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TRENDS ON THE PLATE: A TIME SERIES ANALYSIS OF TWEETS

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Abstract

This study complements food projections based on market data by social media analysis. It uses a sample of 162,000 food-related tweets to examine the trends in discourses about different food items. The findings reveal that most discourses intensify in the period 2012-2022, most significantly for milk, followed by fruits. In contrast, beer is the only category showing a significantly negative trend. These results confirm a growing desire to adapt diets to public health requirements.

Key words: *social media, food trends, Twitter, public health, dietary behaviour*

INTRODUCTION

Food demand projections are traditionally derived from economic and consumption data, drawing upon historical trends to forecast future dietary patterns [7], [29], [21].
On this basis, there is broad consensus that the demand for animal-based food, oilseeds, and rice is likely to expand [9]. Simultaneously, growing awareness of health and environmental concerns increasingly shapes food choices [12].
While market data remains central to understanding consumption trends, the proliferation of social media platforms has introduced new avenues for analysing dietary preferences and emerging food discourses [5], [15], [1].
It has been described how discourses lead to mental changes [27]and eventually to behaviour change [16].
Therefore, it should be expected that discourses on social media platforms can provide real-time insights into evolving public attitudes and may precede observable market shifts.
This strain of research is yet underdeveloped in the food sector. A study by Ghaffari and Stewart [11] highlights the role of social media in promoting plant-based eating by analysing the rise in vegan-related hashtags and positive sentiment over time. This study found that public perception toward veganism has generally grown more favourable, with increasing mentions of plant-based alternatives to traditionally animal-derived products, such as plant-based *milk*. Similarly, De Boer, Schösler, and Aiking [6] identify flexitarianism—the choice to reduce rather than eliminate meat consumption—as an emerging dietary trend that has gained traction on social media for appealing to those seeking dietary change without completely abstentaining from meat. Alongside dietary preferences, another important area of social media discourse studied by researchers is the representation and discussion of eating disorders. The ways in which social media platforms both reflect and reinforce narratives surrounding disordered eating have been highlighted in research by Opara and Santos [19], Fitzsimmons-Craft et al [10] and Wilksch et al [30]. These studies highlight how digital interactions contribute to shaping public attitudes towards body image, restrictive diets and food choices. They also highlight the importance of analysing food discourse within the broader context of health-related social media trends.
However, while there has been research into individual dietary trends, there is a need for

systematic research into how the wider discourse on food is evolving over time.

Analysing social media for food trends involves looking at how often terms associated with different dietary choices appear and how attention to them changes over time.

This study seeks to address this gap by applying a time series analysis to X (formerly Twitter) data to examine the temporal dynamics of discourse around key dietary terms, including ***vegetable(s), fruit(s), milk, bread, rice, sweet(s), wine(s) and beer(s),*** *and* within food-related contexts. Tufekci [28] warns of the challenges of representativeness inherent in social media data; however, by tracking patterns over an extended period, this study aims to capture general trends that reflect broader public perceptions. The findings help to understand how digital platforms influence dietary narratives and public health awareness

MATERIALS AND METHODS

This study uses quantitative content analysis to examine how food-related discourse on X (formerly Twitter) evolved over a decade. Data collection was conducted using academic access to X's API in 2023, retrieving approximately 945,000 tweets from six selected years: 2012, 2014, 2016, 2018, 2020, and 2022. These years were chosen to capture longitudinal trends while mitigating excessive data redundancy. The initial extraction targeted three primary keywords—***meat***, ***vegan***, and ***vegetarian***—to examine public discourse on dietary discourse dynamic over time. While the exact number of tweets per year varied due to platform usage and keyword popularity, to ensure consistency and manageability, a balanced sub-sample of 9,000 tweets per year was selected, totalling 162,000 tweets for analysis. The decision to use a database extracted in 2023 was guided by several practical and methodological considerations. Following the initial keyword-based extraction, a word frequency analysis was conducted to identify additional terms indicative of broader food-related discourse. This process resulted in the inclusion of the following keywords: ***fruit(s), vegetable(s), milk, bread, rice, sweet(s), beer(s),*** *and* ***wine(s).*** These terms were selected to facilitate a comprehensive examination of dietary discussions, encompassing plant-based foods, staple food items, and beverages.

To examine temporal trends, a linear regression analysis was applied, assessing changes in the frequency of keyword mentions over time. Additionally, a heat map visualization was generated to illustrate patterns of term co-occurrence and variations in keyword prominence across the selected years. This methodological approach facilitates a systematic investigation of shifts in dietary discourse, thereby offering insights into the extent to which social media discussions mirror broader transformations in food perception and public health awareness. It is noteworthy that this methodological approach also guarantees that the study captures macro-level patterns in food discourse.

RESULTS AND DISCUSSIONS

The analysis has revealed several key findings, which are outlined in Table 1 and illustrated in Fig. 1. These findings demonstrate changes in the prevalence of key food terms, influenced by health consciousness, cultural factors and evolving food preferences.

Bread frequency exhibits a positive trend, with a slope of 2.49 and a relatively low R^2 value of 0.35. While the data suggests some growth, the low R^2 indicates that other variables may also play a significant role. Scientific studies have highlighted the persistent popularity of bread as an affordable and versatile food item, particularly in regions where wheat is a primary agricultural product, with recent preferences shifting toward whole-grain and artisanal varieties, reflecting broader health and lifestyle changes [3].

For ***milk***, the regression analysis shows a consistent increase in frequency over time (slope = 6.31, R^2 = 0.73), indicating growing discussions or relevance of milk-related topics. This trend aligns with Schiano et al. [25], who highlighted that consumer perception of sustainability has significantly influenced the growth of both traditional dairy products and plant-based alternatives. The increasing focus

on milk could be driven by the dual interest in traditional dairy and emerging alternatives, as concerns regarding sustainability and dietary shifts continue to impact global consumption patterns

The data indicates a modest upward trend in ***rice*** frequency over time, as indicated by the slope of 2.13 and a R^2 of 0.27, reflecting a marginal positive correlation. The literature highlights the role of socioeconomic variables, including household income and educational status, in shaping patterns of rice consumption. The phenomenon has been observed in Nigeria, where the influence of household demographics on rice consumption is pronounced [8]. Similarly, data from the United States shows that eating rice is associated with better nutrient intake and diet quality, including higher intakes of fibre and lower intakes of saturated fat [2]. In Asia, rice remains a critical food source. However, consumption patterns are changing due to dietary diversification and urbanisation [17]. These findings suggest that the slight increase in rice frequency is being driven by its cultural importance and role in nutrition, despite challenges such as competition from other grains or cereals and changes in dietary habits.

With a slope of 3.93 and an R^2 of 0.70, *the* frequency of ***vegetable(s)*** on X demonstrates a consistent increase over time, reflecting a strong positive correlation. Increased awareness of the health benefits of vegetables and the public health community's concerted efforts to promote plant-based diets have contributed to this trend. Campaigns and dietary guidelines emphasize the importance of vegetable intake in preventing chronic diseases such as cardiovascular issues and obesity. Research underscores that targeted strategies, such as educating consumers about plant-based dishes can play a significant role in increasing vegetable consumption. These strategies often include making vegetable-based meals more appealing to consumers through better sensory and nutritional profiling [4].

The ***fruit(s)*** category exhibits a strong upward trend with a slope of 4.81 and an R^2 value of 0.96, driven by public health campaigns and increased awareness of health benefits. Initiatives like Go for 2&5 and global efforts to meet World Health Organization (WHO) recommendations have led to measurable gains, though challenges such as food waste and limited access in low-income regions persist [20], [18], [23].

The analysis of ***sweet(s)***presence shows a marked increase over time, with a slope of 4.29 and an R^2 of 0.67, suggesting a moderate-to-strong positive correlation. This trend is primarily attributed to urbanization, shifting dietary preferences, and the widespread availability of processed and sugary foods. In developing societies, there has been a notably increase in sugar use, particularly in the form of sugary beverages and desserts, driven by urban lifestyles and marketing strategies [14]. Additionally, global trends highlight increasing presence of added sugars in packaged foods, which has significant public health implications, including rising rates of obesity[24]. Further ecological analyses have established a correlation between elevated levels of sugar consumption to a greater prevalence of obesity and hypertension. This underlines the need for interventions targeting sugar intake in populations undergoing nutritional transitions [26].

The utilisation of ***wine*** in tweets shows negligible fluctuations over time, with a slope of 0.31 and accompanied by a R^2 value of 0.05, suggesting almost no predictive power. This stability reflects the cultural and regional specificity of wine consumption patterns, with certain regions demonstrating growth due to its perceived health benefits, while others exhibit stable or declining trends as a result of alternative preferences [13].

The regression analysis for the term ***beer*** reveals a declining trend over the years. A moderate negative correlation is indicated with a slope of -1.44 and an R^2 value of 0.65. This aligns with findings that suggest a reduction in alcohol consumption in some regions, which has been attributed to increased level of awareness regarding the adverse health impacts of excessive drinking. Recent research indicates that frequent consumption of alcohol has a negatively impact to physical health, contributing to chronic conditions such as

cardiovascular disease, diabetes, and even cancer. These findings emphasize the necessity for public health strategies and initiatives that are designed to reduce excessive alcohol consumption in the modern world [22].

The significant P-values for health-related categories like fruit(s) and vegetable(s) reflect the impact of sustained public health efforts. At the same time, the non-significant trend for bread and the declining trend for beer(s) underscore the need for further investigation into shifting consumer priorities, such as preferences for artisanal bread or reduced alcohol consumption.

For categories like *wine(s)* and *rice*, the lack of significant trends could indicate stability or competing influences, requiring more granular data to uncover nuanced patterns.

These findings underscore the evolving nature of dietary discourse on social media, reflecting broader societal shifts in food preferences and eating habits.

The increasing prevalence of discussions surrounding fruits, vegetables, and milk aligns with growing public awareness of health-conscious and environmentally sustainable diets, as documented in previous studies on plant-based consumption and nutritional awareness.

In contrast, the decline in beer-related discourse suggests a potential shift away from alcoholic beverages, possibly driven by health campaigns, regulatory measures, or changing social norms regarding alcohol consumption. Meanwhile, the stable trajectory of wine discussions indicates its enduring yet fluctuating role in dietary habits, potentially influenced by cultural and economic factors.

Beyond individual food categories, these trends highlight the broader impact of digital discourse on food-related attitudes, suggesting that social media serves as a dynamic space for shaping, reinforcing, and challenging dietary norms.

Table 1. Regression analysis results

Term	Slope	Intercept	R^2	P-value
Fruit(s)	4.814286	-9660.247619	0.960672	0.000588
Vegetable(s)	3.928571	-7833.095238	0.702062	0.037289
Milk	6.314286	-12676.580952	0.733807	0.029361
Bread	2.485714	-4945.685714	0.353940	0.212892
Rice	2.128571	-4197.161905	0.266780	0.294136
Sweet(s)	4.285714	-8559.952381	0.667095	0.047290
Beer(s)	-1.442857	2937.409524	0.648163	0.053285
Wine(s)	0.314286	-605.580952	0.048922	0.673636

Source: Own calculations.

While online conversations do not necessarily translate directly into behavioural change, they provide valuable insights into emerging consumer priorities and potential market transformations.

Future research could further explore causal relationships between social media discourse and actual consumption behaviours, incorporating market sales data, nutritional studies, and sentiment analysis to provide a more comprehensive understanding of how digital narratives influence food choices.

By integrating social media analytics with public health and consumer behaviour research, these insights contribute to a deeper understanding of how digital platforms function as indicators of shifting dietary landscapes. As discussions concerning health, sustainability, and food ethics continue to evolve, the role of social media in capturing and predicting these trends remains an important area for further investigation.

The heatmap visualization (Fig. 2) provides a complementary perspective to the linear regression analysis by illustrating the relative frequency and variation of selected food-related terms across different years. While regression analysis captures overall trends, the heatmap enables a more granular examination, highlighting shifts, fluctuations, and comparative prominence of keywords over time. This approach offers valuable insights into how certain dietary terms gain or lose attention in social media discourse, even

though it does not account for the full context in which these terms appear within tweets.

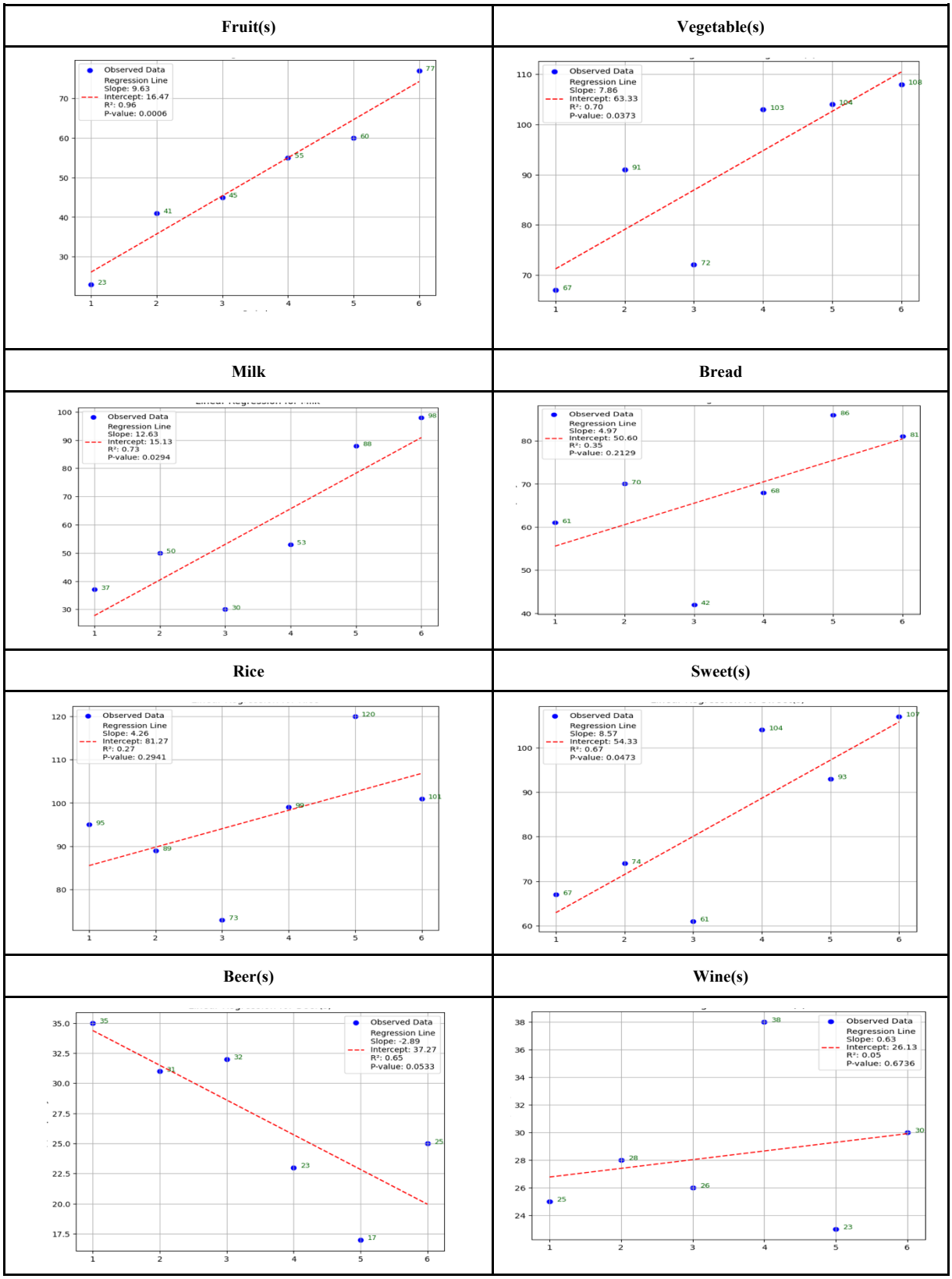

Fig. 1. Linear regression across keywords for food and beverage categories
Source: Own calculation.

A key observation from the heatmap is the consistent increase in mentions of *fruits, vegetables,* and *milk*, with darker hues indicating greater frequency in later years. This growth suggests a heightened focus on health-conscious eating and plant-based dietary choices, possibly influenced by public health narratives, sustainability discussions, and evolving consumer preferences. Notably, *milk* exhibits a sharp increase between 2018 and 2020, which may reflect an increased interest in dairy consumption or plant-based alternatives, though without sentiment analysis, the nature of this discussion remains unclear.

Fig. 2. Heatmap of frequency trends over years
Source: Own calculation.

Other food-related terms display more irregular trends. *Rice* mentions peak in 2020 before experiencing a decline in 2022, possibly reflecting regional shifts in staple food discussions or temporary fluctuations in public interest. Similarly, *bread* mentions increase between 2018 and 2020 before stabilizing, a pattern that may be linked to changes in dietary habits, global supply chain variations, or cultural trends such as home baking movements. Mentions of *sweets* follow a cyclical pattern, peaking in 2018, declining slightly in 2020, and rising again in 2022. This suggests fluctuations in consumer attitudes toward indulgence versus health consciousness, though further analysis would be required to determine the underlying drivers of these variations.

In contrast, *beer* and *wine* discussions remain stagnant or decline over time, with beer mentions showing a marked decrease from 2012 to 2020 before a slight recovery in 2022. This aligns with shifts in alcohol consumption behaviour, potentially influenced by health concerns, changing social drinking habits, or the rising popularity of non-alcoholic alternatives. Wine, however, maintains a relatively stable presence in discourse, indicating that while it does not experience strong growth, it also does not exhibit significant decline. These patterns suggest that while some foods gain increasing attention in online discussions, others maintain a consistent but less dynamic presence.

By integrating both quantitative trend analysis and qualitative heatmap visualization, this study provides a broader understanding of how food-related discussions evolve over time. The heatmap highlights shifts and anomalies that might be oversimplified in a linear regression model, making it a valuable tool for capturing the dynamic nature of social media discourse. As digital conversations continue to shape consumer awareness and dietary narratives, further exploration into how these discussions translate into real-world behaviours remains a promising direction for future research.

CONCLUSIONS

This study contributes to the understanding of food-related discourse on social media, offering insights into how discussions around dietary choices evolve over time. However, several limitations must be acknowledged.

The first limitation is the reliance on the sample extracted in 2023 for other keywords and also on the X(Twitter)'s API, which restricted access to comprehensive historical data. It is still possible to extract historical data from X(Twitter), but it requires navigating significant restrictions and potential costs.Thesecond limitation entails the potential bias introduced by focusing on specific keywords, which may not capture the full spectrum of dietary discussions or represent the diversity of public discourse across regions and demographics. Finally, the dataset reflects only English-language tweets, limiting the

generalizability of findings to non-English-speaking populations and culturally specific dietary practices.It is important to acknowledge that these findings are based solely on keyword frequency rather than sentiment or contextual analysis. The presence of a term in a tweet does not necessarily indicate positive or negative discourse, nor does it capture the motivations behind its use. Future research could enhance these insights by incorporating sentiment analysis, topic modelling, and demographic segmentation to better understand the nature and drivers of dietary discourse on social media.

Nevertheless, the analysis reveals significant developments over time. The rising numbers for most food items over time reveal a growing interest in nutrition-related issues. However, the significantly negative trend for beer and the stagnating numbers for wine also confirm a decreasing interest in items with considerable health risks, confirming the general trend to feed ourselves in line with health requirements.

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