



## Determinants of the intention to increase vegetable consumption in Vietnam and Switzerland

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### ABSTRACT

Increasing vegetable consumption can result in health benefits. In this context, this study aimed to identify predictors of the intention to increase vegetable consumption. Online surveys were carried out in Switzerland and Vietnam between November and December of 2022. Multiple regression analyses were applied to a sample of 1259 consumers to examine the factors affecting the intention to increase vegetable consumption. The results indicate that, in both countries, the intention to increase vegetable intake was positively influenced by the perceived vulnerability of insufficient vegetable intake and the self-efficacy of eating more vegetables. Furthermore, higher levels of employment among participants strengthened the intention to increase vegetable consumption. Heterogeneity among the studied countries was also observed. While the Swiss participants' intention to eat more vegetables was affected by familial hindering, the intention of the Vietnamese participants towards more vegetable intake was positively related to their interest in animal welfare. The variables response cost of eating more vegetables and biological sex were significant in the Vietnamese sample. We conclude that, for both countries improving consumers' self-efficacy can result in increased vegetable consumption. Campaigns aiming to generate knowledge and improve cooking skills were suggested. The findings contribute to the current literature on sustainable and healthy food consumption.

### 1. Introduction

Low consumption of vegetables can be considered a risk factor for non-communicable diseases and malnutrition [1]. Increasing vegetable intake can result in health benefits such as a lower risk of chronic diseases [2–4] and a lower environmental impact compared to meat [5]. For this reason, understanding consumers' drivers of and barriers to consuming these foods is of great importance.

Verain et al. [4] profiled European consumers regarding their fruit and vegetable consumption and perceptions and found that, in general, all segments perceived vegetables as healthy and natural food. Ha et al. [6] reported that Vietnamese consumers generally worry about

vegetable food safety. According to the authors, food safety concerns and perceptions of risks (such as excess pesticide applications) have led to lower vegetable consumption in that country. Furthermore, more than 88 % of the participants reported avoiding at least one type of vegetable due to food safety concerns. Similarly, in a comparative study between Vietnam and Nigeria, food safety concern was a prominent factor that affected fruit and vegetable consumption in Vietnam [1].

Vietnam is facing a nutrition transition with low vegetable consumption and an increase in both meat consumption and obesity [7]. A similar situation is also observed in Switzerland, where the consumption of fruits and vegetables is lower than recommended and health costs are increasing due to unhealthy lifestyles, including unbalanced diets [8].

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Therefore, the present study aims to offer a valuable contribution to the currently limited literature on the intention to consume more vegetables in these countries. Moreover, there is a lack of cross-cultural studies that also evaluate the influence of cultural background and economic development on the intention to consume more vegetables. The present study also aims to compare these scenarios. Analysing the intention to increase vegetable consumption in different cultural settings will enable the exploration of possible similarities and/or differences in consumers' attitudes, beliefs, levels of trust and traditions.

Despite numerous studies on the nutritional properties of vegetables [9,10], and studies focusing on the health benefits of vegetables [2,3], recent studies on consumer behaviour toward vegetable consumption are scarce [1,4]. Understanding the drivers of consumer food choices allows for better design of interventions for target groups [11,12] and contributes to identifying and implementing effective food system interventions that could lead to healthier and more sustainable diets [13]. A sustainable transformation is urged to enable the growing worldwide population to have access to healthier diets. This study aims to contribute by providing valuable information that can be used by stakeholders and policymakers to set strategies to increase vegetable consumption. Thus, more specifically, the goal of this study was to identify significant predictors of the intention to increase vegetable consumption among consumers in Vietnam and Switzerland. The results of the study can help producers, marketers and retailers as well as policymakers to devise effective strategies to leverage vegetable consumption.

## 2. Materials and methods

### 2.1. Data collection and participants

Data were collected from November to December of 2022. In Switzerland, flyers containing a link to an online survey were sent to randomly selected postal codes in different Swiss cantons, covering both the German- and French-speaking parts.

Data from the Vietnamese participants were collected using the snowball approach, where employees from companies and members of associations located in different urban and semi-urban areas in big cities (Hai Phong, Hanoi and Ho Chi Minh) received a link to the online survey and were asked to share it with their networks. Furthermore, the survey link was shared on social media by the researchers. These methods were chosen with the aim of obtaining a large number of participants in each country. While it is common to receive invitation flyers for surveys by post and fill out questionnaires online in Switzerland, this method was ineffective in Vietnam, due to the unavailability of data on registered households by postcode. All participants provided informed consent before starting the survey. After data cleaning (cases that failed the instructional manipulation check, consistency check or spent less time than the minimum necessary to fill the questions were removed), the final samples were  $n = 643$  for Switzerland and  $n = 616$  for Vietnam.

### 2.2. Questionnaire

The questionnaire comprised questions related to awareness of animal welfare, environmental welfare, preference for local and seasonal food, vegetable safety concerns, response costs of eating more vegetables, self-efficacy of eating more vegetables, perceived vulnerability due to insufficient vegetable intake, hindering familial influence and intention to increase vegetable consumption (Table 1). These variables were selected because they have been proven to be associated with the intention to increase vegetable consumption by previous studies [12,14,15]. Participants were questioned about their socio-demographic variables (i.e., age, education level, income, sex and employment status) at the end of the questionnaire.

**Table 1**  
Scales, items and sources used in the questionnaires.

Scale, reliability and sources	Items queried
<b>1. Animal welfare<sup>a</sup></b> (Cronbach's $\alpha = 0.92$ ; 0.90) [15,16]	... Is produced without animals being in pain ... Is produced with respect for animal rights
<b>2. Environmental welfare<sup>a</sup></b> (Cronbach's $\alpha = 0.95$ ; 0.91) [15,16]	... Is produced in an animal friendly way ... Is produced without disturbing the balance of nature ... Is prepared in an environmentally friendly way ... Is produced in an environmentally friendly way
<b>3. Local and seasonal<sup>a</sup></b> (Cronbach's $\alpha = 0.91$ ; 0.83) [15]	... Is a local/regional product ... Is a seasonal product ... Comes from close by (little transport distance)
<b>4. Vegetable safety concern<sup>b</sup></b> (Cronbach's $\alpha = 0.77$ ; 0.68) Inspired on Ha et al. [14]	Pesticide residues in vegetables Imported vegetables from countries with lower production standards Lack of freshness or poorly stored vegetables (bacterial contamination, mold, mycotoxin formation)
<b>5. Response cost of eating more vegetables<sup>c</sup></b> (Cronbach's $\alpha = 0.63$ ; 0.73) New	By significantly increasing my vegetable consumption, I may experience digestive problems By increasing my vegetable consumption (at the expense of other food groups), my diet would be unbalanced By increasing my vegetable consumption (at the expense of other food groups), I may get cravings
<b>6. Self-efficacy of eating more vegetables<sup>c</sup></b> (Cronbach's $\alpha = 0.81$ ; 0.62) Inspired on Vereecken et al. [17] and Yen et al. [12]	I am confident that I would succeed in eating more vegetables every day even if it is a lot of work to wash, peel, cut and cook them I am confident that I would succeed in eating more vegetables every day even when I am eating out I am confident that I would succeed in eating more vegetables every day even when I don't feel like it
<b>7. Perceived vulnerability of insufficient vegetable intake<sup>c</sup></b> (Cronbach's $\alpha = 0.92$ ; 0.89) Inspired on del Río-Celestino and Font [18] and Wagner et al. [19]	I risk becoming overweight or obese in the next few years if I don't eat more vegetables I am at risk of developing cancer in the next few years if I don't eat more vegetables I risk developing cardiovascular diseases in the next few years if I don't eat more vegetables
<b>8. Hindering familial influence<sup>c</sup></b> (Cronbach's $\alpha = 0.65$ ; 0.67) Inspired from Markoni et al. [20]	Other members of my household like to eat meat and I find it difficult to reduce my meat consumption under these circumstances Other members of my household don't like vegetables and this prevents me from eating more vegetables The specific needs of other members of my household (e.g.: children, sick people) prevent me from adopting new eating habits
<b>9. Intention to increase vegetable consumption<sup>c</sup></b> (Cronbach's $\alpha = 0.96$ ; 0.94) New	I am likely to eat more vegetables in the coming months I plan to increase the amount of vegetables I eat over the next few months I intend to increase the frequency with which I eat vegetables over the next few months

Legend.

The first Cronbach  $\alpha$  coefficient presented (left) reflects the Swiss sample, while the second (right) reflects the Vietnamese sample.

<sup>a</sup> Introductory statement: 'How important is it to you that the food you eat on a typical day ...?'. The scale measurement varied from 1 = 'not at all important' to 6 = 'very important'.

<sup>b</sup> Introductory statement: 'Please indicate the extent to which you are concerned about the following'. The scale measurement varied from 1 = 'not concerned at all' to 6 = 'extremely concerned'.

<sup>c</sup> Introductory statement: 'Please indicate how strongly you agree with the following statements'. The scale measurement varied from 1 = 'strongly disagree' to 6 = 'strongly agree'.

### 2.3. Data analysis

Multiple regression analysis using the backward method [21,22], excluding criteria of  $>0.05$ , was performed using the 'intention to increase vegetable consumption' as a dependent variable. The mean score of each scale (scales 1 to 8 in Table 1) and socio-demographic questions (age, education level, income, sex and employment status) were used as independent variables. The average of the variance inflation factor (VIF) was close to 1, indicating no concerns regarding collinearity [21]. The analyses were performed using IBM SPSS Statistics, version 28.

### 3. Results

The sample of Swiss consumers was composed of 58 % females and 42 % males. Regarding education level, 43 % declared to have completed tertiary education (university), 26 % tertiary professional education, 29 % secondary-level education and only 2 % to have completed mandatory education or 'none'. Regarding employment status, 33 % of participants living in Switzerland declared to be working full-time ( $\geq 90$  %), 32 % part-time and 35 % not working (e.g., students, retirees, unemployed persons). Participants from Switzerland were distributed across four age groups, as follows: 3 % ( $\leq 19$  years), 23 % (20–39 years), 38 % (40–59 years) and 36 % ( $\geq 60$  years).

The valid sample of Vietnam was composed of 59 % females and 41 % males. Of these, 77 % had completed university, 9 % tertiary professional education, 9 % secondary general or professional education and 4 % a lower level of education. Vietnamese residents who participated in the survey were working full-time (70 %), part-time (19 %) or not working (11 %). The age distribution was 2 % ( $\leq 19$  years), 52 % (20–39 years), 40 % (40–59 years) and 6 % ( $\geq 60$  years).

In the Swiss sample, the average score for the intention to increase vegetable consumption was  $3.33 \pm 1.17$ , while it was  $4.58 \pm 0.94$  in the Vietnamese sample. The descriptive statistics of the independent variables, excluding the sociodemographic variables, are presented in Table 2.

The results of the multiple regression analysis indicated four significant predictors for Switzerland and six significant predictors for Vietnam (see Table 3). The models for Switzerland and Vietnam explained

**Table 2**

Descriptive statistics of the independent variables (except sociodemographic).

Independent variables (predictors)	Switzerland (n = 643)		Vietnam (N = 616)	
	Mean	SD	Mean	SD
Environmental welfare <sup>a</sup>	5.09	0.95	5.03	0.82
Animal welfare <sup>a</sup>	5.04	1.01	4.47	1.10
Local and seasonal <sup>a</sup>	4.86	0.90	4.39	1.00
Vegetable safety concern <sup>b</sup>	4.62	1.03	5.19	0.66
Self-efficacy of eating more vegetables <sup>c</sup>	3.91	1.07	4.10	0.95
Perceived vulnerability of insufficient vegetable intake <sup>c</sup>	2.46	1.22	4.06	1.25
Response cost of eating more vegetables <sup>c</sup>	2.34	0.92	3.03	1.13
Hindering familial influence <sup>c</sup>	2.00	0.93	3.18	1.06

Note.

<sup>a</sup> Scale measurement varied from 1 = 'not important at all' to 6 = 'very important'.

<sup>b</sup> Scale measurement varied from 1 = 'not concerned at all' to 6 = 'extremely concerned'.

<sup>c</sup> Scale measurement varied from 1 = 'strongly disagree' to 6 = 'strongly agree'.

**Table 3**

Significant predictors of the intention to increase vegetable consumption in Switzerland ( $R^2 = 0.39$ ) and in Vietnam ( $R^2 = 0.38$ ).

Predictors for	B	SE B	$\beta$	p
<b>Switzerland</b>				
Constant	0.246	0.165		0.135
Self-efficacy of eating more vegetables	0.511	0.036	0.467	<0.001
Perceived vulnerability of insufficient vegetable intake	0.203	0.032	0.216	<0.001
Hindering familial influence	0.231	0.040	0.187	<0.001
Employment status	0.198	0.076	0.082	0.010
<b>Vietnam</b>				
Constant	2.041	0.210		<0.001
Perceived vulnerability of insufficient vegetable intake	0.310	0.027	0.408	<0.001
Self-efficacy of eating more vegetables	0.263	0.035	0.264	<0.001
Response cost of eating more vegetables	-0.116	0.027	-0.138	<0.001
Animal welfare	0.094	0.029	0.110	0.001
Sex	-0.142	0.062	-0.074	0.022
Employment status	0.220	0.097	0.073	0.023

Note: B: Unstandardized coefficient B; SE B: Coefficients standard error;  $\beta$ : Standardized coefficients beta; p: significance; employment status (0: not working, 1: working); sex (0: female; 1: male).

39 % and 38 % of the variance, respectively. 'Self-efficacy of eating more vegetables' and 'perceived vulnerability of insufficient vegetable intake' positively ( $p < 0.001$ ) influenced the intention to increase vegetable consumption in both countries. This means that the higher the perceived confidence in following diets with more vegetables is, the stronger the intention to increase vegetable consumption. Furthermore, the more respondents perceived the health risks of a diet with low vegetable intake, the stronger their intention to consume more vegetables.

'Employment status' was significantly positively related to the intention to increase vegetable consumption in both countries. This means that working participants had a higher intention to consume more vegetables than non-working participants (Table 3).

The variable 'hindering familial influence' was significant for the Swiss sample ( $p < 0.001$ ). This means that, even if the household food environment is not favourable for the adoption of healthier diets (with less meat and more vegetables), this situation did not prevent participants from intending to increase vegetable consumption (Table 3).

The regression model for the Vietnamese sample indicated that the 'response cost of eating more vegetables' was a significant predictor ( $p < 0.001$ ) and was negatively associated with the intention to eat more vegetables. This result means that the less these consumers believe in potential issues caused by vegetable consumption (e.g., digestive problems), the higher their intention to eat more vegetables. Additionally, 'animal welfare' was found to be significant ( $p = 0.001$ ) and positively related to the intention to increase vegetable consumption. This means that the more consumers care about ethical meat production, the stronger their intention to increase vegetable consumption. Furthermore, the significant ( $p = 0.022$ ) influence of the 'sex' variable on the Vietnamese sample indicates that females had a higher intention to consume more vegetables in the future than males (Table 3).

### 4. Discussion

The present research study indicates that the intention to increase vegetable consumption is higher among Vietnamese consumers. These results are interesting from the perspective of stakeholders and policy-makers from Vietnam. Some suggestions to achieve higher vegetable consumption in both countries will be presented at the end of this paper.

The two regression analyses (Table 3) highlighted similarities and differences between the two countries regarding the drivers of and barriers to the intention to increase vegetable consumption. Regarding the similarities, in both countries the self-efficacy of eating more vegetables positively influenced the intention to eat more vegetables. This finding did not come as a surprise, since self-efficacy is related to

respondents' confidence to eat more vegetables even when facing some challenges. In line with the present study, Yen et al. [12] reported self-efficacy to be a driver of vegetable intake.

Perceived vulnerability due to insufficient vegetable consumption was also an important driver of the intention to increase vegetable intake in Switzerland and Vietnam. De Filippo et al. [1] reported that knowledge of health benefits is a determinant that plays an important role in fruit and vegetable consumption among Vietnamese residents (from Hanoi).

The cost of healthier foods such as fruits and vegetables was reported to be a barrier to some consumers [13,23]. However, for people who are employed and therefore might have a higher income, this may not represent as much of an issue as for other groups as they have the means to afford healthier foods. This fact may explain the influence of employment status on the results in both countries, where employed people intend to consume more vegetables in the future.

The first difference between the two samples is related to the variable 'hindering familial influence', which is significant only in the results from Switzerland (see Table 3). This finding indicates that Swiss respondents who live in a family environment where healthy eating habits are unsupported are more likely to increase vegetable intake in the future. This finding is in line with a recent study which indicated that familial barriers, for example, having family members who have unhealthy eating habits such as 'meat lovers', resulted in a higher intention to eat less meat in Switzerland [24].

For the Vietnamese sample, the intention to increase vegetable consumption was significantly influenced by 'response costs of eating more vegetables', 'animal welfare' and 'sex', with females being more inclined to consume more vegetables in the future. This last finding may be related to the fact that in Vietnam, men tend to have a lower level of nutritional knowledge, since they do not purchase food for their households as frequently as women [1]. The effect of the variable of response cost of eating more vegetables on the intention to increase vegetable consumption was expected to be negative, since this variable highlights the negative effects of vegetables on nutrition.

According to Hopwood et al. [25], health, the environment and animal rights can be considered the principal reasons to follow a vegetarian diet. Unsurprisingly, the results of the Vietnamese sample indicate that interest in animal welfare is positively associated with the intention to eat more vegetables. Ethical beliefs and religions such as Buddhism can also be considered factors that influence food consumption and meat reduction in Vietnam [26,27]. These results do not mean that Swiss residents do not care about animal welfare, but that this variable is not able to significantly predict the intention to increase vegetable consumption among Swiss residents. As shown in Table 2, Swiss participants scored high on this variable. One possible explanation for this finding is that, in Vietnam, consumers usually intend to replace meat with vegetables (probably because other options such as meat alternatives are not yet widely available) [20], while in Switzerland, meat replacement can be achieved with a range of alternative proteins, such as meat analogues/substitutes, besides vegetables [20]. Thus, even though Swiss consumers have a high interest in the welfare of animals, they may not intend to eat more vegetables, but may look for other plant-based foods.

Based on the research findings, some measures to increase vegetable consumption can be considered. Yen et al. [12] suggested investing in developing self-efficacy through knowledge and skills. Public policies aimed at improving cooking skills can positively affect vegetable consumption [28]. Campaigns to increase consumers' knowledge of the nutritional benefits of fruits and vegetables are also an important instrument [1]. Educating consumers is vital to improving vegetable consumption, especially the consumption of non-conventional vegetables [29]. School-based promotion programmes may also result in improving vegetable consumption behaviour [30].

Furthermore, based on the interesting finding that the Vietnamese sample has a higher intention to increase vegetable consumption ( $4.58 \pm 0.94$ ) and that the highest average score ( $5.19 \pm 0.66$ ) was obtained

for the construct 'vegetable safety concern' (see Table 2), even if this variable was not significant in the regression model (see Table 3), other strategies may also result in higher vegetable consumption.

The first suggestion would be to provide more vegetable options that address food safety concerns to Vietnamese consumers. Previous research highlighted reservations due to perceptions of food safety risks [6,31]. Investing in organic production and strict control of the pesticides used in vegetable production can lead to an increase in vegetable consumption in Vietnam. Yin et al. [32] reported that the reputation of vegetables' origin significantly impacts consumers' purchase intention. Investing in homegrown vegetables may be another suggestion to improve trust in vegetables and allow an increase in intake levels among consumers [1,6], resulting in a more sustainable and healthier diet. According to De Simone et al. [33], locally produced vegetables can also result in less environmental impact related to transportation.

The present research study did suffer from some limitations. First, two recruitment methods were used to administer the survey in the two countries. Furthermore, the sample evaluated cannot be considered representative of the Swiss or Vietnamese populations in some aspects such as education level. Future research should address these limitations by applying the same recruiting method when aiming at studies comparing two countries and by selecting a sample representing the countries regarding the most important sociodemographics such as sex, education, income and age groups. Furthermore, experimental studies could investigate how to nudge consumers into a higher vegetable consumption.

## 5. Conclusions

The present study revealed that the variables influencing consumers' intention to increase vegetable consumption include demographic characteristics as well as perceptions and attitudes towards health and the environment. Four significant drivers were identified in the Swiss sample, while six significant predictors were revealed in the Vietnamese sample, confirming the heterogeneity between the two cultures. For both countries, the variable self-efficacy of eating more vegetables was a strong predictor of the intention to increase vegetable consumption, highlighting the need for campaigns to improve consumers' self-efficacy. Furthermore, people who perceive the health risks of insufficient vegetable consumption are more open to increased vegetable consumption. This finding suggests the need to improve consumers' knowledge and skills to cook sustainable diets. Campaigns aiming at educating consumers on the benefits of vegetable intake were proposed. The findings can serve as a valuable reference to design appropriate solutions for promoting a healthier diet in Vietnam and Switzerland.

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## CRedit authorship contribution statement

**Beatrice Giacomuzzo:** Writing – original draft, Validation, Investigation, Formal analysis, Data curation. **Minh Hai Ngo:** Writing – review & editing, Visualization, Funding acquisition, Conceptualization. **Thanh Mai Ha:** Writing – review & editing, Visualization, Funding acquisition, Conceptualization. **Evelyn Markoni:** Writing – review & editing, Visualization, Funding acquisition, Conceptualization. **Mathilde Delley:** Writing – review & editing, Funding acquisition, Conceptualization.



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### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Data availability

Data and questionnaire can be found at: <https://doi.org/10.34914/olos:wj6kwqm6pzfu7cwxgapmrhb43m>.

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