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# What can Google Trends and Wikipedia-Pageview analysis tell us about sustainability and sustainable diets?

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**ABSTRACT**

The study aimed to determine the public interest in sustainability and sustainability diet-related topics. Wikipedia Pageviews analysis and Google Trends data were used for the relative internet search popularity on "sustainability" and diet-related topics from 1 July 2015 to 1 May 2023. "Sustainability" was particularly popular in European countries. "Climatarian diet" was a new term, and only three countries were searched. Relative Search Volume increased most dynamically for the topics "Sustainability", "Sustainable diet", "Plant-based diet", "Mediterranean diet", and "Pescetarianism", while page views increased most dynamically for the topics "Plant-based diet", "Flexitarianism", and "Mediterranean diet". According to both Wikipedia and Google Trends, there was a positive correlation between "Sustainability" and "Healthy diet", "Plant-based diet", "Mediterranean diet", "Veganism", "Raw foodism", and "Pescetarianism". Understanding the public's interest in sustainability and sustainable diets is critical to developing and choosing strategies for transitioning to sustainable diets.

**Keywords:** sustainability, sustainable diets, Google Trends, Wikipedia, pageviews analysis

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## INTRODUCTION

Sustainable food systems and diets are gaining popularity in a variety of scientific sectors. A sustainable food system ensures food security and nutrition for everyone without undermining the economic, social, and environmental underpinnings for future generations' food security and nutrition[1].

Sustainable diets are defined as "diets protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources" according to the Food and Agriculture Organization (FAO)[2]. Additionally, it is thought that food is the single most powerful lever for improving human health and environmental sustainability on the planet[3]. The World Health Organization (WHO) recommends that fruit, vegetables, legumes, nuts, and whole grains are important parts of a healthy diet, and free sugars, salt, and fat must be limited[4]. A study showed that the adoption of sustainable diets in middle- and high-income countries can positively affect both health and the environment, while the adoption of sustainable diets in low-income countries may result in more resource expenditure, which may limit sustainability[5]. Additionally, diets that positively affect health and environmentally sustainable diets do not cover each other. Since a nutritionally adequate diet may have a high environmental impact, a diet with low greenhouse gas emissions may be nutritionally inadequate[6]. Therefore, popular-based dietary modifications could benefit both health and the environment[7,8].

There is a greater interest in sustainable and related diets. Animal-based diets were associated with higher greenhouse gas emissions (GHGE), whereas higher consumption of plant-based diets was associated with lower GHGE[1,9]. Additionally, animal-based products include harmful nutrients such as sodium, saturated fat, and added sugars[10]. Therefore, reduced consumption of animal-based products may result in higher sustainability, health advantages, and a decline in disease risks[1]. The Climatarian diet is consistent with a range of environmentally motivated diets (including plant-based and flexitarian), that aims to reduce the carbon footprint from food consumption and mitigate climate change. The diet typically does not include rigid restrictions, but rather focuses on mindfulness about food-related emissions and may include a variety of behaviours to reduce one's carbon footprint from food intake (e.g., lowering meat consumption)[3,11]. However, a healthy diet and Mediterranean diet include a higher number of animal-based products (meat and dairy products) than a Climatarian diet[3,12].

Big Data is currently a hot topic in many industries and academia. “Big Data” are informational resources/assets with such a great volume, speed, and variety that they necessitate specialized technology and analytical methodologies to transform them into value[13]. In today’s digital world, a variety of tools have emerged that make it easier to understand and predict social changes in “big data”, which includes high amounts of data and resources[14,15]. Data collected during internet searches is one type of Big Data that can provide significant insights and information on population behaviour and interests. Google is the global search leader between 2015 and 2023 with an 84.69% usage rate, and one tool Google Trends a free and publicly accessible online portal from Google that allows people to interact with Internet search data[14,16].

However, two new characteristics have recently been assigned to Big Data: variability and veracity. The consistency of the data across time is represented by variability, whereas the accuracy, credibility, and truthfulness of the data are represented by veracity[14]. Wikipedia is a non-profit, free online encyclopedia that is created and maintained by volunteers from all over the world. It is trustworthy for users due to labelled articles based on their appearance[17]. Wikitrends has a similar function to Google Trends and is an attractive new analytics platform for Wikipedia that provides a variety of visualizations of Wikipedia pages[18]. These analytics tools have demonstrated promise for identifying the level of public awareness.

Food systems have a critical role in causing climate change, and food consumption is one of the most important climate change mitigation options in the food systems[1]. Therefore, it is important to evaluate the knowledge levels of consumers about sustainability and dietary patterns. The aim of this study was to determine the public interest in sustainability and sustainable diet-related topics such as sustainable diet, healthy diet, plant-based diet, Climatarian diet, flexitarianism, Japanese diet, Mediterranean diet, Nordic diet, vegetarianism, veganism, raw foodism, fruitarianism, pescetarianism.

## METHODOLOGY

### Wikipedia Pageviews statistics

Wikipedia, an important encyclopedia portal, is one of the top five most popular domains on the global internet[15]. Wikipedia Pageviews statistics (https://pageviews.wmcloud.org/) is a freely available tool for Wikipedia pages that shows how many people have visited an article in a given period since July 2015.

### Google Trends tool

Google Trends (https://trends.google.com/trends/) is a freely available online tool that allows the analysis of a selected expression, in a chosen region and period since January 2004. Google Trends enabled the comparison of up to five terms at once.

The tool estimates the relative search volume (RSV) of queries made using the Google search engine. RSV is an index of search volume adjusted to the number of Google users in a given geographic area and time interval. RSV ranges from 0 to 100, with 100 indicating peak popularity (100% of popularity in a given time and location) and 0 indicating total disinterest (0% of popularity in a given period and location)[19,20].

Google Trends may qualify analyzed phrases as "search term" or "topic". Search terms are literal typed words, whereas Google Trends may suggest topics when it recognizes phrases linked to popular queries. Topics allow for easy comparison of the provided term across countries. For example, Google Trends will analyze the search term "diet" literally; thus, RSV will be highest in English-speaking countries, whereas the topic "diet" will include all queries linked with the query in all available languages[15,20].

### Data collection

We used Google Trends and Wikipedia Pageviews statistics for collecting data from 1 July 2015 to 1 May 2023. We first used the Wikipedia tool Forge to access the pageview statistics of the countries related to the relevant terms (https://pageviews.wmcloud.org/langviews/). When the term "sustainability" was searched in tool forge, we found that a total of 60 languages were searched between 01.07.2015 and 01.05.2023. For Wikipedia pageviews statistics, we analyzed these 60 language-speaking countries. Although Wikipedia has a tool (Wikidata) that provides structured data on page views, we quickly perceived that many selected terms' pages were not registered in Wikipedia's category. Therefore, we manually verified if each selected term had a Wikipedia page. To do this, we used Google Search with the strings such as "site:en.wikipedia.org" (for the English version)", and the name of each selected term (e.g. sustainable diet site:en.wikipedia.org). Moreover, searches were conducted independently for each selected country using the filters "Country", "All Categories", and "Web Searches" for countries speaking these 60 languages for Google Trends.

The same search terms are used wherever possible between Google and Wikipedia searches. We determined the general topics as "sustainability" and diet-related terms such as "sustainable diet", "healthy diet", "plant-based diet",

"Climatarian diet", "flexitarianism", "Japanese diet", "Mediterranean diet", "Nordic diet", "vegetarianism", "veganism", "raw foodism", "fruitarianism", and "pescetarianism". We also searched "lacto-vegetarianism", "ovo-vegetarianism", and "lacto-ovo vegetarianism", however, the data were very limited. Therefore, we excluded these terms. We chose these diet-related terms according to the reports published reports by WHO and IPCC Reports[3,21]. Additionally, we have added the term Climatarian diet because it is an up-to-date term that covers the contents of sustainable diets[11].

Selected terms in all countries speaking these 60 languages were searched according to the official language of the countries. Then, countries without Google Trends RSVs were excluded. Hereby, Google Trends RSVs for Türkiye, Australia, Canada, the United Kingdom, Ireland, Germany, Spain, Mexico, Brazil, Netherlands, Belgium, Austria, Switzerland, France, The United States of America (USA), Greece, Russia, Poland, Czech Republic, Denmark, India, Norway, Croatia, Vietnam, Finland, and Sweden were included. No Wikipedia pageviews statistics and Google Trends RSVs could be retrieved for other countries (for sustainability).

**Statistical analysis**

Data were analyzed using SPSS version 24.0. Due to the structure of the data, non-parametric tests were used as a conservative approach. Jonckheere-Terpstra test was used to determine if there was a statistically significant trend of RSVs for sustainability, sustainable diet, healthy diet, plant-based diet, Climatarian diet, flexitarianism, Japanese diet, Mediterranean diet, Nordic diet, vegetarianism, veganism, raw foodism, fruitarianism, pescetarianism across time. The Kendall's Tau correlation coefficient was used to determine pairwise correlations between sustainability RSVs and RSVs of sustainable diet, healthy diet, plant-based diet, Climatarian diet, flexitarianism, Japanese diet, Mediterranean diet, Nordic diet, vegetarianism, veganism, raw foodism, fruitarianism, pescetarianism. We performed the seasonal Mann–Kendall test using XLSTAT Statistical Software for Excel to search for the presence of a significant secular trend of time series. For all statistical tests, a p-value of $<0.05$ was considered statistically significant.

**RESULTS and DISCUSSION**

According to Wikipedia pageviews results, healthy diet, plant-based diet, Climatarian diet, and Mediterranean diet showed positive trends (22.05%, 9109,52%, 420.53%, and 7,14%, respectively), however, sustainability, sustainable diet, flexitarianism, vegetarianism, veganism, raw-foodism, fruitari-

anism, and pescetarianism were decreased over time (%4.15, %31.89, %18.51, %44.96, %62.16, %66.49, %38.29, %22.97, respectively). Based on the Google Trends RSVs, sustainability, sustainable diet, plant-based diet, flexitarianism, Mediterranean diet, fruitarianism, and pescetarianism increased (226.91%, 224.74%, 92.91%, 779.07%, 361.83%, 65.55%, and 565.08%, respectively), whereas healthy diet, Climatarian diet, Japanese diet, Nordic diet, vegetarianism, and raw foodism decreased between 2015 to 2023 (29.63%, 50.77%, 33.08%, 70.07%, 45.04%, 41.03%). The term "veganism" was found no changes over time (Figure 1).

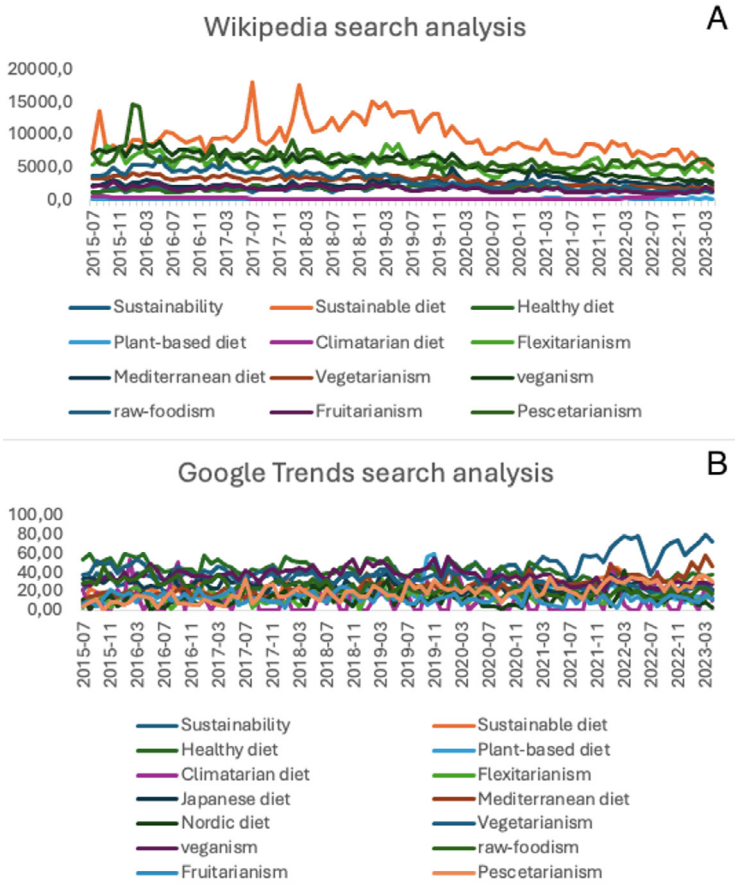


**Figure 1.** Search volume for the terms "sustainability, sustainable diet, healthy diet, plant-based diet, climatarian diet, flexitarianism, Japanese diet, Mediterranean diet, Nordic diet, vegetarianism, veganism, raw-foodism, fruitarianism, pescetarianism" across two online platforms (A: Wikipedia search analysis, B: Google Trends search analysis)

For all topics, Table 1 shows the top five countries with the highest worldwide RSV. Sustainability was particularly popular in European countries. Similarly, as many as three of the five top countries with the highest interest in the sustainable diet, healthy diet, plant-based diet, Mediterranean diet, raw foodism, and pescatarianism, included European countries. Climatarian diet was a new term, and only three countries were searched. Flexitarianism was popular mostly in Eastern European countries. The highest RSV for the Japanese diet, and Nordic diet were found in the USA and the United Kingdom. Vegetarianism and veganism were generally popular in United States countries. Fruitarianism was prevalent in the United States, European, and Asian countries.

**Table 1.** Top five countries with the highest page views and RSV by region of all related topics according to Google Trends data

| Topic | Top 5 countries with the highest RSV |
|---|---|
| Sustainability | Australia (65.58), Netherlands (60.65), Switzerland (58.39), Canada (58.10), Russia (57.18) |
| Sustainable diet | France (40.43), Germany (40.28), USA (40.21), United Kingdom (34.94), India (20.46) |
| Healthy diet | Australia (73.64), USA (73.47), India (65.04), Canada (64.09), France (60.63) |
| Plant-based diet | USA (41.55), Germany (33.09), Türkiye (30.74), Poland (22.79), Canada (21.08) |
| Climatarian diet | United Kingdom (12.69), Australia (11.21), USA (10.91) |
| Flexitarianism | France (32.46), Russia (20.63), Australia (17.10), Brazil (16.02), Poland (15.01) |
| Japanese diet | USA (68.20), United Kingdom (53.97), Russia (46.54), Brazil (35.01), India (34.67) |
| Mediterranean diet | Australia (50.37), Canada (44.64), United Kingdom (44.20), France (39.93), Poland (36.36) |
| Nordic diet | United Kingdom (25.43), Canada (24.42), USA (16.61), Australia (15.48), France (13.46) |
| Vegetarianism | Poland (65.78), Brazil (56.42), United Kingdom (50.74), USA (48.98), Russia (48.54) |
| Veganism | USA (60.24), Germany (59.52), Spain (58.64), Mexico (57.92), Canada (57.65) |
| Raw-foodism | Germany (63.68), Austria (54.21), Switzerland (49.68), Russia (44.76), Türkiye (25.70) |
| Fruitarianism | Brazil (26.08), Vietnam (20.70), Poland (17.39), Russia (16.96), Spain (14.35) |
| Pescatarianism | Russia (36.35), United Kingdom (32.00), Canada (31.74), USA (31.37), Australia (22.88) |

Table 2 shows the correlation between sustainability and diet-related topics. There was a positive correlation between sustainability and healthy diet, plant-based diet, Mediterranean diet, veganism, raw foodism, and pescetarianism according to both Wikipedia and Google Trends. Sustainability showed a positive correlation between sustainable diet in Google Trends ($\tau$=0.201, p<0.001), whereas it showed a negative correlation in Wikipedia ($\tau$=-0.563, p<0.001). Based on Wikipedia, sustainability presented a positive and moderate correlation with flexitarianism ($\tau$=0.465, p<0.001), vegetarianism ($\tau$=0.422, p<0.001), and a positive weak correlation with fruitarianism ($\tau$=0.278, p<0.001). Japanese diet and the Nordic diet were weakly associated with sustainability according to Google Trends ($\tau$=0.090, p<0.001, $\tau$=0.111, p<0.001, respectively).

**Table 2.** Sustainability correlations with diet-related topics

| | **Wikipedia Pageviews Statistics** | **Google Trends RSVs** |
|---|---|---|
| | $\tau$; p | $\tau$; p |
| Sustainability vs Sustainable diet | -0.563, <0.001** | 0.210; <0.001** |
| Sustainability vs Healthy diet | 0.383, <0.001** | 0.133, <0.001** |
| Sustainability vs Plant-based diet | 0.097, <0.001** | 0.061, <0.001** |
| Sustainability vs Climatarian diet | -0.509, <0.001** | 0.026, 0.574 |
| Sustainability vs Flexitarianism | 0.465, <0.001** | -0.023, 0.217 |
| Sustainability vs Japanese diet | - | 0.090, <0.001** |
| Sustainability vs Mediterranean diet | 0.477, <0.001** | 0.190, <0.001** |
| Sustainability vs Nordic diet | - | 0.111, <0.001** |
| Sustainability vs Vegetarianism | 0.422, <0.001** | 0.011, 0.437 |
| Sustainability vs Veganism | 0.453, <0.001** | 0.115, <0.001** |
| Sustainability vs Raw-foodism | 0.204, <0.001** | 0.087, <0.001** |
| Sustainability vs Fruitarianism | 0.278, <0.001** | -0.018, 0.346 |
| Sustainability vs Pescatarianism | 0.366, <0.001** | 0.156, <0.001** |

Table 3 shows the time-series analysis of all related topics according to Google Trends. The RSV most dynamically increased over the observational period for topics sustainability ($\tau$=0.778, p<0.001), sustainable diet ($\tau$=0.378, p=0.002), plant-based diet ($\tau$=0.484, p=0.006), the Mediterranean diet ($\tau$=0.738, p<0.001), and pescetarianism ($\tau$=0.494, p=0.004); whereas the RSV most rapidly decreased for Healthy diet ($\tau$=-0.680, p<0.001), Japanese diet ($\tau$:=-0.235, p: 0.027), vegetarianism ($\tau$=-0.794, p<0.001), and raw-foodism ($\tau$=-0.659, p<0.001).

**Table 3.** Time-series analysis of all related topics according to Google Trends

| Topic | The month with the highest seasonal component (RSV) | The month with the lowest seasonal component (RSV) | Seasonal Mann–Kendall test (τ, p) | Mean ± SS |
|---|---|---|---|---|
| **Sustainability** | April (59.62) | July (36.50) | 0.778, <0.001** | 50.01 ± 16.01 |
| **Sustainable diet** | May (50.42) | July (25.25) | 0.378, 0.002* | 37.57 ± 23.22 |
| **Healthy diet** | January (83.6) | December (51.18) | -0.680, 0.001** | 63.77 ± 15.35 |
| **Plant-based diet** | February (31.8) | July (23.06) | 0.484, 0.006** | 26.90 ± 23.17 |
| **Climatarian diet** | March (19.87) | May (2.57) | -0.133, 0.210 | 11.80 ± 24.63 |
| **Flexitarianism** | May (21.57) | August (6.00) | 0.127, 0.206 | 12.59 ± 22.81 |
| **Japanese diet** | January (77.62) | October (49.00) | -0.235, 0.027* | 61.09 ± 17.58 |
| **Mediterranean diet** | January (64.68) | December (28.06) | 0.738, < 0.001** | 40.08 ± 18.10 |
| **Nordic diet** | June (30.71) | December (11.31) | 0.127, 0.314 | 21.02 ± 21.47 |
| **Vegetarianism** | November (58.81) | July (36.12) | -0.794, < 0.001** | 49.86 ± 18.58 |
| **Veganism** | January (51.62) | August (35.31) | -0.227, 0.225 | 41.96 ± 23.30 |
| **Raw-foodism** | February (13.37) | August (3.75) | -0.659, 0.001** | 8.86 ± 19.03 |
| **Fruitarianism** | May (16.92) | August (4.68) | -0.195, 0.066 | 9.48 ± 15.91 |
| **Pescatarianism** | July (42.93) | May (20.64) | 0.494, 0.004* | 31.68 ± 22.99 |

Table 4 shows the time-series analysis of all related topics according to Wikipedia. The pageviews most dynamically increased over the observational period for topics plant-based diet (τ=0.921, p<0.001), flexitarianism (τ=0.595, p=0.004), the Mediterranean diet (τ=0.413, p: 0.022); whereas the pageviews most rapidly decreased for Climatarian diet (τ=-0.722, p<0.001), vegetarianism (τ=-0.690, p=0.001), veganism (τ=-0.818, p<0.001), raw-foodism (τ=-0.802, p<0.001), fruitarianism (τ=-0.683, p<0.001), and pescetarianism (τ=-0.579, p=0.004).

**Table 4.** Time-series analysis of all related topics according to Wikipedia Pageviews Statistics

| Topic | Seasonal Mann–Kendall test (τ, p) | Mean ± SS | The month with the highest seasonal component | The month with the lowest seasonal component |
|---|---|---|---|---|
| **Sustainability** | -0.135, 0.462 | 822.67 ± 187.01 | January (1008.75) | December (715.00) |
| **Sustainable diet** | -0.183, 0.349 | 28668.56 ± 7867.05 | February (31056.37) | December (24644.50) |
| **Healthy diet** | 0.222, 0.264 | 18517.71 ± 16632.84 | November (25739.25) | June (14983.00) |
| **Plant-based diet** | 0.921, <0.001** | 122.50 ± 161.70 | March (181.00) | July (81.125) |
| **Climatarian diet** | -0.722, <0.001** | 606.96 ± 1168.21 | March (1059.25) | July (285.00) |
| **Flexitarianism** | 0.595, 0.004* | 51133.27 ± 12375.34 | May (57337.14) | July (41531.25) |
| **Mediterranean diet** | 0.413, 0.022* | 41533.93 ± 18921.92 | January (61840.75) | December (31282.37) |
| **Vegetarianism** | -0.690, 0.001** | 45060.93 ± 10064.61 | January (48426.00) | June (42410.42) |
| **Veganism** | -0.817, <0.001** | 77735.26 ± 20420.61 | January (89374.37) | June (71864.14) |
| **Raw-foodism** | -0.802, < 0.001** | 9355.10 ± 2832.08 | March (11108.25) | December (8507.62) |
| **Fruitarianism** | -0.683, < 0.001** | 14216.08 ± 4333.54 | July (15984.62) | December (12233.62) |
| **Pescetarianism** | -0.579, 0.004* | 99600.03 ± 33359.75 | January (131628.25) | June (89847.71) |

Over the past decade, public interest in sustainability has increased, with consumers increasingly seeking information on their food consumption decisions' environmental and human health effects[22]. In this study, we used Wikipedia pageviews statistics and Google Trends, to our knowledge this was explored for the first time, to determine the public interest in sustainability and dietary patterns related to sustainability. We found that the RSV most dynamically increased over the observational period for topics sustainability, sustainable diet, plant-based diet, Mediterranean diet, and pescetarianism, whereas the pageviews most dynamically increased over the observational period for topics plant-based diet, flexitarianism, and Mediterranean diet. There was a positive correlation between sustainability and healthy diet, plant-based diet, Mediterranean diet, veganism, raw foodism, and pescetarianism according to both Wikipedia Pageviews statistics and Google Trends.

Sustainability has been a global concern in the last 50 years, but it is now vital[23]. Global Sustainable Development Report seeks to strengthen the science-policy interface as an evidence-based instrument to support policymakers and other stakeholders in the implementation of the 2030 Agenda across the social, economic, and environmental dimensions of sustainable development[24]. Therefore, the knowledge of the public about sustainability and related terms may be important to be a guide. A study reported that public interest in environmental sustainability increased significantly between 2009 and 2019 according to Google Trends[22]. Similarly, it was observed that there was a positive trend in sustainability from 2010 to 2021 in European countries using Google Trends[15]. We found that the interest in sustainability increased according to Google Trends, whereas the interest in sustainability did not change according to Wikipedia page views over time. However, Wikipedia is an encyclopedia that provides more scientific data than Google Trends. Therefore, it is not possible for scientific interest in the issues to fully coincide with the interest of the public.

The FAO defines sustainable diets as "diets with low environmental impacts which contribute to food and nutrition security and healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources"[2]. This definition is quite complex, encompassing environmental, social, and economic factors. However, consumers' food choices play a key role in the transition to more sustainable diets. Therefore, it is of great importance to understand how consumers interpret the concept of "sustainability" according to their eating habits. A study found that the mean European RSVs for food sustainability significantly increased from 2010 to 2021[15]. However, a recent systematic review determined that consumers struggle to define "sustainability", and to estimate the environmental impact of their food choices[25]. According to Google Trends, there was an increasing trend in sustainable diet over time in this study, not Wikipedia page views. It is possible that the results are contradictory because the changes in sustainable diet and food sustainability and public interest in these concepts occurred simultaneously but in some unrelated ways.

According to the WHO, a healthy diet is defined as the type of diet essential for health, well-being, optimal growth, and development. A healthy diet should also be more environmentally sustainable as it is associated with lower greenhouse gas emissions, less freshwater, and land mass use[4]. It was observed that the interest in healthy diet from 2010 to 2021 increased in the Northern

and Western European regions by using Google Trends[17]. Another study, using Google Trends, showed that the interest in healthy diet globally decreased from 1 January 2004 to 30 June 2020[26]. We found that interest in a healthy diet decreased according to Google Trends, whereas it increased according to Wikipedia Pageviews. Time-series analysis showed that interest in a healthy diet followed a negative trend according to Google Trends, while there was no statistically significant trend according to Wikipedia Pageviews over time. While our results were similar to the study evaluating the worldwide, the other study may have been different as it only included the European region.

The Mediterranean diet is thought the most beneficial type of diet, so we chose it[27]. A study showed that according to Google Trends, from 2004 to 2019, interest in the Mediterranean diet increased[20]. Another study showed that statistically significant seasonal differences were found for the Mediterranean (the mean pageviews were highest in spring) from 2015 to 2021 according to Wikipedia[14]. We found that global interest in the Mediterranean diet increased according to both Google Trends and Wikipedia from July 2015 to May 2023, and the mean Pageviews were highest at the beginning of the year. New Year's resolutions appear to be a fantastic opportunity to influence the establishment of new health goals.

The Climatarian diet is a new term that refers to a group of environmentally oriented diets (including plant-based and flexitarian diets)[3,11]. It was observed that the interest in plant-based diet increased from 2004 to 2019 according to Google Trends, and it was most popular in the USA[20]. According to the literature, only one study evaluated the interest in flexitarianism, and that found that the interest in flexitarianism from 2010 to 2021 increased in most European countries by using Google Trends[15]. The present study showed that the plant-based diet increased according to both Google Trends and Wikipedia, however, flexitarianism increased, and the Climatarian diet decreased according to only Wikipedia. Similarly, we found that the term plant-based diet is most popular in the USA. We did not find any statistically significant in the term flexitarianism and Climatarian diet according to Google Trends, and compared to Portugal-Numes et al., the mismatch in these findings may lie in the regional specificity[15]. Additionally, the Climatarian diet is a new term, and only three countries searched this term in our findings.

Vegetarian diets (including fruitarianism, pescetarianism, and raw foodism) reduce greenhouse emissions compared to omnivore diets[28]. Therefore, we searched these terms in addition to other vegetarian diets such as lacto-ovo, ovo, and lacto. However, the data about lacto-ovo, ovo, and lacto vegetarianism is not enough to analyze, thus they were excluded. It was observed that

global interest in raw foodism, pescetarianism, veganism, and vegetarianism increased according to Google Trends from 2004 to 2019[20]. A study showed that statistically significant seasonal differences were found for vegetarian (the mean pageviews highest in spring), and pescetarianism diets (the mean pageviews highest in winter) from 2015 to 2021 according to Wikipedia Pageviews[14]. We found that the trend in pescetarianism significantly increased, however vegetarianism and raw-foodism significantly decreased according to Google Trends; and vegetarianism, raw-foodism, veganism, pescetarianism, and fruitarianism significantly decreased according to Wikipedia. The reason for this difference may be due to the fact that we analyzed the years July 2015 to May 2023 in order to compare both Google Trends and Wikipedia data.

The study has some limitations. First, Wikipedia pageviews analysis does not contain precise location data, making it difficult to locate viewers due to its privacy policy. Summary data is available for each Wikipedia language providing the page view rate by country, and a page's language can be used as a rough proxy for its geography[29]. However, Wikipedia pageviews statistics have advantages over other metadata in measuring public interest. They reflect the search for information about a topic and involve the highest amount of user interaction[30]. Second, Google Trends contains precise location data, but it does not provide real-time usage data and more precise time intervals, which reduces predicting capability. Also, these results lack transparency, as there is no clear data on the methods used by Google to calculate RSVs[26]. Third, both Google Trends and Wikipedia Pageviews statistics do not provide user characteristics. Therefore, the results cannot be generalized to Internet users.

On the contrary, the study has some strengths. In the study, firstly, using Wikipedia pageviews statistics, a total of 60 languages containing the word "sustainability" were searched. In this context, sustainability and diet-related terms were all researched with Google Trends RSVs in all 60 languages-speaking countries. Therefore, the study provides a valuable resource for future studies.

In conclusion, here it was explored, for the first time, public interest in sustainability and sustainable diet-related topics. According to our results, there was a growing interest in sustainability, sustainable diet, plant-based diet, Mediterranean diet, and pescetarianism according to the RSVs, whereas the page views most dynamically increased over the observational period for topics plant-based diet, flexitarianism, and Mediterranean diet. We believe that more research is needed to reflect real life in this field, however, Google Trends and Wikipedia pageviews statistics have the potential to be useful tools. Understanding the public's interest in sustainability and sustainable diets is criti-

cal to developing and choosing strategies for transitioning to sustainable diets. Therefore, our findings could help scientists, practitioners, policymakers, as well as the public who are interested in diet-related topics. Moreover, artificial intelligence has begun to support search tools as of 2023. Currently, Microsoft Bing is using Chat GPT, etc., and Google has started its algorithm and Google Bard, whereas Wikipedia still uses its algorithm called page view statistics. In summary, Google searches and Wikipedia with their algorithm and give these results in Google trends and Wikipedia pageviews statistics, this study can be an important source for the question of how this will change with artificial intelligence in the future.

## STATEMENT OF ETHICS

Not applicable.

## CONFLICT OF INTEREST STATEMENT

No conflict of interest was declared by the authors.

## AUTHOR CONTRIBUTIONS

Design: HMB, AÖ; Acquisition of Data: HMB; Analysis of Data: HMB; Statistical Analysis: HMB, Drafting of the Manuscript: HMB; Critical Revision of the Manuscript: AÖ; Statistical Analysis: HMB; Supervision: AÖ.

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