associated with fruit and vegetable consumption and Vinther *et al.* (2016) reported that people who became separated/divorced or stayed single showed declines in vegetable variety. Also, some other previous studies indicated that marital termination has adverse dietary effects for fruit and vegetable intakes (Conklin *et al.*, 2014; Donkin *et al.*, 1998; Eng *et al.*, 2005; Horwath, 1989). Ensuring family integrity can be considered as an important factor for a healthier diet of family members. This inference may be the reason for the fact that the FFV consumption of households for separated parents decreases.

Covid status, of which reference category is Covid status 2, is a significant predictor of FFV consumption level. The odds of Covid status 1 for being in high consumption level is 0.573 times that of Covid status 2 (Wald $\chi^2 = 67.714$, $P = 0.000$). Based on these results, hypothesis H_7 can be accepted. This indicates that a person infected with Covid-19 is more likely to be in high consumption level for FFV compared to the one who has not been infected with Covid-19. People infected with Covid-19 generally look for solutions to recover and reduce the effects of post-Covid-19, which is ongoing symptoms that people experience more than four weeks after getting Covid-19. Contrary to some previous studies conducted by Giacalone *et al.* (2020) and Jia *et al.* (2021), the result that Covid-19 has positive effects on FFC consumption is consistent with some studies (Ben Hassen *et al.*, 2020; Cancellato *et al.*, 2020; Coulthard *et al.*, 2021; Pérez *et al.*, 2020; Pulighe and Lupia 2020; Lamarche *et al.*, 2021; Marty *et al.*, 2021; Pfeifer *et al.*, 2021). It was interpreted that healthy

lifestyle habits, such as eating more FFV, is a result of habits acquired to stay healthy both in Covid-19 and in post-Covid-19 period.

Contrary to some previous studies (Prattala *et al.*, 2009; WHO, 2004; Darmon and Drewnowski, 2008; Lallukka *et al.*, 2010; Janda *et al.*, 2022), the present research has found that household income is not associated with FFV in Turkey, showing that hypothesis H_4 was rejected. There may be two reasons for this finding. While one possible reason is that the prices of FFV are low in Turkey through agricultural production capacity relative to other countries, the other one is that, perhaps, Covid-19 affected household consumption positively for all income groups.

CONCLUSIONS

FFV is considered to be protective against diseases and a potential treatment. Although it has numerous health benefits, only few countries meet daily requirement for FFV. This research focused on affective factors on FFV consumption level of households, of which our current knowledge has been limited in Covid-19 period. In addition, FFV consumption rates and their statistical significance according to regions, in accordance with NUTS-1 level, were investigated.

Age, marital status, education level and Covid status, which has not been used before in literature, were found to have a significant effect on FFV consumption level. The findings are consistent with several previous studies in which age, marital status and education level are statistically significant (Azagba and Sharaf, 2011; Madhavan-Nambiar *et al.*, 2015; Stea *et al.*, 2020; Poelman *et al.*, 2021). Higher age and education level increase FFV consumption. Similarly, it has already been reported that older adults tend to eat more FVV compared with younger adults (Linchtenstein *et al.*, 2008; Nicklett and Kadell, 2013). Besides, a research has revealed that FFV consumption



has declined among older adults in the past decade (Anonymous, 2012). Also, Hong *et al.* (2012) and Stea *et al.* (2020) have demonstrated that there is a clear association between educational attainment and FFV intake with regard to total intake. Parallel to these results, it was interpreted that age and education level may increase the level of awareness and anxiety about health, resulting increase in FFV consumption. Other studies also have focused on the important role of marital status in determining FFV consumption. Payette and Shatenstein (2005) found out that marriage is positively associated with fruit and vegetable intake. Further, Kroshus (2008) has described that marriage is positively associated with healthy food intake habits. Indeed, married people consume more FFV compared to the ones identified as single or separated, and being married has positive effect on FFV consumption level. It may be a result of the tendency that married people live more orderly. Contrary to some previous studies conducted by Lallukka *et al.* (2010) and Janda *et al.* (2022), it was found that household income level and the type of the residential area have not statistically significant effect on the FFV consumption level. It may be result of being easy to have FFV in terms of price in Turkey, since the country has geographic features enabling production of FFV and self-sufficiently. In addition, although the income level generally decreases in rural areas, it can be interpreted that there is no relationship between place status and FFV consumption level since FFV prices are also lower in rural areas. The fact that FFV production is high in the Mediterranean and Aegean regions in four seasons is thought that it is reflected in the consumption culture of the people in the region. For this reason, it has been deduced that these regions have higher FFV consumption than other regions. The results of the analysis also revealed that the differences are statistically significant.

The study presents some determinants that have not been investigated in previous studies. Increasing FFV consumption

contributes to agricultural economics, medical savings, greater longevity, and productivity. To promote an increase in households' FFV consumption level, it is important to identify factors that affect consumption. Study findings provide evidence for governments in order to design public health interventions aimed at high FFV consumption by nutritional support. Some criteria, which are able to prioritize individuals, should be established based on effective factors determined by this study. A new FFV consumption support program should be developed for individuals that meet these criteria. Individuals who are young, single/divorced, with no university education, or tested negative for Covid-19 should be included in this support program to increase FFV consumption by governments' health care departments. Besides, using the information about the benefits of FFV consumption, FFV food assistance can be given in kind or in cash within the scope of this program. Thus, an effective way will be followed to increase FFV consumption for households being in low FFV consumption level.

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تعیین عوامل مؤثر بر مقدار مصرف میوه و سبزیجات تازه (FFV) در طول دوره همه گیری کووید-۱۹: مورد ترکیه

ع. د. بولوت

چکیده

میوه و سبزیجات تازه (FFV) برای سلامت انسان ضروری است و نیز از نظر اقتصادی یک زیربخش مهم کشاورزی است. اهمیت FFV به ویژه با همه گیری کووید-۱۹ افزایش یافته است. هدف این پژوهش تعیین نرخ مصرف FFV در خانوارها به تفکیک مناطق و عوامل مؤثر بر سطح مصرف FFV بود. (به این منظور) نمونه ای شامل ۷۲۰ پاسخ دهنده برای نظرسنجی روی خط (آنلاین) از ساکنان تمامی شهرها متناسب با جمعیت ترکیه انتخاب گردید و مطالعه پیمایشی در سال ۲۰۲۱ انجام شد. نرخ مصرف FFV بر پایه مناطق محاسبه شد و همچنین مدل ترتیبی رگرسیون لجستیک (ordinal logistic regression: OLR model) برای تعیین عوامل مؤثر نیز اجرا شد. نتایج آشکار ساخت که نرخ مصرف منطقه ای به این صورت بود: منطقه اژه: (۳۴/۱۲٪)، منطقه مدیترانه ای (۳۳/۰۶٪) و مناطق شرق مرمره (۲۶/۸۴٪) بود در حالیکه کمترین نرخ در مناطق مرکزی شرق آتالیا (۱۸/۶۰٪) دیده شد. نیز، بر پایه نتایج OLR، برخی متغیرهای تشریحی مانند سن، وضعیت تاهل، سطح آموزش، و وضعیت کوید-۱۹ تاثیر منفی معناداری روی سطح مصرف FFV داشت. با افزایش سن، احتمال قرار گرفتن در سطح مصرف بالا افزایش می یافت ($p < /0.05$). همچنین احتمال مصرف بالای افراد متأهل بیشتر از افراد مجرد بود ($p < /0.01$). افراد با تحصیلات دانشگاهی در مقایسه با افراد دارای تحصیلات ابتدایی بیشتر در سطح مصرف بالا قرار داشتند ($p < /0.05$). افرادی که قبلاً مبتلا به کووید-۱۹ بودند در مقایسه با افرادی که کووید-۱۹ مثبت نبودند، احتمال بیشتری داشت که در سطح بالایی از مصرف قرار بگیرند ($p < /0.01$). افرادی که جوان، مجرد/طلاق گرفته بودند، فاقد تحصیلات دانشگاهی بودند، یا آزمایش کووید-۱۹ آنها منفی بود، باید توسط سازمان‌های مراقبت‌های بهداشتی دولتی تشویق شوند که FFV

بیشتری مصرف کنند. علاوه بر اطلاع رسانی در مورد مزایای مصرف FFV، می توان کمک های غذایی
به صورت نقدی یا غیر نقدی به این افراد ارائه کرد