*Original research paper*

# MODELING FRUIT AND VEGETABLE CONSUMPTION IN SERBIA

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**Abstract:** Although regular intake of fruits and vegetables has an essential role in a healthy diet and well-being, a majority of consumers in Serbia have a suboptimal intake of these groceries. To understand the main determinants of this unsatisfactory situation, the study tested an extended model of the theory of planned behavior intending to suggest necessary steps for improving fruits and vegetables daily intake. This theory, extended for the role of knowledge, was tested using structural equation modeling. Fit indices confirmed the utility of this extended model of the theory of planned behavior in explaining consumers' behavior as well as the mediating role of behavioral intentions. Serbia, as one of the central developing countries in the Balkans, was chosen to test the model with the possibility of applying it to other developing countries facing malnutrition. Data were collected in north Serbia, through an online survey (n=688). Despite consumers' high awareness of fruits and vegetables' beneficial health effects, the influence of consumers' knowledge only is not sufficient to trigger behavioral changes. Consumers' intentions and behavior should be influenced indirectly, by changing their attitudes and subjective norms. All custom-made activities promoting a higher fruit and vegetable intake should consider the present findings to achieve a bigger effect on behavioral changes among consumers.

**Key words:** *consumer behavior, fruit consumption, structural equation modeling, theory of planned behavior, vegetable consumption*

## INTRODUCTION

Fruits and vegetables (F&V) contain essential nutrients whose adequate daily intake may improve consumers' health and support the prevention of common non-communicable diseases (Slavin & Lloyd 2012). Despite this, their consumption in many countries (OECD, 2019), including Serbia, (Institute of Public Health of Serbia, 2018) remains unsatisfactory.

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According to the „Health at Glance 2019 OECD Indicators" (2019), only 57% of all adult respondents had fruit as a part of a daily diet. Women (63%) consumed more fruit than men (50%). Vegetables were daily consumed by 60% of respondents in OECD member countries. Like fruits, vegetables were more frequently consumed by women (65%) compared to men (55%). In Serbia, there is a lack of studies focusing on F&V consumption. Only 46% of respondents in Serbia consumed fruits, and 57% consumed vegetables daily. Women have healthier habits than men as their daily fruit and vegetable intake was higher: 51% compared to 40% and 60% compared to 54%, respectively. A positive correlation between F&V consumption and consumers' educational level i.e. financial status was noted (Institute of Public Health of Serbia, 2018). A recent study (Ubiparip Samek et al., 2021) about vegetable consumption among residents of northern Serbia showed that consumers consider vegetables as tasty, easy to use and healthy for consumption. Contrary, safety issues, short shelf-life and high prices are the main obstacles to higher vegetable consumption.

This study aims to provide a better understanding of consumers' viewpoints related to F&V consumption, and their impact on behavior. It explores the applicability of the theory of planned behavior (TPB) (Ajzen, 1991) to reveal effective strategies for achieving increased F&V daily intake. The TPB has been widely applied in predicting and describing F&V consumption behavior patterns, and numerous studies confirmed the importance of the theory for a better understanding of actual behavior (Blanchard et al., 2009; Emanuel, McCully, Gallagher & Updegraff, 2012; Kothe, Mullan & Butow, 2012; Menozzi, Sogari & Mora, 2015; Carfora, Caso & Conner, 2016; Menozzi, Sogari & Mora, 2017). But, as TPB may not necessarily capture all the predictors of consumers' behavior (Kothe & Mullan, 2014), according to the recommendations from the author (Ajzen, 2006), additional constructs were applied in many studies. For example, the influence of socio-demographic factors (Menozzi et al., 2015) such as gender (Blanchard et al., 2009; Emanuel et al., 2012), ethnicity (Blanchard et al., 2009), self-identity (Carfora et al., 2016) or habits (Menozzi et al., 2017), was used to im-

prove the TPB explanatory and predictive power of F&V consumption. The study examines the effect of consumers' knowledge (KN) about the valuable nutritional components in F&V and their positive benefits on human health as a prerequisite for effective action. The cornerstone of this study is the impact of consumers' knowledge on their attitudes, subjective norms and perceived behavioral control as well as their intentions, which consequently influence the behavior as knowledge triggers F&V concerns, which, in turn, stimulates consumption (Kushida, Iriyama, Saito & Yoshita, 2017).

Given the limited number of studies exploring the extended model of the TPB focusing on F&V consumption, this study could provide a new framework for planning and creating interventions to fight insufficient intake of these groceries. For this reason, the extended model of TPB, used as a conceptual framework, was tested among consumers in north Serbia, but it can also be used worldwide. It represents the base for developing different interventions to change behavioral patterns among consumers.

## MATERIALS AND METHODS

### Survey design and data collection

An online questionnaire survey was applied in north Serbia, between September 2016 and May 2017. Before sharing, it was discussed with the focus group (n=20) and created using *Survey Monkey, Inc.* The link was shared via e-mails and social networks. The sample consisted of 754 respondents, but according to the Mahalanobis test, 66 were not considered on the account of incomplete responses.

### Sample description

The sample consisted of 66% females and 34% males with the largest proportion (43.62%) of middle-aged respondents (age 25 to 45). Approximately, the same level of respondents was with and without a college degree and married and single. Among them, 36.97% had four family members and 26.50% had income approximately between 250€ and 500€ representing the average income in Serbia. Dominant participation of women can be explained by their key influence on purchase decision-making and the impact on the diet of their family members (Belch & Willis, 2002). They tend to consume higher amounts of F&V

compared to men and have a higher level of consciousness and knowledge about the importance of F&V consumption (Blanck, Gillespie, Kimmons, Seymour & Serdula, 2008).

**Study background**

TPB (Ajzen, 1991) has been widely applied in predicting and describing F&V consumption behavior patterns and numerous studies confirmed the importance of the theory for a better understanding of behavior (Menozzi et al., 2015; Menozzi et al., 2017). An additional construct of "knowledge" was added to the TPB. Questionnaire items were measured on a 7-point Likert scale where: 1 denotes "strongly disagree" and 7 "strongly agree" (Likert, 1932) and grouped into appropriate TPB constructs (Table 1).

**Data analysis**

The explanatory power of the extended TPB model was tested using the structural equation modeling (SEM) in SPSS 21.0 (IBM Corp., Armonk, NY), Microsoft Excel 2010 (Microsoft Corporation) and Ωnyx (Version 1.0-1026).

***SEM requirements fulfillment***

The multivariate normality was checked using the Mahalanobis test and SPSS 21.0. Multicolinearity was tested through the variance inflation factors (VIF<10) and tolerance (above 0.01) (O'Brien, 2007). The assumptions of linearity (Coakes, 2007) and homoscedasticity (Min, Holzmann & Czado, 2010) were tested using the SPSS 21.0. The sample size was tested according to the "A-priori Sample Size Calculator for Structural Equation Models" by Free Statistics Calculator v.4 (n.d.) and it was concluded that the minimum sample should be 265 survey members. The construct reliability was tested on the basis of Cronbach's alpha (≥ 0.7) (Gliem & Gliem, 2003).

***Model testing***

The convergent validity (CV) that shows the correspondence between the similar constructs (Trochim, 2008) was analyzed through squared multiple correlations (SMC ≥ 0.5) and composite reliability (CR > 0.7) including the average variance extracted (AVE > 0.5) (Trochim, 2006). Both, AVE and CR were calculated using the worksheet http://www.watoowatoo.net/sem/sem.html with the following formula:

$$AVE = \frac{\text{sum of squared standardized loading}}{\text{sum of squared standardized loading} + \text{sum of indicator measurement error}}$$

whereas: *sum of indicator measurement error = 1, minus the square of each loading was used.*

The discriminant validity (DV) was used to test weather two constructs differ from each other. Fornell and Larker's (1981) suggested AVE method to conclude DV where AVE value should be greater than squared correlation of each variable.

***Confirmatory Factor Analysis (CFA) and SEM***

CFA was used to calculate fit indices which show if overall model is acceptable. The overall fit of the proposed model was tested using the following fit indices: Model Chi Square ($\chi^2$) which assess overall fit and the discrepancy between the sample and fitted covariance matrices (p> 0.05); (Adjusted) Goodness of Fit ((A)GFI) as the proportion of variance accounted for the estimated population covariance (GFI ≥ 0.95; AGFI ≥0.90); Root Mean Square Error of Approximation (RMSEA) where values closer to 0 represent a good fit (RMSEA<0.08); Comparative Fit Index (CFI) that compares the fit of a target model to the fit of an independent, or null model (CFI ≥0.90) and Tucker Lewis index (TLI) which when about 0.95, indicates the model of interest (Hooper, Coughlan & Mullen, 2008).

*Mediating role of constructs*

The mediation role of a construct which is in a causal sequence between two constructs was tested using the standard error of construct a (SEa) and of construct b (SEb):

$$Z = \frac{a \times b}{\sqrt{b^2 \times SEa^2 + a^2 \times SEb^2}}$$

This ratio was treated as a Z test (i.e. larger than 1.96 in absolute value is significant at the 0.05 level) (Sobel 1982).

**RESULTS AND DISCUSSION**

**TPB constructs description**

All TPB constructs used in this research, including the additional construct of knowledge and obtained results for each construct are presented in Table 1.

A certain level of **knowledge (KN)** about the nutrients in F&V and their benefits to human health is necessary to increase F&V consumption. The highest percentage of consumers agree that F&V are an important source of vitamins (89.2%) and antioxidants (78.3%) which confirms that consumers' knowledge is relatively high (Table 1).

**Table 1**. The Theory of Planned Behavior (TBP) extended for the construct "knowledge" for consumers' behavior related to F&V consumption

| Constructs | | Likert scale (% of respondents) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | rearly | | sometimes | | | often | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| **KNOWLEDGE (KN)** | To what extent do you agree that F&V are important source of: | | | | | | | |
| | KN1 vitamins? | 0.9 | 0.3 | 0.4 | 1.8 | 4.5 | 11.0 | 78.2 |
| | KN2 fibers? | 1.5 | 0.7 | 1.4 | 4.9 | 9.3 | 15.0 | 63.0 |
| | KN3 antioxidants? | 1.3 | 0.6 | 1.5 | 2.8 | 9.6 | 15.2 | 63.1 |
| | KN4 minerals? | 1.6 | 1.5 | 2.4 | 6.2 | 13.0 | 14.7 | 56.6 |
| | KN5 proteins? | 9.3 | 9.1 | 9.3 | 9.9 | 10.9 | 11.5 | 35.9 |
| | KN6 water? | 2.4 | 1.9 | 4.1 | 6.5 | 12.8 | 15.2 | 53.5 |
| | KN7 carbohydrates? | 5.9 | 5.5 | 6.9 | 13.1 | 12.6 | 13.1 | 38.6 |
| **ATTITUDES (ATT)** | I wish there is/ I would like: | | | | | | | |
| | ATT1 a more diverse offer of fresh fruit out of season. | 11.5 | 5.5 | 6.1 | 8.2 | 10.9 | 14.3 | 43.5 |
| | ATT2 better availability and more diverse organic fruit offer. | 7.8 | 3.9 | 6.6 | 11.2 | 10.2 | 12.2 | 48.1 |
| | ATT3 to learn more techniques for fresh fruit preparation. | 19.0 | 7.0 | 8.3 | 10.9 | 11.3 | 13.2 | 30.3 |
| | ATT4 a more diverse offer of fresh vegetables out of season. | 7.7 | 4.3 | 6.9 | 11.1 | 12.0 | 13.1 | 44.9 |
| | ATT5 better availability and more diverse organic vegetables offer. | 7.1 | 4.7 | 7.7 | 11.5 | 10.0 | 11.8 | 47.2 |
| | ATT6 to learn more techniques for fresh vegetable preparation. | 10.9 | 5.6 | 6.4 | 10.2 | 15.0 | 12.5 | 39.4 |
| **SUBJECTIVE NORMS (SN)** | To what extent do you agree that regular consumption of F&V helps in: | | | | | | | |
| | SN1 maintaining good mood and good state of condition? | 1.4 | 1.4 | 3.0 | 5.9 | 14.7 | 35.7 | 37.9 |
| | SN2 prevention of malignancy? | 2.5 | 1.2 | 2.8 | 15.7 | 14.9 | 30.6 | 32.3 |
| | SN3 prevention of cardiovascular diseases? | 1.6 | 1.1 | 3.2 | 6.8 | 13.0 | 35.3 | 39.0 |
| | SN4 prevention of obesity? | 3.4 | 2.8 | 3.6 | 4.1 | 15.3 | 30.5 | 40.3 |
| | SN5 prevention of diabetes? | 2.4 | 2.8 | 3.7 | 9.9 | 14.7 | 32.7 | 33.8 |
| **PERCEIVED BEHAVIORAL CONTROL (PBC)** | To what extent do the following factors affect F&V consumption in your households? | | | | | | | |
| | PBCP1 price | 19.7 | 8.5 | 9.6 | 15.9 | 16.8 | 9.5 | 20.0 |
| | PBCP2 the level of income | 18.8 | 8.3 | 10.2 | 15.5 | 16.2 | 11.2 | 19.8 |
| | PBCA1 risk of the pesticide residues | 13.1 | 8.5 | 12.0 | 15.4 | 12.6 | 14.4 | 24.0 |
| | PBCA2 short durability/perishability | 18.5 | 7.8 | 11.3 | 17.1 | 19.0 | 11.7 | 14.6 |
| | PBCA3 preparation requirements | 25.2 | 12.1 | 9.3 | 17.2 | 17.2 | 10.1 | 8.9 |
| | PBCA4 distance from place of purchasing | 28.8 | 10.7 | 12.5 | 16.9 | 11.9 | 8.9 | 10.3 |
| | PBCA5 market choice | 12.1 | 6.2 | 11.2 | 17.8 | 19.3 | 15.8 | 17.6 |
| **INTENTIONS (INT)** | INT1 I eat fruit because of its pleasant taste. | 4.0 | 2.7 | 5.4 | 10.6 | 11.7 | 17.0 | 48.6 |
| | INT2 I eat fruit to get more energy. | 10.4 | 6.5 | 9.7 | 14.1 | 15.1 | 16.2 | 28.0 |
| | INT3 I eat fruit as a part of balanced diet for diseases prevention. | 15.4 | 8.5 | 9.5 | 16.9 | 12.0 | 12.9 | 24.8 |
| | INT4 I eat vegetables because of its pleasant taste. | 3.6 | 4.0 | 6.2 | 11.5 | 18.8 | 15.4 | 40.5 |
| | INT5 I eat vegetables to get more energy. | 5.0 | 5.8 | 7.7 | 14.5 | 16.0 | 16.0 | 35.0 |
| | INT6 I eat vegetables as a part of balanced diet for diseases prevention. | 11.0 | 5.3 | 10.7 | 14.3 | 12.0 | 15.4 | 31.3 |
| **BEHAVIOR VEGETABLES (BV)** | BV1 How often do you eat vegetables for breakfast? | 18.0 | 24.0 | 22.0 | 15.8 | 4.5 | 8.1 | 7.6 |
| | BV2 How often do you eat fresh vegetables? | 7.9 | 4.3 | 17.7 | 17.4 | 5.2 | 33.4 | 14.1 |
| | BV3 I enjoy eating vegetables every day. | 4.3 | 2.5 | 5.3 | 10.6 | 11.0 | 15.3 | 51.0 |
| | BV4 How often do you eat vegetables for lunch? | 2.0 | 2.7 | 6.6 | 20.4 | 10.0 | 28.7 | 29.6 |
| | BV5 How often do you eat vegetables for dinner? | 4.8 | 8.0 | 17.1 | 21.9 | 12.5 | 20.6 | 15.1 |
| | BV6 How often do you eat vegetables at home? | 4.0 | 1.5 | 8.6 | 16.9 | 7.7 | 42.4 | 18.9 |

| Constructs | | | | Likert scale (% of respondents) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | rearly | | sometimes | | | often | |
| | | | | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| | BV7 | How often do you eat vegetables as a snack? | | 35.2 | 25.4 | 22.2 | 8.5 | 4.0 | 3.1 | 1.6 |
| | BV8 | How often do you eat vegetables at work, in college or school? | | 60.8 | 5.9 | 15.2 | 7.3 | 1.7 | 7.7 | 1.4 |
| | BV9 | How often do you eat vegetables salads? | | 6.1 | 2.3 | 12.3 | 18.6 | 7.5 | 39.7 | 13.5 |
| **BEHAVIOR FRUIT (BF)** | BF1 | How often do you eat fruits for breakfast? | | 35.0 | 20.7 | 22.1 | 9.4 | 2.6 | 5.2 | 5.0 |
| | BF2 | How often do you eat fruits at work, in college or school? | | 55.4 | 11.0 | 15.3 | 5.4 | 0.4 | 11.3 | 1.2 |
| | BF3 | How often do you eat fruit as a snack? | | 3.1 | 6.8 | 18.6 | 24.5 | 9.7 | 18.9 | 18.4 |
| | BF4 | I enjoy eating fruits every day. | | 7.9 | 5.0 | 9.3 | 9.1 | 10.0 | 11.8 | 46.9 |
| | BF5 | How often do you eat fruits at home? | | 9.4 | 7.1 | 16.7 | 15.5 | 4.7 | 30.1 | 16.5 |
| | BF6 | How often do you eat fresh fruits? | | 9.2 | 7.9 | 18.4 | 16.3 | 4.2 | 30.5 | 13.5 |
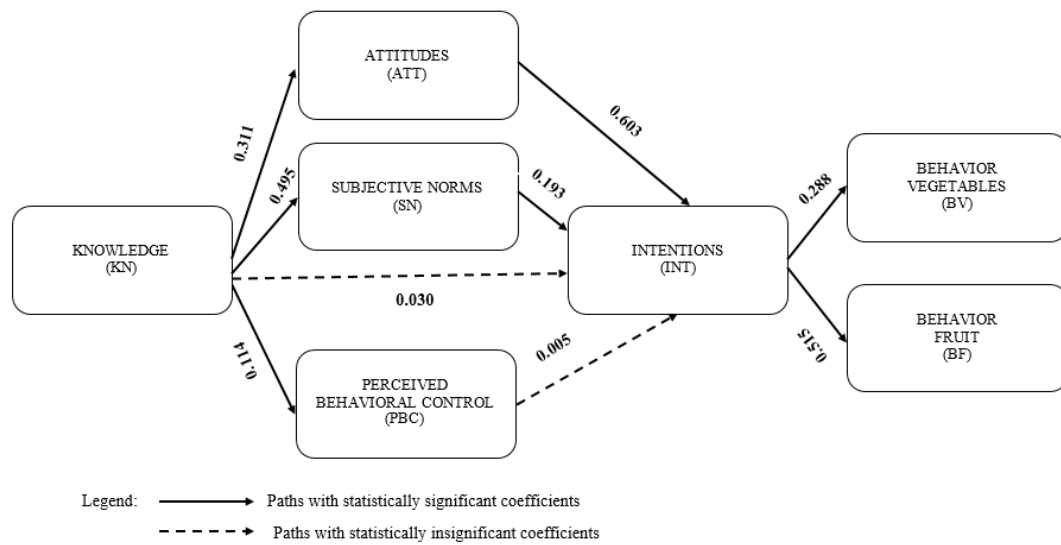


Figure 1: The unique SEM model

Respondents' **attitudes** (**ATT)** emphasized the necessity of better F&V offer out of season (57.8% and 58.0%) and organic products (60.3% and 59.0%). There is a positive attitude to learn new techniques (43.5 %) and recipes (51.9%) for F&V preparation (Table 1). They perceive F&V and especially organic products, as better, safer, healthier and fresher (Kihlberg & Risvik, 2007). The more positive the attitude, the greater the consumption (Smith & Paladino, 2010).

**Subjective norms (SN)** were analyzed indirectly, through the beliefs towards regular F&V consumption which are a consequence of the direct influence of people of interest and indirect influence of modern society's attitude towards healthy eating. The majority of respondents believe that regular F&V consumption contributes to the prevention of cardiovascular diseases (74.3%), maintaining good

mood and fitness (73.6%) and plays a significant role in the prevention of chronic non-communicable diseases of modern society like obesity (70.8%), diabetes (66.5%) and malignancy (62.9%) (Table 1). It is confirmed that regular F&V consumption may improve consumers' health and support the prevention of common non-communicable diseases (Slavin & Lloyd 2012).

**Perceived behavioral control (PBC)** implies the consumer's belief in how difficult or easy it is to perform certain behavior which is influenced by economic factors and their availability. The level of income is positively correlated with F&V consumption (Giskes, Turrell, Patterson & Newman, 2002). The rich assortment in one place (56.9%) impacts the consumption (Table 1) of F&V also confirmed in literature (Laska, Hearst, Forsyth, Pasch & Lytle, 2010).

**Table 2.**
Structural Path Coefficients

| Path | | | Estimate |
|---|---|---|---|
| **KNOWLEDGE (KN)** | | | |
| KN1 | ← | KN | 0.777 |
| KN2 | ← | KN | 0.822 |
| KN3 | ← | KN | 0.853 |
| KN4 | ← | KN | 0.818 |
| KN5 | ← | KN | 0.473 |
| KN6 | ← | KN | 0.683 |
| KN7 | ← | KN | 0.574 |
| **ATTITUDES (ATT)** | | | |
| ATT1 | ← | ATT | 0.539 |
| ATT2 | ← | ATT | 0.680 |
| ATT3 | ← | ATT | 0.525 |
| ATT4 | ← | ATT | 0.749 |
| ATT5 | ← | ATT | 0.771 |
| ATT6 | ← | ATT | 0.682 |
| **SUBJECTIVE NORMS (SN)** | | | |
| SN1 | ← | SN | 0.616 |
| SN2 | ← | SN | 0.807 |
| SN3 | ← | SN | 0.880 |
| SN4 | ← | SN | 0.855 |
| SN5 | ← | SN | 0.840 |
| **PERCEIVED BEHAVIORAL CONTROL (PBC)** | | | |
| PBCP1 | ← | PBC | 0.678 |
| PBCP2 | ← | PBC | 0.680 |
| PBCA1 | ← | PBC | 0.500 |
| PBCA2 | ← | PBC | 0.646 |
| PBCA3 | ← | PBC | 0.655 |
| PBCA4 | ← | PBC | 0.626 |
| PBCA5 | ← | PBC | 0.619 |
| **INTENTIONS (INT)** | | | |
| INT3 | ← | INT | 0.576 |
| INT5 | ← | INT | 0.721 |
| INT6 | ← | INT | 0.835 |
| **BEHAVIOR FRUIT (BF)** | | | |
| BF3 | ← | BF | 0.404 |
| BF4 | ← | BF | 0676 |
| BF5 | ← | BF | 0.903 |
| BF6 | ← | BF | 0.909 |
| **BEHAVIOR VEGETABLE (BV)** | | | |
| BV1 | ← | BV | 0.493 |
| BV2 | ← | BV | 0.704 |
| BV3 | ← | BV | 0.660 |
| BV4 | ← | BV | 0.600 |
| BV5 | ← | BV | 0.578 |
| BV6 | ← | BV | 0.790 |
| BV9 | ← | BV | 0.644 |

**Consumers' intentions (INT)** to increase F&V consumption are defined indirectly through positive consumer opinion about these food items due to their pleasant taste and contribution to well-being. Respondents eat F&V (65.6% and 55.9%) primarily because of their pleasant taste (Table 1) and perceive F&V as an important source of energy for the body. These results correspond to other studies that confirm their positive impact on the general condition of the organism (Nguyen et al., 2016).

**Vegetable consumption behavior (BV)** shows that vegetables are consumed often (47.2%). Fresh salads are often consumed as an addition to the main meal (53.2%). Vegetables are mostly consumed at home (61.3%), and rarely outside (school, work etc.) (66.7%). They are predominantly consumed for lunch or dinner. Despite the unsatisfactory level of vegetable consumption, consumers mostly enjoy vegetable consumption (66.3%) (Table 1).

**Fruit consumption behavior (BF)** results indicate that 44.0% of respondents often consume fresh fruit. Fruits are most often consumed at home, predominantly as a snack. In general, consumers enjoy their daily consumption (58.7%) (Table 1).

**SEM requirements fulfillment**

The results showed the fulfillment of all SEM requirements. Multivariate normality was checked with the highest Mahalanobis distance value (162.11). The assumption of multicollinearity was not violated (VIF=4.06), and tolerance (as a measure of collinearity) was 0.25 (O'Brien, 2007). The assumptions of linearity and homoscedasticity were not violated. All constructs showed a similar level of variance. Cronbach's alpha and Guttman Lambda confirmed the reliability of all TPB constructs in ranges from 0.74 to 0.87 for Cronbach's alpha (Gliem & Gliem, 2003).

## Model testing

The CR range from 0.91 to 0.99 was particularly significant. As AVE varies from 0.44 to 0.67 it can be concluded that latent variables are bringing significant variation in the face of random measurement error. All of the conditions of the CV are satisfactory met. By comparing the variance of constructs with the parameter of constructs, it can be found that correlation squares are less than that of AVE, hence confirming the DV of the construct.

## SEM

The unique solution is graphically shown in Figure 1. SEM resulted in structural path coefficients and structural path coefficients between constructs provided in Tables 2 and 3.

The model shown in Figure 1 with the introduction of the "knowledge" is based on the calculated coefficients of the path structure (Table 2) (Supplementary Data). It checks the influence of all observed variables on the intention to implement the desired F&V consumption behavior and the influence of consumers' intentions on this behavior. In further text, only the significant results will be discussed.

The structural path coefficients from knowledge to attitudes, subjective norms and perceived behavioral control are statistically significant (0.31, 0.49 and 0.11, respectively), suggesting their mediating role in forming consumers' positive intentions to increase consumption.

Consumers' intentions to increase F&V consumption were influenced by attitudes and subjective norms (0.60 and 0.19). The coefficient from knowledge to perceived behavioral control was statistically signifycant (0.11). The correlation between intentions and consumers' behavior related to F&V consumption behavior was significant (0.29 and 0.52).

These results indicate that all the actions aiming to increase F&V consumption should not focus on increasing consumers' knowledge about these food items only, as it is already at a relatively high level. The strategies for higher F&V intake should focus on changing consumers' attitudes and subjective norms to influence their intentions, and consequently their behavior. All this implies the mediating role of intentions for changing consumers' behavior related to F&V consumption.

According to the results of fit indices which were used to test the acceptance and explanatory power of the proposed model, the model Chi-Square ($\chi$ 2=4.33) indicates the excellent overall fit of the presented model.

(Adjusted) The goodness of Fit (GFI=0.93 and AGF=0.90) including Root Mean Square Error of Approximation (RMS-EA=0.04) also confirmed the good model fit and acceptance. Additionally, Comparative Fit Index (CFI=0.94) and Tucker Lewis index (TLI=0.92) confirm the good model fit and its explanatory power (Hooper et al.-, 2008). Overall, the TPB extended for the construct knowledge, is a reliable and predictive model for consumers' F&V consumption behavior.

## Mediating role

Testing of mediating role of attitudes, subjective norms and intentions as significant intermediaries (mediators) between knowledge and behavior is presented in Table 4.

**Table 3.**
Structural path coefficients between constructs

| Regression | | | Estimate | p |
|---|---|---|---|---|
| **Knowledge (KN)** | → | Attitudes (ATT) | 0.311 | + |
| **Knowledge (KN)** | → | Subjective norms (SN) | 0.495 | + |
| **Knowledge (KN)** | → | Perceived behavioral control (PBC) | 0.144 | + |
| **Knowledge (KN)** | → | Intentions (INT) | 0.090 | |
| **Attitudes (ATT)** | → | Intentions (INT) | 0.603 | + |
| **Subjective norms (SN)** | → | Intentions (INT) | 0.193 | + |
| **Perceived behavioral control (PBC)** | → | Intentions (INT) | 0.005 | |
| **Intentions (INT)** | → | Behavior vegetables (BV) | 0.515 | + |
| **Intentions (INT)** | → | Behavior fruits (BF) | 0.288 | + |

**Table 4.**
Structural path coefficients between constructs

|  |  |  | a | SEa |  |  |  | b | SEb | a*b | SEa*SEb | Z |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **KN** | → | ATT | 0.286 | 0.043 | ATT | → | INT | 0.831 | 0.078 | 0.238 | 0.042 | 5.642 |
| **KN** | → | SN | 0.362 | 0.037 | SN | → | INT | 0.335 | 0.075 | 0.121 | 0.030 | 4.063 |
| **ATT** | → | INT | 0.831 | 0.078 | INT | → | BV | 0.263 | 0.029 | 0.219 | 0.032 | 6.906 |
| **ATT** | → | INT | 0.831 | 0.078 | INT | → | BF | 0.116 | 0.020 | 0.096 | 0.019 | 5.094 |
| **SN** | → | INT | 0.335 | 0.075 | INT | → | BV | 0.263 | 0.029 | 0.088 | 0.022 | 4.007 |
| **SN** | → | INT | 0.335 | 0.075 | INT | → | BF | 0.116 | 0.020 | 0.038 | 0.011 | 3.539 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| **KN** | → | PBC | 0.142 | 0.042 | PBC | → | IN | 0.007 | 0.049 | 0.001 | 0.007 | 0.143 |
| **KN** | → | INT | 0.038 | 0.057 | SN | → | IN | 0.335 | 0.075 | 0.013 | 0.019 | 0.659 |
| **KN** | → | INT | 0.038 | 0.057 | INT | → | BV | 0.263 | 0.029 | 0.010 | 0.015 | 0.665 |
| **KN** | → | INT | 0.038 | 0.057 | INT | → | BF | 0.116 | 0.020 | 0.004 | 0.007 | 0.662 |
| **PBC** | → | INT | 0.007 | 0.049 | INT | → | BV | 0.263 | 0.029 | 0.002 | 0.013 | 0.143 |
| **PBC** | → | INT | 0.007 | 0.049 | INT | → | BF | 0.116 | 0.020 | 0.001 | 0.006 | 0.143 |

Based on the obtained results ($Z > 1.96$), it is shown that consumers' attitudes towards F&V represent a significant mediator between their knowledge and intentions to increase their consumption. Subjective norms are a significant mediator between consumers' knowledge and their intentions. Their intentions to increase the consumption of these groceries are a significant mediator between their attitudes and specific fruit consumption behavior and vegetable consumption behavior. Intentions are also a significant mediator between subjective norms and specific fruit consumption behavior as well as vegetable consumption behavior.

The absence of the mediating role for perceived behavioral control, intentions and subjective norms is also confirmed. The results showed that the consumers' attitudes towards F&V were positively and significantly related to the intention of higher F&V consumption, which is in consent with a previous study by Keller, Motter, Motter & Schwarzer (2018).

Contrary to our results, previous studies showed that knowledge significantly influences intentions, but not behavior (Kumar, 2012). On the other hand, in developing countries, people still have insufficient knowledge about the F&V in terms of their nutritional value (Gurău & Ranchhod, 2005, Boca, 2021), so the absence of this observation can be interpreted as insufficient knowledge influencing the formation of intentions, but not on concrete behavior. The differences in the obtained findings could be attributed to the results that indicate a relatively high level of knowledge about F&V among consumers in northern Serbia. Limited knowledge regarding F&V can also be at-

tributed to the low level of advertising and low awareness of this topic. Thus, the quality, as much as the quantity of information available to the consumers, has a crucial role in their decision (Ajzen, Joyce, Sheikh & Cote, 2011). According to Ajzen et al. (2011), consumers' should have accurate information of general nature for understanding this issue, so they will engage in a desirable behavior. Furthermore, it should be examined what information they actually have, whether they are accurate or not, and how will affect their intentions. It is necessary to inspect the knowledge that guides the behavior of interest and not their general knowledge. Once they are recognized, different actions and strategies could be created to reach consumers, providing them with information that will challenge their beliefs and direct them to desired behavior (Ajzen et al., 2011).

**LIMITATIONS**

The results confirmed the explanatory power of the extended TPB model in testing the key determinants of F&V consumption in the example of the population in north Serbia. The consumers' knowledge about F&V beneficial effects on health has an important role in increasing their consumption. But, knowledge itself, although it is necessary, is not sufficient. It influences consumers' intentions indirectly, by influencing the attitudes and subjective norms as mediators. All strategies and actions created to motivate consumers' to increase the consumption of F&V should not only be focused on their knowledge, but also on changing their attitudes and subjective norms affecting the consumption. Achieving favorable at-

titudes by offering better availability of fresh F&V, including organic F&V and providing new and easy preparation recipes for consumers could motivate them to increase F&V consumption. People with positive attitudes could impact other persons to change their behavior if they are people of importance to them, and it could engage in the wanted behavior. This paper provides a framework for further research in other countries for defining targeted interventions dealing with similar issues, which will consequently lead to the desired behavior of increased F&V consumption.

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# MODELOVANJE KONZUMACIJE VOĆA I POVRĆA U SRBIJI

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**Sažetak:** Uprkos tome što voće i povrće imaju ključnu ulogu u pravilnoj ishrani i dobrom zdravstvenom stanju, većina potrošača u Srbiji ne konzumira dovoljne količine ovih namirnica. U cilju boljeg razumevanja ovog nezadovoljavajućeg stanja, istraživanje testira prošireni model teorije planiranog ponašanja, kako bi se predložili potrebni koraci za unapređenje svakodnevne konzumacije voća i povrća. Ova teorija, proširena za ulogu znanja, testirana je upotrebom strukturnih jednačina. Indeksi podesnosti su potvrdili korisnost proširenog modela teorije planiranog ponašanja za bolje razumevanje ponašanja potrošača, kao i za medijatorsku ulogu namera potrošača da povećaju konzmaciju ovih namirnica. Republika Srbija, kao jedna od ključnih zemalja u razvoju na Balkanu, izabrana je za testiranje modela, uz mogućnosti njegove primene i na druge zemlje u razvoju koje se suočavaju sa neadekvatnom ishranom stanovništva. Podaci su prikupljeni u Vojvodini putem online upitnika (n=688). I pored visokog nivoa svesti potrošača u Vojvodini o značaju voća i povrća na zdravlje, njihovo znanje, samo po sebi, nije dovoljno da dovede do promena u njihovom ponašanju vezanom za konzumaciju voća i povrća. Na namere i ponašanje potrošača treba uticati indirektno, kroz promenu njihovih stavova i subjektivnih normi. Upravo zbog toga, rezultate ove studije treba uzeti u obzir prilikom kreiranja aktivnosti usmerenih na promenu ponašanja potrošača u pravcu povećanja konzumacije voća i povrća.

**Ključne reči:** *ponašanje potrošača, konzumacija voća, modelovanje strukturnim jednačinama, teorija planiranog ponašanja, konzumacija povrća*