



Plant-based dietary patterns in Flemish adults: a 10-year trend analysis

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Abstract

Purpose Although the beneficial health effects of plant-based dietary patterns are evident, it is not clear if population-wide dietary patterns are shifting in a more plant-based direction. This study evaluated trends in dietary patterns among Flemish adults over a 10-year period. Furthermore, differences in socio-demographic characteristics between different dietary pattern groups were explored.

Methods A time series design, during which five different representative cohorts (2011, 2013, 2016, 2018 and 2020; N = 4859) were surveyed through an online questionnaire, was used to evaluate trends in dietary patterns over the past decade.

Results Findings show that the vast majority of participants were omnivorous as measured at the different time points. The proportion of flexitarians increased over time, while the opposite was true for omnivores. The proportion of vegetarians and vegans, on the other hand, remained stable. Eating more plant-based diet was associated with female sex, younger age, higher education and living in urban areas.

Conclusions In contrast to the stricter plant-based dietary patterns, a modest shift from the omnivorous towards the flexitarian dietary pattern was observed over the past decennium in the Flemish adult population. Campaigns might benefit from targeting older and lower educated male living in rural areas.

Keywords Plant-based · Dietary pattern · Trend · Adults · Belgium

Introduction

Plant-based dietary patterns are known to improve, or at least maintain human health and are therefore being increasingly integrated in dietary guidelines [1–3]. Willett and colleagues characterize the healthy reference diet as largely consisting of vegetables, fruits, whole grains, legumes, nuts, and unsaturated oils, including a low to moderate amount of seafood and poultry, and including no or a low quantity of red meat, processed meat, added sugar, refined grains, and starchy vegetables [1]. Healthy dietary patterns consisting of a diversity of plant-based foods are likely to meet the

nutritional requirements and reduce the incidence of non-communicable diseases and overall mortality [1]. In fact, shifting our dietary pattern towards more plant-based may even be a key element in the battle against climate change [1, 4]. The above underpins the importance of shifting from a more animal source dietary pattern towards the consumption of more plant-based foods. In Belgium, like in many other Western high-income countries, there is a long-lasting tradition of consuming considerable amounts of animal source food products. Although many campaigns have been launched in the last decade, aimed at increasing awareness and changing attitudes towards plant-based dietary patterns, it is not clear if dietary patterns are indeed shifting in a more plant-based direction. Therefore, this study evaluated

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trends in dietary patterns among Flemish adults over the past decennium. Furthermore, to inform future campaigns with more detailed insights, differences in socio-demographic characteristics between different dietary pattern groups were explored.

Methods

Design and participants

A time series design was used to investigate trends in dietary patterns in Flemish adults. A cross-sectional online survey was conducted among five different representative cohorts (2011, 2013, 2016, 2018 and 2020) consisting of men and women aged 18 years or older. Respondents were selected from a representative consumer panel of the market research company iVOX (<http://ivoxpanel.be>), including more than 110,000 Belgians who are available to participate in surveys. On each test occasion, a Flemish subsample of this panel was invited in the present surveys. The panel members that were invited to participate in this survey were selected via a multiple stage sampling procedure that aimed at representativeness for the general Flemish population regarding sex, age, educational level and urbanization level. Two reminder emails were sent to the selected panel members. This study was conducted in accordance with the Helsinki Declaration and its later amendments. Written informed consent was obtained by iVOX from all panel members at registration. More detailed information can be found elsewhere [5].

Procedure and questionnaire

The online questionnaire was developed by the non-profit organization Ethical Vegetarian Alternative (EVA). The questionnaire focused on vegetarianism and veganism and consisted of a wide range of questions concerning dietary pattern, enablers and barriers of vegetarianism/veganism, beliefs and attitudes towards vegetarianism/veganism, vegetarianism/veganism among the social environment, consumption of specific food products, knowledge on and participation in vegetarian/vegan campaigns and initiatives, and socio-demographics, such as sex, age, education and geographical distribution. The number and sort of questions evolved across the time points. This means that, over the years, some questions were added, deleted or updated in order to be topical and anticipate on particular trends (e.g. the rise in production and consumption of vegan food products). For the purpose of the present study, dietary pattern was used as the primary outcome measure and socio-demographics were used to describe the sample. At each time point (2011, 2013, 2016, 2018 and 2020), the different cohorts were asked to self-report their own dietary pattern

by selecting one of the following categories: (1) vegan (eating no animal products, such as meat, fish, cheese, dairy or eggs), (2) almost vegan (eating no meat or fish and eating dairy or eggs for maximally 2 days per month—only questioned in 2018 and 2020), (3) vegetarian (eating no meat or fish), (4) almost vegetarian (eating meat or fish for maximally 2 days per month), (5) flexitarian/part-time vegetarian (eating no meat or fish for minimally 3 days per week), (6) 1 day per week veggie (eating no meat or fish for 1 day per week—only questioned in 2020), (7) pesco-vegetarian (eating no meat but eating fish), or (8) omnivore (eating meat or fish almost every day).

Statistical analysis

Descriptive statistics were calculated using SPSS version 27. Two proportions z tests were performed in R version 4.0.2. to evaluate trends in dietary patterns over time. The statistical analysis was performed only when 2011 (baseline) values were available. Consequently, dietary patterns that were added to the questionnaire later on, such as “almost vegan” (added in 2018) and “veggie for 1 day per week” (added in 2020), were not included in the statistical analysis. Bonferroni corrections were applied to correct for multiple testing, so p values < 0.002 were considered as statistically significant. Furthermore, χ^2 tests were performed in SPSS version 27 to assess differences in socio-demographic characteristics between different dietary pattern groups. As prevalence rates of the stricter plant-based dietary patterns (i.e. vegan, almost vegan, vegetarian, almost vegetarian and pesco-vegetarian) were small, these were grouped together into a vegan/vegetarian group and compared to flexitarians, veggie for 1 day per week and omnivores. Here, p values < 0.05 were considered as statistically significant.

Results

In total, 4859 participants were surveyed. Across time points, around 50% were female, the majority was 35 years or older, around one third was higher educated and a modest majority came from rural surroundings. The response rates ranged from 30 to 34% and the average time needed to complete the questionnaire was between 14 and 28 min, depending on the time point. More detailed sample characteristics can be found in Table 1.

Trends in Flemish dietary patterns are shown in Table 2. Across the 10-year time period, the vast majority of Flemish participants were omnivorous and only a very small proportion reported to be vegetarian or vegan. Compared to baseline, the relative number of Flemish flexitarians increased from 5.3 to 10.0% (~88.7% increase) in 2016 and from 5.3 to 9.2% (~73.6% increase) in 2020, whereas the relative

Table 1 Characteristics of the different Flemish samples across the 10-year measurement period

Cohort	2011 <i>n</i> = 1132	2013 <i>n</i> = 993	2016 <i>n</i> = 996	2018 <i>n</i> = 580	2020 <i>n</i> = 1158
Sex (% females)	49.8	49.9	50.1	50.1	50.1
Age group (%)					
18–34 years	25.3	25.9	29.6	27.6	27.2
35–54 years	44.2	41.3	39.1	37.4	36.5
55+ years	30.5	32.8	31.4	35.0	36.4
Education (%)					
No higher education	66.2	65.8	65.2	65.5	65.4
Higher education (college or university)	33.8	34.2	34.8	34.5	34.6
Geographical distribution (%)					
Urban	41.2	45.2	43.8	42.0	44.4
Rural	58.8	54.8	56.2	58.0	55.6

Table 2 Trends in Flemish dietary patterns

Cohort	2011 <i>n</i> = 1132	2013 <i>n</i> = 993	2016 <i>n</i> = 996	2018 <i>n</i> = 580	2020 <i>n</i> = 1158
Vegan (I never eat animal products, such as meat, fish, cheese, dairy or eggs) (%)	0.3	0.2	0.3	0.0	0.3
Almost vegan (I never eat meat or fish and I eat dairy or eggs for maximally 2 days per month) (%)	–	–	–	0.4	1.0
Vegetarian (I never eat meat or fish) (%)	1.2	1.1	1.3	0.9	1.4
Almost vegetarian (I eat meat or fish for maximally 2 days per month) (%)	2.6	1.7	2.2	1.6	2.1
Flexitarian/part-time vegetarian (I eat no meat or fish for minimally 3 days per week) (%)	5.3	5.3	10.0*	7.6	9.2*
Veggie for 1 day per week (I eat no meat or fish for 1 day per week) (%)	–	–	–	–	12.1
Pesco-vegetarian (I eat no meat but I do eat fish) (%)	1.6	1.0	1.6	1.8	1.3
Omnivore (I eat meat or fish almost every day) (%)	89.0	90.6	84.6*	87.6	72.7*

Significance testing was performed only when 2011 (baseline) values were available

*Significantly different compared to baseline ($p < 0.002$)

number of Flemish omnivores decreased from 89.0 to 84.6% (~4.9% decrease) in 2016 and from 89.0 to 72.7% (~18.3% decrease) in 2020. No significant differences over time were found for vegan, vegetarian, almost vegetarian and pesco-vegetarian patterns in Flemish adults.

The vegan/vegetarian group differed from the omnivorous group in sex (67.1 vs. 47.0% of females), age (42.9 vs. 23.9% of 18–34-year olds), education (44.3 vs. 30.0% reporting higher education) and geographical distribution (54.3 vs. 42.0% living in urban areas). More details concerning socio-demographic differences between the dietary pattern groups as measured in 2020, are presented in Table 3.

Discussion

The vast majority reported to be omnivorous, which is consistent with other research [6–8]. No trends were observed for the stricter plant-based dietary patterns, including vegan, vegetarian and almost vegetarian. Except for the almost

vegetarian pattern, this is not consistent with positive (but small) trends observed in vegetarianism among a Swiss population [6]. Unfortunately, no comparisons could be made with other populations as the latter seems to be the only similar and recent study evaluating trends in comparable dietary patterns over time.

The relative number of the more intermediate plant-based pattern, namely the flexitarian dietary pattern (i.e., no meat and fish for minimally 3 days per week), nearly doubled in 2016, while the share of omnivores decreased proportionately. The latter suggests that part of the Flemish omnivores have shifted to the flexitarian dietary pattern since 2013. A shift towards this more ‘prudent’ plant-based dietary pattern can be seen as a positive trend as such patterns, which allow moderate animal source food intake, may equally improve people’s health status compared to vegetarian dietary patterns [3]. It should be noted that, despite the increase, the share of flexitarians remains relatively low (nearly 10%) and plateaued after 2016. The observed increase might be the result of several campaigns

Table 3 Socio-demographic differences between the dietary pattern groups as measured in 2020 (with vegan, almost vegan, vegetarian, almost vegetarian and pesco-vegetarian grouped together into a vegan/vegetarian group)

Dietary pattern	Vegan/Vegetarian (6.1%)	Flexitarian (9.2%)	Veggie for 1 day per week (12.1%)	Omnivore (72.7%)	χ^2
<i>n</i> = 1158					
Sex (%)					16.743**
Male	32.9	38.7	48.6	53.0	
Female	67.1	61.3	51.4	47.0	
Age group (%)					23.400**
18–34 years	42.9	32.1	35.3	23.9	
35–54 years	37.1	36.8	33.8	36.8	
55+ years	20.0	31.1	30.9	39.3	
Education (%)					27.845**
No higher education	55.7	51.9	53.6	70.0	
Higher education (college or university)	44.3	48.1	46.4	30.0	
Geographical distribution (%)					10.114*
Urban	54.3	55.7	44.6	42.0	
Rural	45.7	44.3	55.4	58.0	

p* < 0.05, *p* ≤ 0.001

that have been launched in Flanders during the last decennium, such as “Thursday Veggie Day”, “Days Without Meat”, “Try Vegan”. For example, “Thursday Veggie Day”, which is the equivalent of “Meatless Monday” [9] in the US, has made Flemish cities like Ghent (among others) invest in more plant-based school meals, while encouraging restaurants and supermarkets to improve availability and accessibility of plant-based foods. It is not clear, however, why the observed peak occurred in 2016, as some of these campaigns have been initiated even prior to the start of our measurements in 2011. A possible explanation is the fact that these campaigns received more (media) attention and visibility from 2013 onwards. The observed plateau effect may suggest that these campaigns mostly triggered the more receptive and open-minded people. Once these ‘early adopters’ have been reached, it may be hard to convince those who are less receptive and are more hesitant and less willing to change their eating pattern. This highlights the importance of designing easy accessible campaigns for the general public, and more specifically tailored to those being less open-minded on the topic.

In 2020, the relative number of omnivores decreased to an even greater extent, but this may be due to the fact that people had been given the ‘new’ answering possibility “veggie for 1 day per week”. It seems likely that during the prior test occasions, people eating veggie for 1 day per week categorized themselves as omnivores as they did not fulfill the criteria for being a flexitarian. The decreasing trend of people eating meat on a daily basis without further shifting towards stricter plant-based dietary patterns may be explained by the fact that the step towards vegetarianism or

veganism is quite large, where people may be more likely to adapt their eating pattern in a more gradual way. Hence, future campaigns tailored towards more prudent plant-based dietary patterns might be more successful than campaigns focusing on vegetarianism or veganism.

Finally, the more strict the plant-based dietary pattern, the higher the proportion of females, younger people (18–34 years) and people reporting higher education. Vegan/vegetarians and flexitarians lived more in urban areas, whereas the veggies for 1 day per week and omnivores lived more in rural areas. The observed association between stricter plant-based dietary patterns, such as veganism and vegetarianism, with female sex, younger age and higher education, is consistent with previous research [6, 7]. Our results suggest that future campaigns might benefit from targeting older and lower educated males living in rural areas.

An important strength of this study is that we used a representative sample of the Flemish population, ensuring external validity. Due to cultural differences between Belgian regions (i.e. Flanders, Brussels and Wallonia), however, our findings may not be generalized to the entire Belgian population. In fact, Brussels and Wallonia specific data (which were only collected in 2018 and 2020 and therefore not included in the present study) suggest slightly higher proportions of plant-based dietary patterns compared to Flanders. Due to variability in prevalence of vegetarianism and veganism as well as in macro- and micronutrient intakes, the same caution should be in place when comparing with other European countries [7, 8, 10]. Another limitation of this study may be the use of self-reports, which may introduce bias. If present, we do not expect this to have

influenced our findings, as these potential bias(es) may be expected to be systematic and therefore equally present across time points.

Conclusion

In contrast to the stricter plant-based alternatives, a modest shift from the omnivorous towards the flexitarian dietary pattern was observed over the past decade in the Flemish adult population. Eating more plant-based was associated with female sex, younger age, higher education and living in urban areas. In light of public health and environmental sustainability, efforts are urged to further shift population-wide dietary patterns towards more plant-based.

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Availability of data and material The data are available upon reasonable request with the corresponding author.

Code availability Not applicable.

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

Ethics approval This study was conducted in accordance with the Helsinki Declaration and its later amendments. Ethics approval has not been sought, as this study reports on data that were collected by the market research company iVOX (secondary data analysis). The manuscript does not contain clinical studies or patient data.

Consent to participate All participants gave their written informed consent prior to their inclusion in the study.

Consent for publication Not applicable.

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