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# Consumers' perception of plant-based alternatives and changes over time. A linguistic analysis across three countries and ten years

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ABSTRACT

Aiming to minimise environmental impacts, diets with reduced consumption of animal products have increased strongly in recent years. These changes give rise to innovative developments in the plant-based market. In this study, we aimed to investigate these changes by looking at the linguistic discourse on plant-based alternatives in three countries. We chose the USA as the country with the highest meat consumption and India as the country with the highest percentage of vegetarians. For both countries, we analysed linguistic data from the most read English newspapers over the last two years. As a third country, we chose Switzerland, where a lot of plant-based innovation is currently happening. Additionally, we performed a longitudinal analysis on Swiss data from the last ten years to more closely examine this recent period of plant-based innovation. With that, we focused on consumer perception of plant-based products by analysing the linguistic discourse and thereby contrast the available data from the literature that was mainly obtained through interrogation of consumers. Cross-cultural comparison reveales that in all three countries, there is a distinct focus on meat (alternatives). Dairy alternatives seem to play a minor role in the discourse. In the USA, appearances matter (food stylist), the Indian discourse includes the aspects health ("skin", "hair") and wealth (prices) and the Swiss discourse includes sustainability. Longitudinal analysis of the Swiss discourse over the last ten years revealed that there was an overall increase of the discourse and a connection to the ongoing political debate. Our study suggests that plant-based products are not only part of the sustainable transition but can also be a lifestyle choice. Overall, the study highlights cross-cultural differences and similarities in the language used about plant-based alternatives and discusses some implications.

## 1. Introduction

Food produces around 20–30 % to the total environmental impact caused by humans (Tukker & Jansen, 2006). The production of animal products (i.e., meat and dairy) significantly contributes to the emission of greenhouse gases and biodiversity loss and animal suffering (FAO, 2006; Poore & Nemecek, 2018; Willett et al., 2019). As a result of these challenges and aiming to reduce the environmental impact of our diet, consumers have grown more aware of various sustainability issues including environmental protection or animal welfare. One result of this grown awareness is that our current levels of meat consumption have been questioned and that vegetarian and vegan (veg*an[1]) diets have increased significantly in recent years (Ploll et al., 2020; Ruby, 2012).

### 1.1. Meat consumption

The consumption of meat has evolved together with human nature over a long period of time and is part of our food tradition (Leroy & Praet, 2015). From a biological perspective, meat contains important nutrients for the human diet such as protein, minerals and vitamins. Today, meat consumption is relatively high and the amounts consumed are still expected to grow (OECD, 2021a). However, consumption levels significantly differ across countries and cultures. In the USA, it is relatively high with around 100 kg meat (sheep, pork, beef, and poultry) per capita and year (OECD, 2021a). In Switzerland, it is lower with around 50 kg per capita and year and in India, average meat consumption is 4.4 kg meat per capita and year (OECD, 2021a).

Current levels of meat consumption, however, come with some

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[1] Veg*an summarises both vegan and vegetarian lifestyles, which aim to reduce the consumption of animal products.

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major challenges. In terms of health, some types of meat (i.e., processed meat or unprocessed red meat) have been found related to increased risk of non-communicable diseases such as cardiovascular disease, colorectal cancer or type-2 diabetes (Abete et al., 2014; Chan et al., 2011; Micha et al., 2012). A recent study from Finland reported that partial substitution of red or processed meat with plant-based alternatives reduces the risk of type-2 diabetes (Maukonen et al., 2023). Matching meat consumption with dietary guidelines to reduce these health risks at the same time reduces greenhouse gas emissions from meat production and thereby benefits the environment (Hallström et al., 2014). Another reason not to eat meat are ethical concerns or animal welfare aspects (Marcus et al., 2022; Rothgerber, 2015).

### 1.2. Meat alternatives

According to a recent review, there are four categories of meat alternatives: 1) conventional plant-based proteins, 2) meat analogues, 3) cultured meat and 4) insects (Siegrist & Hartmann, 2023). The easiest way to substitute meat without major changes in habits is the substitution with meat analogues. Various forecasts predict that meat alternatives will continue to grow. It has been projected that meat alternatives could make up around 10 % of the global meat industry by 2029 (Barclays, 2019) and that consumption of conventional meat will drop to 40 % by 2040 (Warschun et al., 2020).

A study conducted in Switzerland showed that meat alternatives are not exclusively consumed as a substitute for meat but can also be a complementary component in people's diet (Gotze & Brunner, 2021). Indeed, it was suggested that individuals' choice of eating meat can be rationalised with the 4Ns, that is, natural, normal, necessary, and nice (Piazza et al., 2015). Other research finds that people, depending on how committed they are to meat eating, strategically avoid evidence regarding the quality of animals' minds, which is based on the widespread belief that the treatment of animals should depend on the quality of their minds (Leach et al., 2022). Similarly, committed meat eaters were found less likely to believe that livestock farming contributes to climate change (Malek et al., 2019).

While flexitarians (i.e., individuals who follow a primarily vegetarian diet but occasionally eat meat or fish (Oxford Dictionaries) generally have more positive attitudes towards plant-based products as compared to omnivores, they still put a lot of importance on taste (Spendrup & Hovmalm, 2022). Indeed, taste seems to be a major barrier for acceptance of meat alternatives (van den Berg et al., 2022), and consumers still tend to prefer meat (Cordelle et al., 2022).

### 1.3. Veg*an diets and its drivers

Vegetarianism is the practice of abstaining from eating meat (see Ruby, 2012 for a review), whereas veganism is the practice of abstaining from consuming any foods that are derived from animals and avoiding the use of other animal products (Oxford Dictionaries). Dietary patterns vary significantly across countries and cultures. For instance, the share of vegetarians in India is comparably high with around 25 % and in the US it is around 5 % (Statista, 2021). Similar numbers were found for Switzerland, where a national survey conducted in 2022 found that 5 % of the population followed a veg*an diet (swissveg, 2022). A Finnish study provides evidence that veg*anism might be in part heritable (Çınar et al., 2022), which has implications for the future development of veg*anism.

There are various drivers for reducing animal products in the diet. In terms of environmental impact, animal-based products tend to have a bigger ecological footprint than plant-based products (Errickson et al., 2021). Besides the sustainability aspect, health and costs are further important drivers for consumers not to eat meat or to choose plant-based alternatives (Grasso et al., 2021; Neff et al., 2018). Some studies even find that health, price or taste can be more important than sustainability (Ammann, Arbenz, et al., 2023; Rolfe et al., 2023).

### 1.4. Current study

The current literature on alternative proteins primarily focuses on sustainability and environmental impact (Green et al., 2022), whereas consumer acceptance seems to be a minor focus (Siegrist & Hartmann, 2023). Following up on the consumer side and given the fast developments in the plant-based markets, we aimed to investigate the discourse, that is, the actual language use, on plant-based alternatives, as it provides a different view on these developments. Instead of asking consumers, we chose this alternative approach and analyse the media discourse, which ultimately influences and potentially reflects consumer perception.

In the first part of this study, we looked at three countries to allow for cross-country comparisons. For this, we chose the country with the highest meat consumption (i.e., the USA) and the country with the highest percentage of veg*ans (i.e., India) (Statista, 2020), where linguistic data from the most read English newspaper was analysed. As the third country, we chose Switzerland, a European country where a lot of veg*an innovation is happening at the moment. On the one hand, Switzerland is home to some of the world's largest food companies, which drive innovation in the food industry. On the other hand, Switzerland is one of the few countries in Europe where plant-based alternatives were introduced and distributed in large-scale distributors at an early stage (e.g. Quorn, Marlow Foods Ltd.) and where innovation is still flourishing (e.g. Planted Foods AG). By studying these three countries and comparing them with each other, we aim to find out, what has shaped the discourse of each country over the last 2 years and what differences exist between the three countries.

In Switzerland, market demand for meat alternatives has strongly increased in recent years (Hermann & Bolliger, 2021). Following up on these developments, in a second part, our study provides a longitudinal analysis based on linguistic approach on plant-based products using Swiss data from the last 10 years to put a closer look at this innovation period. Linguistic investigations contribute to a better understanding of how language and public discourse might influence consumer perceptions.

With that, the objective of our study is threefold. First, we study the linguistic discourse on plant-based in three countries, identifying the most important keywords, to see what shaped the discourse in the last 2 years (objective 1). Discourse analysis allows to study social life and to investigate meaning (Potter & Wetherell, 1987; Traynor, 2006). Second, dive a bit deeper and put the focus on the most important food products mentioned in the discourse to see which specific products play a major role (objective 2). Third and finally, we take a closer look on Switzerland and perform a longitudinal analysis of the linguistic discourse on plant-based in the last 10 years to analyse the developments with a focus on temporal changes (objective 3).

## 2. Materials and methods

### 2.1. Discourse analysis in linguistics

In linguistics, utterances on topics that are frequently and intensively discussed in public are examined using discourse linguistic methods. Following the understanding of Michel Foucault, a "discourse" is understood as a collection of all – or a very large number of – utterances on a topic (cf. Baker, 2006, McEnery & Hardie, 2011). In linguistics, this collection of utterances can be systematically examined for various aspects with the help of qualitative and quantitative statistical methods (cf. Baker, 2006, Bubenhofer, 2008). The aim of linguistic discourse analysis is to examine actual language use with the help of quantitative approaches in order to make statements about which words and language patterns (e.g. in argumentations) are used to talk about important topics. Ideally, it would be possible to collect all or at least a very large number of utterances on a topic. However, due to feasibility, discourse studies are normally limited to the analysis of written utterances, which

are usually published (e.g. media or websites of different discourse actors).

The collection of these utterances is called a "corpus"(McEnery & Hardie, 2011). In order to be able to analyse the language data with (corpus) linguistic methods, the data are enhanced with further information. For example, the text itself can be enriched with metadata, such as source or information on the publication date. Further linguistic information, so-called "annotations", can also be added to the words of a text, e.g. part of speech tags. When analysing a discourse, both metadata and annotations are used to show exactly how language is used.

A particularly important way to examine important concepts and sub-topics within a discourse is to calculate keywords (cf. Baker, 2006, Bubenhofer, 2008). Keyword calculation is a quantitative approach that can also be applied to large amounts of text. Keywords in this context are words that occur significantly more often in the examined text corpus than in a corpus with which one compares the examined corpus. If, for example, one wants to examine the media discourse on plant-based alternatives to meat, it makes sense that the comparison corpus or reference corpus also contains media text types but is thematically non-specific. In this way, the keywords do not provide information about the frequency of the words, but about their statistical significance, which is usually given in the form of a log-likelihood ratio (LLR). Based on the LLR values, the visualisations of terms in form of word clouds were generated. All LLR values above a value of 3.84 are statistically significant at a 5 % significance level. All our results are well above this value.

The advantage of a linguistic discourse study which analyses the data available in a corpus is that the actual topics of the respective discourse can be determined from this data material. In the present example, the discourse was only limited by the use of the search terms, the subsequent analysis consists of statistical evaluations (e.g. keywords) of the available data material, which is a so-called "corpus driven" approach (Biber, 2012). This distinguishes the corpus-driven approach from other methods, which also evaluate language data, but only test existing hypotheses (e.g. there is more discussion about vegetarian than vegan food in the media data found).

For this study, keywords were calculated in comparison to a non-topic-specific media corpus. For the USA and India corpus, the English-language media corpus of the Leipzig Corpus Collection was used, for the Swiss corpus (German-Language) the media corpus of Swiss-AL (ZHAW Zürcher Hochschule für angewandte Wissenschaften, 2023).

### 2.2. Corpora and data analysis

For the present study on the media discourse on plant-based foods, we created three corpora - one for each country studied (i.e. India, USA, Switzerland). For India and the USA, we searched the 10 most read daily newspapers (cf. Appendix 1 and 2) over a period of 2 years (November 2020 to November 2022) for the terms "plant-based", "vegan" and "vegetarian". These terms were chosen so that the texts in which they are used are most likely to be about veg*an food or plant-based alternatives to meat. No further restrictions such as explicit mention of the word "food" were chosen as this would have limited the data set. For instance, while it is likely that a text using the term "vegan" also addresses vegan food (or other vegan products), the word "food" does not have to be used explicitly. In the Swiss corpus, the phrase "pflanzliche Alternative" was used as a search term in addition to "vegan", "vegetarian" and "plant-based", since both the English term "plant-based" and the German equivalent "pflanzlich" are commonly used in Switzerland.

Depending on the further analysis options, the USA and India corpus were analysed without further processing. In the Swiss text corpus, the

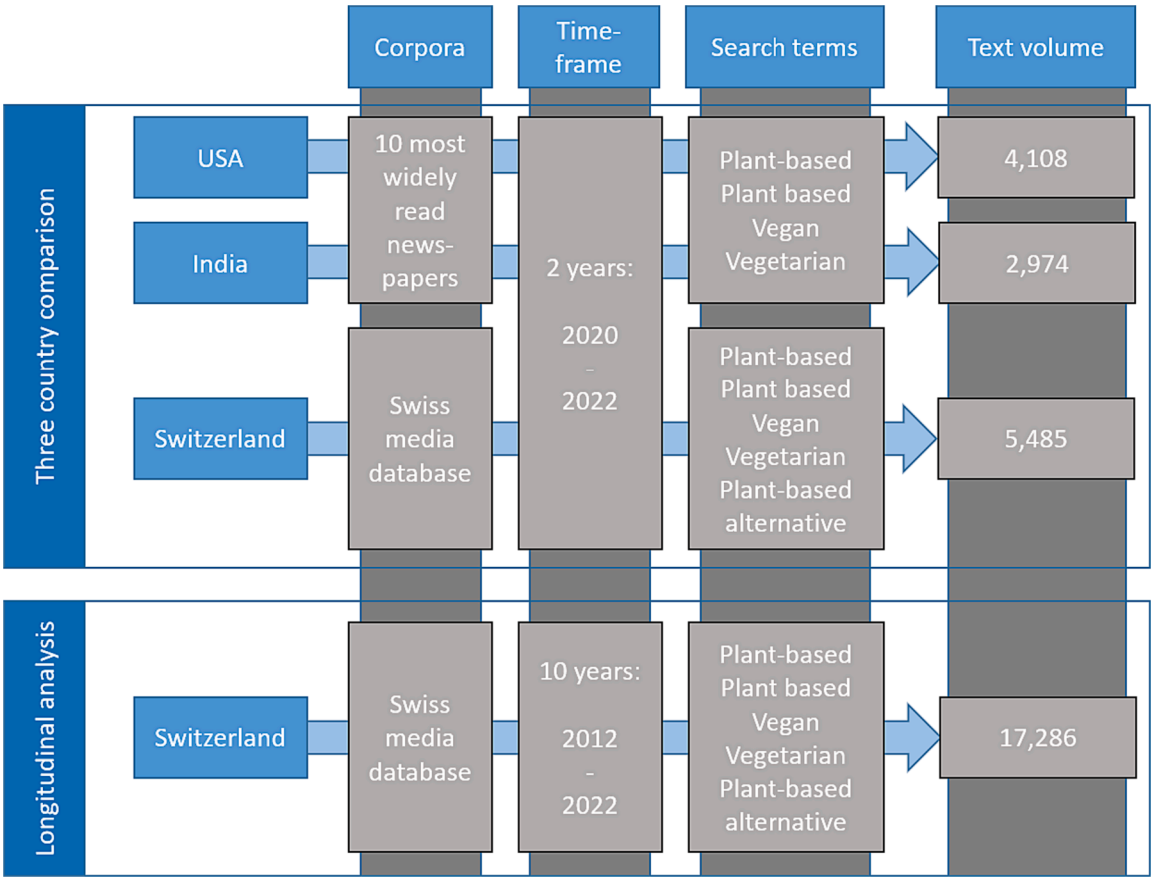


**Fig. 1.** Schematic overview of the procedure used for data collection and analysis.

results of the queries were enriched with part-of-speech tags and metadata (publication date, newspaper, etc.). The USA corpus consists of a total of 4,108 texts, the India corpus of 2,974 texts and the Swiss corpus of 5, 485 texts. The procedure is visualised in Fig. 1.

Additionally, we investigated specifically for Switzerland how the discourse has changed over a period of 10 years, to see since when plant-based alternatives have been thematised and how. For the Swiss corpus, we queried the Swiss media database, extending the study period to a total of 10 years (November 2012 to November 2022). The result of this query on all media read in Switzerland was a total of over 36,000 texts, which were reduced to 17,286 texts by removal of duplicates. The text volume for the years 2020 to 2022 amounts to 5,485 texts.

The English texts were further analysed with the corpus analysis tool AntConc (version 3.5.9.). With the possibilities implemented in AntConc, the keywords were calculated. Furthermore, the typical contexts of chosen keywords could be evaluated by calculating "collocations" (frequently used multi-word units). In the case of unusual keywords, the corresponding contexts in the texts could be searched for.

However, the functions in AntConc do not allow lemmatisation, that is, merging of different word forms to one basic form (e.g. singular and plural forms of a word). Therefore, in the results presented in the next chapter, different word forms of the same word will appear (i.e. the word forms "recipe" and "recipes" are listed both). The exclamation mark is also calculated as a linguistic token as overrepresented in the corpus and is therefore also included in the data shown. The following example shows that the exclamation mark can be a signal of positive surprise in relation to vegetarian food: "From the hot plate to the attractive presentation, everything was more than solid, a really nice veggie dish!"

The Swiss-AL corpus was used for the German-language texts. For the analyses of this corpus, the corpus analysis platform Corpus Workbench with the query tool CQPweb (version 3.2.43) was used. This corpus could be tagged and lemmatised according to the possibilities of the software, which allows a much more precise analysis.

## 3. Results and discussion

The results and discussion section is organised in two parts. Part 1 deals with the comparison of three countries addressing the study objectives 1 and 2. Part 2 then focuses on the longitudinal analysis of the Swiss data, dealing with study objective 3. Words in inverted commas are examples from the results (e.g. keywords). The keywords are visualised by word clouds, with the size of the words based on the LLR value (see Tables B1–B3). The larger the word is in a word cloud, the more significant its use is in the corpus. This is based on the principles of the data-driven approach, in which the available data are statistically analysed without any further specifications in order to examine the language use typical of the discourse.

### 3.1. Part 1: Keywords across three corpora

For all three corpora (India, USA and Switzerland), keywords were first calculated that result in the most frequently used words per corpus (see Fig. 2, Tables B1–B3 in the appendix). In the USA, the country with the highest meat consumption per capita worldwide, we find that the media discourse mainly deals with the preparation or eating of (meatless) dishes ("recipe", "cooking", "restaurant"). Keywords dealing with specific food items frequently refer to foods required for these recipes (i.e., "meat", "chicken", "sauce", "cheese", "salad"). Given the sustained demand of meat in the country, this is not surprising (Hocquette, 2023). The keyword "stylist" refers to a "food stylist", which makes it clear that a focus here is appearance of the (vegan) food.

The discourse in India, a country where most veg*ans live worldwide, looks substantially different. As in the USA, it also includes "meat" (substitutes) and "recipes", but in addition, it further includes "skin" (referring to skin care and "hair"), "lifestyle", "proteins" and "prices" (rs = rupees). With that, the focus of the discourse in this country is shifted more towards basic needs including health and wealth. In terms of wealth, affordable prices have been identified as an important driver of meat consumption (Liu et al., 2023). In terms of health, looking more closely at the data about skin and hair, the focus especially on skin care is strongly linked to vegan products. Health is a theme that comes up in both vegan and anti-vegan communities. On the one hand, there are health benefits of following a vegan diet, on the other hand, anti-vegan communities focus on negative health effects, such as missing nutrients (Gregson et al., 2022). Still, the discourse on vegan products clearly has expanded from food to cosmetics and the number of products on the market labelled as vegan is increasing (Urban et al., 2022). So, besides the recipe focus, we here find a discourse that also covers a veg*an lifestyle (including food and cosmetics). This might be due to the fact that the veg*an diet is strongly rooted in the Indian cuisine, therefore shifting the discourse from meals towards health.

For the discourse in Switzerland, as a country where the proportion of veg*ans has doubled since 2015 (swissveg, 2022), we find that besides the expected keywords such as "meat", "restaurant" and "products", the topics of "sustainability" and "health" play a central role. Additionally, we find prices and personal pronouns (me, we) to be important in this discourse. The pronouns often appear in contexts where it is about the food offered (e.g. in restaurants: "When we go to restaurants, we order fish or vegetarian.") or about personal experiences with veg*an food ("Nowadays, I eat vegan and feel great about it."). Overall, our findings are well-aligned with the literature, where various drivers for reducing animal products or meat specifically have been identified. Among the most important are sustainability, health and high costs of meat (Grasso et al., 2021; Neff et al., 2018).

### 3.2. Part 1: Products across three corpora

Next, we looked at the most frequently mentioned food products to see which products are most prominent in the plant-based discourse. For all three countries, we find that the most important product in the keywords is "meat" (see Fig. 3), supporting the notion that meat consumption is deeply rooted in human food tradition (Leroy & Praet, 2015). In both the USA and India, "chicken" is named as the most important type of meat, a term that does not appear in the Swiss keywords. One reason why chicken does not appear among the most frequently mentioned keywords in Switzerland might be due to the fact that in German, there are various words (i.e. "Poulet", "Hühnchen", "Huhn") to describe this product. The fact that meat and chicken appear as two separate issues may be explained by the fact that plant-based meat alternatives tend to substitute red meat (Rizzo et al., 2023). Further, "fish" and meat substitutes ("planted", Planted Foods AG) appear in the Swiss discourse. In the USA, another meat that is mentioned is "beef" and for India, it is "fish" and "mutton".

Further, we find that "tofu" is mentioned in both the Swiss and the US discourse, but is missing from the Indian keywords, indicating different consumption patterns. Given that soybean production in tonnes per hectare is much lower in India than in the USA and Switzerland, this is not surprising (OECD, 2021b). Additionally, tofu has its origins in China and Japan and is much less rooted in the Indian food tradition (Shurtleff & Aoyagi, 1998).

In all three corpora, we see that meat alternatives seem to be important in the plant-based discourse. Further, it is surprising to see that in the USA, cheese is among the 50 first keywords, whereas it is not in Switzerland, where cheese plays a central role in the food culture (Krieger et al., 2018; Swiss Federal Office of Public Health, 2019). A closer look at the corpora reveals that the discourse on Swiss data covers more the general discourse on plant-based products whereas the discourse in the USA covers recipes including cheese. Overall, we can conclude that meat products were mentioned more often than dairy.


**Fig. 2.** The first 50 keywords (statistically significant words) for the corpora USA (left), India (middle) and Switzerland (right, translated), data from 2020 to 2022.

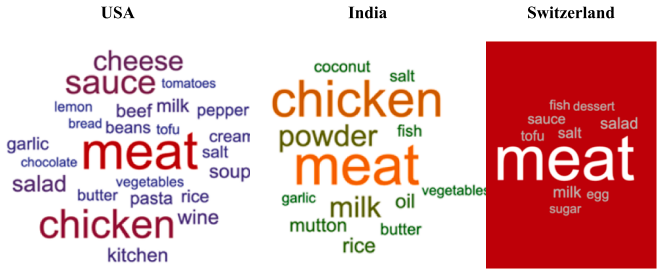


**Fig. 3.** Food products among the first 50 keywords (statistically significant words) by country (from left to right: USA, India, Switzerland), data from 2020 to 2022.

### 3.3. Part 2: Longitudinal analysis of the Swiss corpus

In a second part of the study, we looked in more detail at the development in Switzerland, conducting a longitudinal analysis. For this, we analysed the discourse on plant-based alternatives over the last 10 years. The total text volume of the Swiss corpus and its distribution over the years is shown in Fig. 4. We see a clear increase over time, with temporary drops in 2018 and 2020. Since 2016, several popular initiatives targeting agricultural or food-related topics have been launched in Switzerland (Huber & Finger, 2019). Popular initiatives allow any citizen to launch a proposal for revision of the Federal Constitution. In 2018, three popular initiatives on agriculture or food-related issues were put to the vote in Switzerland. These include the "fair food" initiative addressing ecological standards for imports, the "food sovereignty" initiative addressing an increase of state aid for farmers and the "horn-cow" initiative addressing direct payments for cows with horns. These discussions on agriculture and food might have drawn the focus of the public discourse in 2018 away from plant-based and towards the political debates on the initiatives.

In 2019, the focus changed back to plant-based, with a guerrilla action in which stickers were placed on trains, banning passengers from consuming animal products[2] and with vegans criticising the lack of vegan food and drink offers on trains.[3] After that, in 2020, with the media focussing on the pressing issue of the COVID-19 pandemic, plant-based alternatives were again less in the focus of media and therefore mentioned less often.

In a next step, we put a closer look on the content. Fig. 5 shows the 50 most frequent keywords for the discourse in Switzerland from 2012 to 2022 as a word cloud. The two major keywords are "meat" and "food" in general. Although there are many plant-based dairy products currently available on the Swiss market (Ammann, Grande, et al., 2023), they play a minor role in the plant-based discourse. Further, there seems to be a focus on preparing food at home or in restaurants. We find for instance the "Hiltl" restaurant in the discourse, which is, according to their own claim, "the oldest vegetarian restaurant in the world" (Hiltl, 2019). Similarly, Tibits is a vegetarian and vegan restaurant that dominates the discourse.

Besides taste, health and price (Swiss Francs) play an important role in food choice and are important aspects for a more plant-based diet (Ammann, Arbenz, et al., 2023). Some studies even find that health and price are more important than sustainability (Rolfe et al., 2023). Our results support this finding, as health ("healthy", "vitamins", "salt", "processed food") was touched upon several times among the first 50 keywords in Switzerland. This is not surprising, as there seems to be a major public debate on healthiness of meat alternatives and perceived healthiness is a major driver for consumer acceptance (Anusha Siddiqui et al., 2022; Green et al., 2022; Siegrist & Hartmann, 2023).

It is further interesting to see that the plant-based discourse goes beyond products and also covers the perception of a person (me, we). The term "I" is statistically significant, which - like the term "we" - indicates individual aspects in the discourse on veg*an food. Reasons for the veg*an diet are often mentioned, as well as the duration and the well-being after the change of the diet. Similar observations can be found for the term "we", here however also extended by the aspect of selling veg*an food by a group.

Importantly, in Switzerland, there are various terms that can be used for plant-based products. The most frequently used include the English "plant-based" and "plant based" and their German term "pflanzliche Alternative". Fig. 6 shows how often these three terms were used for meat alternatives over the last 10 years. We find that the term "plant-based alternative" was used as early as 2012, but until 2018 it had a very low frequency of only 10 mentions in one million words (frequency per million words) and was therefore infrequent. The English-language terms "plant-based" and "plant based" appeared in Switzerland as of 2018. All three terms have experienced a significant increase since 2018, with "plant-based alternative" still being the most frequently mentioned term. This fast increase over time is not surprising, given that the demand for meat alternatives and investments in alternative proteins have increased significantly in the last 10 years (GFI Good Food Institute, 2022; Hermann & Bolliger, 2021).

An analysis of the keywords for the respective years in comparison to the corpus as a whole shows that the discourses of the individual years in Switzerland are dominated by different subtopics shown along the time axis (Fig. 6). In 2012, the **referendum** on vegetarian food in the **mensa** demanded by the **Student Council (in German** "**Studierendenrat**" = **SR**) of the University of Basel was a big topic. In the end, the demanded referendum did not take place because the students were able to push through a compromise on the veg*an offer in the mensa, as media data in our corpus show. In 2013, the **vegi day** (vegetarian day) is also a topic

[2] https://www.20min.ch/story/passagiere-sollen-im-zug-keine-tierprodukte-essen-981041645255.

[3] https://www.watson.ch/schweiz/sbb/782882652-veganer-kritisieren-milch-angebot-der-sbb-das-ist-nicht-zeitgemaess.

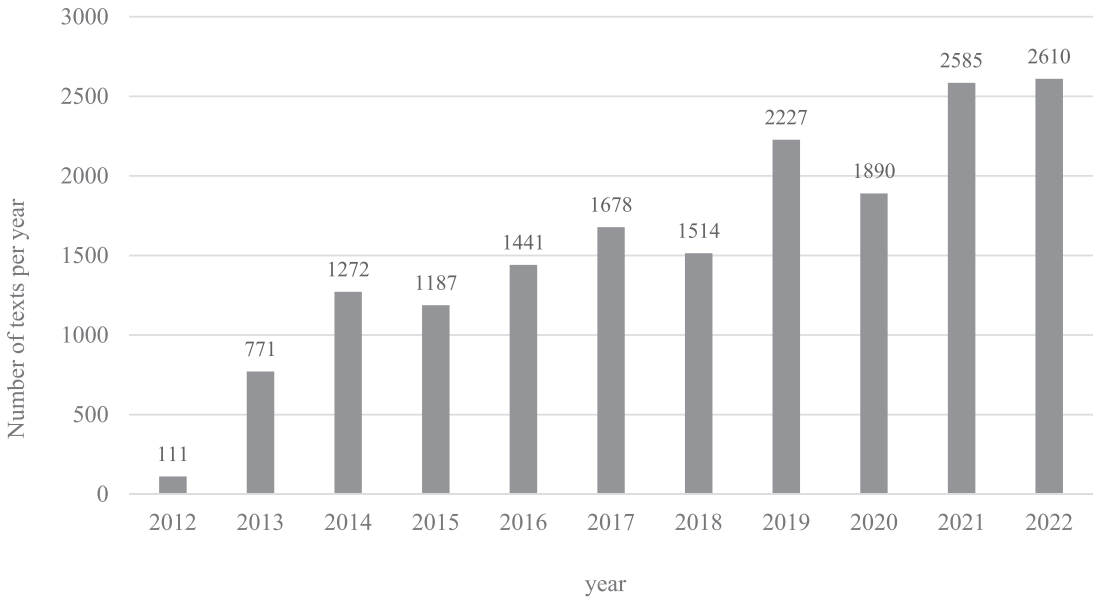


**Fig. 4.** Number of texts in the Swiss corpus in the study period 2012–2022 with the queried terms "plant-based", "plant-based alternative", "vegetarian" and "vegan".


**Fig. 5.** The first 50 keywords (statistically significant words) in the discourse in Switzerland, 2012–2022 (translated from German).

at other institutions, for instance in secondary schools, in canteens, but also in the army. In 2014, no clear themes were identified, but in 2015, the keyword **veeconomy** is statistically significant. A contextual analysis shows that Veeconomy is an agency for vegan products. In 2016, the keyword **halal** is significant. In various contexts, it is emphasised that vegetarian and vegan food is also halal. In 2017, there is a lot of attention on the vegan street festival **Veganmania** in Gossau, which is organised by Swissveg, the organisation for vegans and vegetarians in Switzerland. In addition, there is a lot of information about the Zurich initiative "Sustainable and Fair Nutrition", which wants vegan and thus environmentally friendly nutrition to be included in the **municipal regulations**. The **Vegantasia** shop in St. Gallen is mentioned very often in 2018. This is probably due to the fact that the shop with exclusively vegan products opened in January 2018 amid protests from meat eaters because it had to close again in October, as the offer at the large distributors like Migros and Coop was too much competition.

From this point on, the Swiss corpus shows that significantly more texts on plant-based alternatives or vegetarian and vegan food are published throughout Switzerland, but also that the mention of these terms increases overall (Fig. 6). In 2019, the discourse is strongly dominated by **Greta Thunberg** as an activist and by **climate change** as an overall topic. Specific to Switzerland is the coverage of the Swiss model **Tamy Glauser**, who switched to a vegan diet in 2019 and is thus repeatedly cited as a well-known representative of this diet. These examples clearly show how few individuals can significantly shape the discourse about plant-based.

In terms of companies, **Beyond Meat Inc.** is one of the most significant keywords of the year. In the Covid years 2020 and 2021, the focus is less on the form of nutrition and more on the type of supply (**takeaway**) as well as the entry conditions for restaurants (**vaccination**, **certificate**). This does not change again until 2022, when the topic of **Ukraine** is also present in the discourse on plant-based alternatives. This covers both the supply of basic foods, but to a lesser extent also the eating behaviour of Ukrainian refugees.

### *3.4. Limitations and outlook*

Our study analyses the media discourse on plant-based products across three countries. However, it does not look into the specific consumer groups that consume this information. Based on the fact that it has been demonstrated that perception of livestock farming and meat consumption depends on sociodemographic factors (Ammann et al., manuscript submitted; Liu et al., 2023), future studies could analyse what consumer groups consume what type of media and how the information is perceived. Additionally, we looked at three distinctly different countries. It is important to keep in mind that keywords can differ in their meaning depending on the cultural context they appear in. As this study followed an explorative and quantitative approach, the exact contextualisation of the keywords could be an interesting endeavour for future studies.

## 4. Implications and conclusion

In this study, we conducted a cross-cultural comparison of the plant-based discourse between the USA, India and Switzerland. Analysis

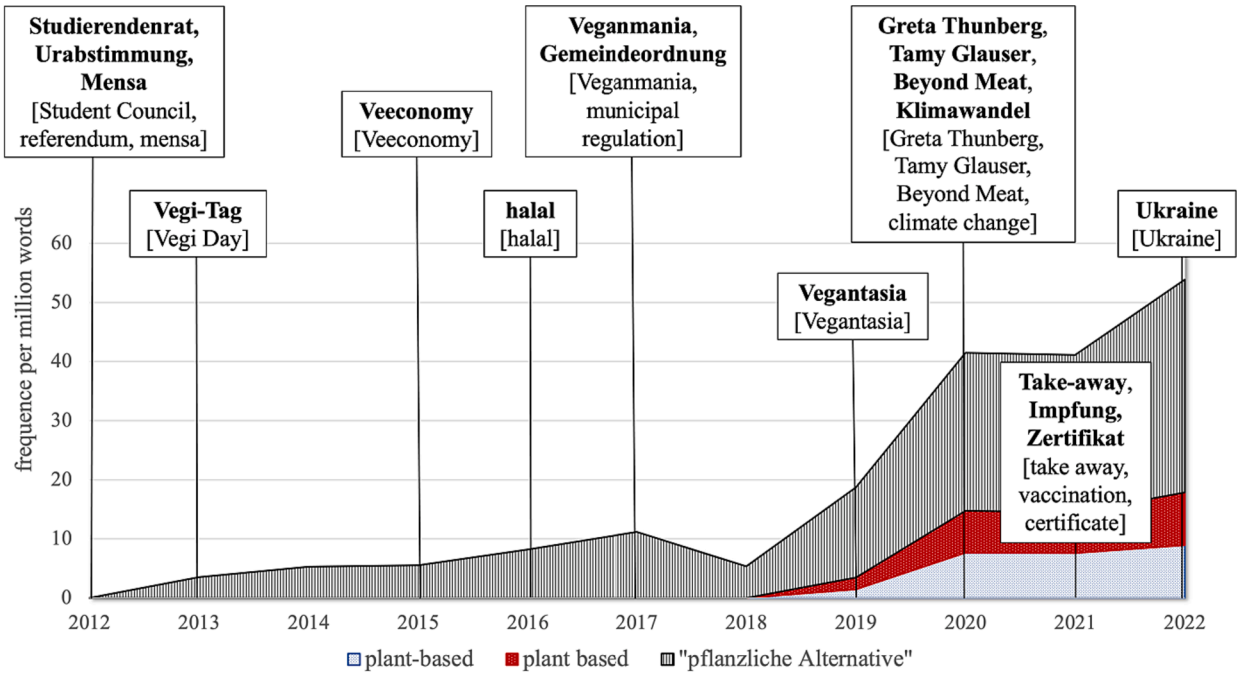


**Fig. 6.** Term variations over time (2012–2022), topics (keywords) per year in German and their [English translation].

revealed that in all countries, there was a clear focus on meat (alternatives), whereas alternatives to dairy seem to play a minor role. This supports the crucial role of meat in human food tradition. In India, where a significant part of the population is vegetarian, the discourse on plant-based includes health topics and food prices, which cover relatively basic needs. In the Swiss discourse, a focus on sustainability emerged, which is more about individual values and beliefs. Further, the 10-year discourse in Switzerland revealed that there was a clear increase of interest in the topic over time. Additionally, it seemed that the discourse was partly supported by climate youth and climate activism. With that, our study identified cross-cultural differences regarding sustainability as driver of the discourse and similarities regarding meat as a central food product. Importantly, our results show the central role of meat in our diet and indicate that plant-based products are not only a part of the sustainable transition, but can also be lifestyle choice.

Restricting the analysis to discourse in the media is not only sensible for purely practical reasons (access to data), but analysing the media discourse also allows us to look at what is (and what is not) mentioned in the public discourse in specific countries. While being embedded in the discourse of a country makes a detached analysis difficult and the advantage of a cross-cultural comparison can be helpful to better identify the characteristics of each individual country. For example, vegetarian food does not seem to be a big issue in India (possibly because it is already a main part of Indian cuisine), while in Switzerland and the USA, recipes of veg*an dishes actually have to be cited, as it less rooted in their food tradition.

In the USA, we further found a focus on appearance, food preparation and consumption. In India, there is a focus on health and wealth and the Swiss discourse deals with cooking (for guests), sustainability and health. The plant-based industry can use these insights and tailor their products accordingly. For instance, appealing plant-based meals by well-known chefs can win consumers in the USA, healthy and affordable vegan products (both food and cosmetics) appeal to consumers in India and a sustainability claim or label can help convince consumers in Switzerland. Overall, meat-alternatives are well-known by consumers and play a central role in the plant-based discourse, whereas the potential for dairy is slightly smaller at the moment. It remains to be seen how much the plant-based dairy market will grow in the future.

For Switzerland, we found a constant increase in the plant-based discourse over time. A lot of innovation has been taking place and with popular initiatives addressing the agricultural and food sector, the topic has definitely reached a political level as well. With the Swiss government recently announcing their climate strategy,[4] which includes a dietary shift towards less animal products, future increases in the plant-based discourse and market growth are to be expected. It will be worthwhile to further observe changes in the discourse of media as the topic undergoes rapid changes and is essential for the future of our global environment.

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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 will be made available on request.

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[4] https://www.srf.ch/news/schweiz/hoeherer-selbstversorgungsgrad-landwirtschaft-soll-mit-neuer-klimastrategie-nachhaltiger-werden.

## Appendix A

See Tables A1 and A2

**Table A1**
USA newspapers investigated.

| | Newspaper |
|---|---|
| 1 | USA Today |
| 2 | The Wall Street Journal |
| 3 | The New York Times |
| 4 | New York Post Los Angeles Times |
| 5 | The Washington Post |
| 6 | Star-Tribune (Chatham, Va.) |
| 7 | Newsday (N.Y.) |
| 8 | Chicago Tribune |
| 9 | The Boston Globe |

**Table A2**
India newspapers investigated (English language).

| | Newspaper |
|---|---|
| 1 | The Hindu |
| 2 | Assam Times |
| 3 | The Times of India |
| 4 | Hindustan Times |
| 5 | The Sentinel |
| 6 | BusinessLine (The Hindu) |
| 7 | The Statesman |
| 8 | The New Indian Express |
| 9 | The Tribune |
| 10 | The Telegraph |
| 11 | Greater Kashmir |

## Appendix B

**Table B1**
Keywords USA corpus.

| Word | LLR Value | Frequency |
|---|---|---|
| recipe | 13922.39 | 5096 |
| cooking | 10259.48 | 4268 |
| meat | 10066.74 | 4364 |
| restaurant | 9793.98 | 5283 |
| chicken | 7817.74 | 3375 |
| chef | 7272.46 | 3006 |
| recipes | 6718.13 | 2633 |
| sauce | 6646.69 | 2612 |
| stylist | 5611.22 | 1900 |
| cheese | 5497.11 | 2316 |
| i | 5252.88 | 39,805 |
| dish | 5044.89 | 2124 |
| menu | 4985.31 | 2320 |
| dishes | 4833.22 | 1952 |
| salad | 4481.01 | 1700 |
| cook | 4470.24 | 2487 |
| you | 4408.95 | 29,563 |
| fried | 4347.62 | 1653 |
| eat | 4124.11 | 2462 |
| wine | 3967.7 | 2142 |
| kitchen | 3752.49 | 2221 |
| soup | 3719.51 | 1523 |
| milk | 3692.11 | 1887 |
| beef | 3685.3 | 1714 |
| dining | 3638.05 | 1988 |
| rice | 3528.59 | 1946 |
| pasta | 3523.72 | 1394 |
| garlic | 3424.17 | 1294 |
| ingredients | 3354.5 | 1642 |
| cream | 3350.16 | 1665 |
| based | 3343.46 | 5458 |

(*continued on next page*)

**Table B1** (*continued*)

| Word | LLR Value | Frequency |
|---|---|---|
| flavor | 3333.63 | 1374 |
| pepper | 3318.69 | 1453 |
| salt | 3287.58 | 1804 |
| beans | 3252.99 | 1390 |
| dinner | 3199.91 | 1870 |
| butter | 3156.61 | 1385 |
| restaurants | 3139.58 | 2611 |
| roasted | 3125.39 | 1125 |
| sweet | 2888.67 | 1707 |
| tofu | 2862.58 | 966 |
| vegetables | 2831.97 | 1375 |
| like | 2802.22 | 13,282 |
| eating | 2764.6 | 1707 |
| meal | 2730.45 | 1603 |
| lemon | 2728.23 | 1113 |
| tomatoes | 2705.32 | 1100 |
| taste | 2660.42 | 1527 |
| bread | 2659.36 | 1345 |
| chocolate | 2644.86 | 1351 |

**Table B2**
Keywords India corpus.

| Word | LLR Value | Frequency |
|---|---|---|
| india | 10249.71 | 4410 |
| skin | 7907.26 | 2394 |
| meat | 7063.72 | 2045 |
| chicken | 6362.51 | 1781 |
| protein | 5976.33 | 1505 |
| diet | 5125.13 | 1415 |
| non | 4791.26 | 2517 |
| dishes | 4509.78 | 1158 |
| ingredients | 4332.58 | 1235 |
| rs | 4197.22 | 1809 |
| requirement | 4184.7 | 1230 |
| powder | 3985.95 | 1017 |
| indian | 3923.91 | 1785 |
| milk | 3876.3 | 1197 |
| hair | 3769.85 | 1539 |
| tsp | 3600.38 | 747 |
| menu | 3437.22 | 1074 |
| delhi | 3405.91 | 1420 |
| biryani | 3262.71 | 677 |
| add | 3228.56 | 1563 |
| kolkata | 3221.68 | 811 |
| puja | 3142.11 | 686 |
| products | 3117.83 | 1787 |
| dish | 3099.46 | 894 |
| chef | 3079.6 | 942 |
| vitamin | 3076.05 | 778 |
| rice | 2994 | 1044 |
| ltd | 2886.13 | 989 |
| cooked | 2880.27 | 777 |
| respect | 2879.12 | 1301 |
| eat | 2839.48 | 1136 |
| oil | 2822.65 | 1675 |
| tbsp | 2701.08 | 560 |
| mutton | 2674.74 | 567 |
| flavours | 2673.37 | 603 |
| taste | 2641.84 | 914 |
| fish | 2420.21 | 1016 |
| coconut | 2383 | 586 |
| salt | 2371.89 | 862 |
| butter | 2370.3 | 685 |
| lifestyle | 2363.73 | 764 |
| recipe | 2320.74 | 723 |
| healthy | 2249.28 | 1144 |
| vegetables | 2222.45 | 702 |
| cuisine | 2211.88 | 554 |
| formulation | 2202.46 | 499 |
| garlic | 2184.92 | 555 |
| veg | 2168.62 | 480 |
| foods | 2132.35 | 764 |
| flavour | 2101.75 | 512 |

**Table B3**
Keywords Swiss corpus.

| Word | LLR Value |
|---|---|
| food | 65516.37 |
| meat | 62895.5 |
| restaurant | 31671.9 |
| product | 29456.94 |
| me | 28616.5 |
| vegan (pers) | 28536.39 |
| cook (verb) | 24366.04 |
| we | 19214.88 |
| animal (adj) | 15573.54 |
| taste (verb) | 14688.18 |
| ingredients | 14483.95 |
| recipe | 12198.92 |
| food products | 11618.94 |
| animal (noun) | 11510.81 |
| healthy | 11090.46 |
| serve | 11011.78 |
| it | 10795.51 |
| plate | 10648.82 |
| g | 10620.17 |
| or | 10488.23 |
| vegetarian (pers) | 10307.69 |
| ? | 10300.77 |
| salad | 9317.71 |
| prepare | 9054 |
| milk | 8871.22 |
| fresh | 8345.46 |
| salt | 8253.68 |
| meatless | 7865.11 |
| food (EN) | 7760.28 |
| chef | 7727 |
| local | 7568.32 |
| tofu | 7479.02 |
| Swiss Francs | 7452.99 |
| sauce | 7148.91 |
| fish | 6925.83 |
| Hiltl | 6733.7 |
| veganism | 6503.16 |
| meat consumption | 6439.37 |
| guest | 6427.2 |
| culinary | 6417.5 |
| dish /dishes | 6416.27 |
| egg | 6411.96 |
| cookbook | 6258.61 |
| vitamin | 6200.13 |
| taste (noun) | 5944.49 |
| our | 5907.24 |
| sustainable | 5563.37 |
| sugar | 5522.49 |
| dessert | 5522.22 |
| preparation | 5490.3 |

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