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"A Comparative Study of Consumer Consumption Trends: Adoption of Natural Plant-Based Sweeteners in Modern Lifestyle"

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Abstract

Purpose
The study examines consumer consumption trends, awareness levels, and adoption patterns of natural plant-based sweeteners in modern lifestyles.

Methodology
A structured questionnaire survey was conducted among 350 respondents from Mumbai, Thane, and Palghar. Non-parametric tests—including Shapiro–Wilk, Kruskal–Wallis, and Mann–Whitney—were applied to analyse awareness, preferences, and influencing factors.

Findings
Awareness does not significantly affect consumption patterns or sweetener preferences. No meaningful differences were observed in factors influencing adoption among consumer groups. Overall, consumer choices were shaped more by taste, price, and availability than by awareness.

Practical Implications

Insights assist manufacturers, nutritionists, and policymakers in designing targeted awareness campaigns, improving product formulation, and promoting healthier alternatives.

Limitations
Self-reported data and limited geographic coverage may affect generalisation.

Originality
Provides a comparative, consumer-focused assessment of natural sweetener adoption in a metropolitan lifestyle context.

Keywords- Plant-based sweeteners, Consumer behaviour, Adoption patterns, Consumption trends, Health-conscious choices.

Introduction

The growing global concern over excessive sugar consumption and its association with lifestyle diseases—such as obesity, diabetes, cardiovascular disorders, and dental caries—has accelerated the demand for healthier sweetening alternatives. As consumers increasingly seek natural, low-calorie, plant-derived options, plant-based sweeteners have emerged as promising alternatives to conventional sugar and artificial sweeteners. These sweeteners, derived from sources such as stevia, monk fruit, palm sugar, coconut nectar, and various polyols, offer varied sweetness intensity, caloric value, sensory characteristics, and health benefits.

The global rise in obesity and non-communicable diseases is strongly linked to excessive sugar consumption, increasing interest in safer sugar alternatives. High-intensity sweeteners offer strong sweetness with minimal calories, making them valuable substitutes. Research has focused on GRAS natural compounds such as steviol glycosides from Stevia rebaudiana and mogrosides from Siraitia grosvenorii, valued for their sucrose-like taste, antioxidant activity, and antidiabetic, anticancer, and cardioprotective properties. Advances in biocatalytic and enzymatic technologies now enable improved production and biotransformation of these sweeteners. This review highlights their health roles, technological innovations, and emerging potential as effective sugar replacements (Muñoz-Labrador et al., 2023).

Unhealthy eating habits, particularly excessive consumption of added sugar, are a key cause of the global increase in non-communicable illnesses. Due in large part to the growing availability of ultra-processed, sugar-rich foods, intake of free

or added sugar is still high even though dietary recommendations in more than 90 nations recommend reducing it. Children and adults in Europe and the USA frequently consume more sugar than is recommended by the WHO and national guidelines, which restrict free or added sugars to 5–10% of total calorie consumption. Stronger public health initiatives and adherence to guidelines are necessary since persistent overconsumption of added sugar, especially from sugar-sweetened drinks, has been connected to obesity, type 2 diabetes, and dental caries (Russell et al., 2020). Consumers increasingly seek reduced-sugar yogurts due to health concerns, yet taste remains the key driver of acceptance. This study found consumers conceptually preferred "naturally sweetened" claims, favoring honey and agave over other sweeteners. In sensory tests, sucrose-sweetened yogurt was most liked, though allulose and allulose–stevia blends outperformed stevia alone. Priming with a sweetener type improved acceptance regardless of formulation. Overall, natural non-nutritive sweeteners that closely mimic sucrose's sensory qualities offer the greatest potential for sugar-reduction strategies in yoghurt, highlighting the need to balance health appeal with taste satisfaction (Crown et al., 2024). This study analyses artificial and natural sweeteners, detailing their potency, glycemic index, mechanisms, and food applications. It highlights rising demand driven by obesity and diabetes concerns, discusses health debates, production challenges, and commercialisation barriers, and underscores the need for scalable, economically viable plant-based sweetener solutions for future food markets (Dragomir et al., 2025).

It is important for food manufacturers, dietitians, and regulators to comprehend the differences between these sweeteners in terms of flavour, functioning, acceptability, and perception among consumers. Their physico-chemical characteristics, glycemic response, sensory qualities, and general consumer approval across various demographic groups may all be evaluated through a comparative study. Such comparison studies offer insights into the advantages, disadvantages, and appropriate uses of each sweetener in the context of changing dietary choices and growing demand for natural ingredients.

This study aims to systematically compare plant-based sweeteners to identify their potential as mainstream sugar alternatives and explore their implications for health, product formulation, and consumer behaviour in modern food systems.

Background of the Study

Growing health concerns related to obesity, diabetes, and excessive sugar intake have encouraged consumers to shift toward natural plant-based sweeteners. As modern lifestyles emphasise wellness and clean-label products, understanding consumer consumption trends and adoption patterns of these natural sweeteners has become essential for guiding industry strategies and promoting healthier choices.

Problem Statement

Despite rising interest in natural plant-based sweeteners, consumer adoption varies due to differences in awareness, taste preferences, accessibility, and perceived health benefits. Limited comparative research exists on modern lifestyle consumption trends, creating a knowledge gap that restricts manufacturers, nutritionists, and policymakers from effectively promoting and integrating these sweeteners into daily diets.

Objective of the Study

1. To examine consumer awareness and preferences toward natural plant-based sweeteners.
2. To compare consumption trends and adoption levels of selected plant-based sweeteners in modern lifestyles.
3. To identify key factors influencing consumer acceptance and usage of natural plant-based sweeteners.

Research Questions

1. What is the level of consumer awareness and preference for natural plant-based sweeteners?
2. How do consumption trends and adoption rates differ among various plant-based sweeteners?
3. What factors influence consumer acceptance and use of natural plant-based sweeteners

Significance of the Study

This study provides valuable insights for food manufacturers, nutrition experts, and policymakers in understanding consumer behaviour toward natural sweeteners. It supports product development, promotes healthier dietary choices, and

guides strategic decisions in the growing market for natural plant-based sweeteners within modern, health-focused lifestyles.

Limitations of the Study

1. Limited to self-reported information, which might compromise accuracy.
2. Not every demographic group may be represented by geographic coverage.
3. Focuses purely on certain plant-based sweeteners, excluding less well-known alternatives.

Literature Review

Nutrition policies aimed at reducing sugar intake have increased the use of non-nutritive sweeteners (NNS) in foods and beverages. While NNS have lower energy intake, concerns persist about their role in promoting the consumption of ultra-processed foods. Evidence on global NNS trends and their dietary impact remains limited and inconsistent (Russell et al., 2020).

According to Kumar et al. (2021), Sweet taste is the most preferred flavour among humans, leading food industries to increase sweetener use, often at the cost of rising health risks. Excessive sugar intake contributes to obesity, metabolic disorders, diabetes, and dental issues, yet sugar consumption continues to grow. As health concerns escalate, consumers increasingly seek safer alternatives, especially natural plant-based sweeteners. It also highlights health concerns associated with both traditional and modern sweetening agents, emphasising the rising need for healthier sugar substitutes. (Anwar et al., 2023) Food producers are increasingly seeking vegan, low-calorie sweeteners as consumers move away from sucrose due to health concerns. Replicating sucrose's taste and texture is challenging, but growing interest in natural, plant-based options and advances in phytoceuticals and sustainable production have boosted demand for healthier, nutrient-preserving sweetening alternatives. This study compared Danish and Brazilian consumers' acceptance of plant-based cocoa ice cream sweetened with various natural sweeteners. Xylitol–sucrose blends maintained liking, while stevia-based samples were less accepted, especially by Danish consumers. Findings highlight cultural differences and the need for targeted consumer testing (Lacerda et al., 2023). Plant-based beverage success depends on understanding consumer behaviour shaped by health, sustainability, innovation, and sensory preferences. Overcoming barriers like neophobia through nutrient enhancement and sensory customization broadens appeal. A consumer-centric approach supports loyalty and market growth, emphasizing the need for continued research and innovation (Sharma et al., 2024). The rise in lifestyle diseases linked to excess sugar has increased demand for natural sweeteners. This review examines non-nutritive and bulk sweeteners, their applications across food sectors, and their effects on sensory and textural qualities. It also highlights sweetener blends and microencapsulation to improve taste, stability, and functionality (Ilaria Benucci et al., 2024).

Methodology

i. Research design:

The research conducted was descriptive and analytical, so a Survey method was used. A Survey was conducted using a structured questionnaire, tested for reliability, and data were collected across Mumbai, Thane, and Palghar.

ii. Primary data:

Primary data was collected randomly through the structured questionnaire in Mumbai, Thane and Palghar by using simple random sampling.

iii. Sample size:

The study was limited to participants who voluntarily completed the instruments in their entirety. There was a total of 350 respondents.

The sample to which the questionnaire was administered was based on random sampling techniques. The sample distribution was given in Table 1. Socio-Demographic profile

Parameters	Classification	Sample (N)	Percentage (%)
	Male	207	59.14

Gender	Female	143	40.86
	Total	350	100
Age (in years)	20-30	40	11.42
	31-40	167	47.71
	41-50	85	24.26
	50 and above	58	16.61
	Total	350	100
Occupation	Service/Employed	136	38.85
	Self-employed/Business	92	26.28
	Professional	85	24.28
	House Maker	30	8.57
	Student	07	2.02
	Total	350	100
Income Group (In Rupees)	Below 20,000	15	4.29
	20,000-30,000	110	34.43
	30,001-40,000	130	37.14
	40,001-50,000	85	24.29
	50,000 and above	10	2.85
	Total	350	100
Educational Qualification	Under graduate	07	2.00
	Graduate	167	47.71
	Post Graduate	76	21.71
	Others	100	28.58
	Total	350	100
Are you diabetic?	Yes	180	51.43
	No	170	48.57
	Total	350	100
If yes, mention the type	Type – I	85	24.29
	Type–II	95	27.14
	Not Applicable	170	48.57
	Total	350	100
Are you aware of natural sweeteners?	Yes	272	77.77
	No	43	12.30
	May be	35	10.00

	Total	350	100

Table 1. Source: Primary data

Which natural sweeteners have you heard of?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Stevia	176	50.3	50.3	50.3
	Jaggery	34	9.7	9.7	60.0
	Date Sugar/Syrup	44	12.6	12.6	72.6
	Monk fruit sweetener	75	21.4	21.4	94.0
	Maple Syrup	10	2.9	2.9	96.9
	Coconut Sugar	6	1.7	1.7	98.6
	Honey	4	1.1	1.1	99.7
	Agave nectar	1	.3	.3	100.0
	Total	350	100.0	100.0	

Do you believe natural sweeteners are healthier than artificial sweeteners or refined sugar?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	12	3.4	3.4	3.4
	Agree	163	46.6	46.6	50.0
	Strongly agree	175	50.0	50.0	100.0
	Disagree	00	00	00	
	Strongly Disagree	00	00	00	
	Total	350	100.0	100.0	

Compared to artificial sweeteners, how likely are you to recommend natural sweeteners to others?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Much more likely	62	17.7	17.7	17.7
	Somewhat more likely	259	74.0	74.0	91.7
	Neutral	27	7.7	7.7	99.4
	Somewhat less likely	2	.6	.6	100.0
	Total	350	100.0	100.0	

iv. Sample design:

When conducting the study, the researcher followed the rules and used a straightforward random sample strategy. The respondents who did not express a desire to participate in the study were not included in the analysis, as was advised during the study.

v. Area of research:

Mumbai, Thane, and Palghar

vi. Secondary data:

The secondary information or data was collected from newspapers, research articles, magazine, and websites.

vii. Research instruments

A summated closed-ended questionnaire was used with different viewpoints of respondents. In this questionnaire, all the questions were positively framed to study the impact of independent variables like age, gender and profession on the dependent variable.

viii. Statistical analysis

Efficient and effective data analysis is the result of effective data preparation. This was found to be very crucial between the completion of the field work and the statistical processing of the collected data. Based on the data sheet, tables and graphs were prepared for the analysis.

Hypothesis

1. H_0: There is no significant relationship between consumer awareness and the likelihood of using natural plant-based sweeteners.
   $H_{a:}$ There is a significant relationship between consumer awareness and the likelihood of using natural plant-based sweeteners.
2. H_0: There is no positive correlation between Consumption patterns and preferences that significantly differ among various natural plant-based sweeteners.
   $H_{a:}$ There is a positive correlation between Consumption patterns and preferences that significantly differ among various natural plant-based sweeteners.
3. H_0: There is no correlation between factor influences and a significant influence on the adoption of natural plant-based sweeteners.
   H_a: There is no correlation between factor influences and a significant influence on the adoption of natural plant-based sweeteners.

Analysis

1. H_0: There is no significant relationship between consumer awareness and the likelihood of using natural plant-based sweeteners.

Case Processing Summary							
	How often do you use natural sweeteners?	Cases					
		Valid		Missing		Total	
		N	Percent	N	Percent	N	Percent
Are you aware of natural sweeteners?	Daily	189	100.0%	0	0.0%	189	100.0%
	2–3 times a week	132	100.0%	0	0.0%	132	100.0%
	Occasionally	17	100.0%	0	0.0%	17	100.0%
	Rarely	12	100.0%	0	0.0%	12	100.0%

Table 2. Source: Primary data - Shapiro–Wilk Test

Tests of Normality							
	How often do you use natural sweeteners?	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	Df	Sig.
Are you aware of natural sweeteners?	Daily	.520	189	.000	.355	189	.000
	2–3 times a week	.409	132	.000	.647	132	.000
	Occasionally	.367	17	.000	.684	17	.000
	Rarely	.262	12	.022	.781	12	.006
a. Lilliefors Significance Correction							

Table 3. Source: Primary data - Shapiro–Wilk Test

Conclusion on Hypothesis:

The null hypothesis is rejected.

There is a significant relationship between consumer awareness and the likelihood of using natural plant-based sweeteners.

Interpretation

The Shapiro–Wilk results show that all usage groups (Daily, 2–3 times a week, Occasionally, Rarely) have p-values below .05, indicating the data is not normally distributed. Since the assumption of normality is violated, a parametric test cannot be applied to examine the relationship between awareness and usage of natural plant-based sweeteners. Therefore, the stated hypothesis of a significant relationship cannot be accepted based on this test alone. Instead, non-parametric tests such as Chi-Square should be used to determine whether awareness influences usage behaviour among consumers.

2. H_0: There is no positive correlation between Consumption patterns and preferences that significantly differ among various natural plant-based sweeteners.

Ranks			
	Are you aware of natural sweeteners?	N	Mean Rank
Which natural sweeteners have you heard of?	Yes	272	172.27
	No	43	172.72
	May Be	35	204.00
	Total	350	
Why do you prefer natural sweeteners?	Yes	272	170.13
	No	43	190.83
	May Be	35	198.39
	Total	350	

Table 4. Source: Primary data - Kruskal-Wallis Test

Test Statistics[a,b]		
	Which natural sweeteners have you heard of?	Why do you prefer natural sweeteners?
Kruskal-Wallis	3.588	5.191

H		
Df	2	2
Asymp. Sig.	.166	.075
a. Kruskal-Wallis Test		
b. Grouping Variable: Are you aware of natural sweeteners?		

Table 5. Source: Primary data - Kruskal-Wallis Test

Conclusion on Hypothesis:

The null hypothesis is rejected.

There is a positive correlation between consumption patterns and preferences that significantly differ among various natural plant-based sweeteners.

Interpretation

The null hypothesis is not accepted, as the Kruskal–Wallis tests show p-values (.166 and .075) greater than .05, indicating no statistically significant difference between groups.

The Kruskal–Wallis results show no significant difference in consumption patterns preferences among awareness groups, as p-values exceed .05. This indicates that awareness does not meaningfully influence which sweeteners consumers know or why they prefer them. Therefore, consumption and preference patterns do not significantly differ across natural sweetener types.

3. H_0: There is no correlation between factor influences and a significant influence on the adoption of natural plant-based sweeteners.

Test Statistics[a]		
	What factors influence your choice of natural sweetener?	Which natural sweeteners have you heard of?
Mann-Whitney U	3972.000	4106.500
Wilcoxon W	32413.000	4772.500
Z	-.741	-.437
Asymp. Sig. (2-tailed)	.459	.662
a. Grouping Variable: Why do you prefer natural sweeteners?		

Table 6. Source: Primary data - Mann-Whitney Test

Conclusion on Hypothesis:

H_0: There is no correlation between factor influences and the significant influence on the adoption of natural plant-based sweeteners.

The null hypothesis is accepted, as both Mann–Whitney tests show p-values (.459 and .662) greater than .05, indicating no significant difference between groups.

Interpretation

The Mann–Whitney results show non-significant p-values, meaning the factors influencing sweetener choice and the

types heard of do not differ across preference groups. This indicates no meaningful correlation between influencing factors and adoption behaviour. Therefore, consumers' reasons for preferring natural sweeteners do not significantly shape their actual adoption patterns.

Discussion

The findings highlight a growing interest in natural plant-based sweeteners; however, awareness alone does not significantly influence adoption or consumption frequency. The Shapiro–Wilk test revealed non-normal data distribution, indicating varying consumption behaviour across respondents. While many consumers are aware of sweeteners like stevia, monk fruit, jaggery, and coconut sugar, the Kruskal–Wallis test showed no significant variation in preference or recognition across awareness categories. This suggests that consumers do not necessarily translate awareness into diversified usage patterns. Taste preference, product familiarity, and cultural habits continue to play dominant roles. Furthermore, the Mann–Whitney results confirm that factors such as perceived health benefits, availability, cost, and trust do not differ significantly across groups and therefore do not drive adoption strongly.

Despite widespread concerns about sugar-related health risks, consumers still rely heavily on taste acceptance and product accessibility. This indicates that natural sweeteners need stronger marketing positioning, improved sensory similarity to sugar, and wider availability. Overall, the study reflects an emerging but still developing trend toward adopting natural sweeteners. Consumers are health-conscious but may lack adequate information or motivation to consistently replace traditional sugar with plant-based options. Greater education, taste-improved formulations, and pricing strategies may enhance adoption in the future.

Recommendation/Suggestion

1. Strengthen awareness campaigns by educating consumers about health benefits, glycemic impact, and natural origins of plant-based sweeteners.
2. Improve taste and formulation to closely mimic the sensory profile of sugar, increasing acceptance in daily foods and beverages.
3. Enhance affordability and availability through wider retail distribution, small, affordable packaging, and promotional pricing.
4. Promote culturally relevant applications, such as use in Indian sweets, tea, and home cooking, to increase familiarity.
5. Develop targeted marketing strategies for diabetics, fitness-oriented consumers, and young health-conscious groups to boost adoption.

Conclusion

The study concludes that although consumer awareness of natural plant-based sweeteners is relatively high, this awareness does not significantly influence consumption behaviour or sweetener preference. Non-parametric analyses demonstrate that awareness levels do not translate into differentiated adoption patterns across consumer groups. Factors such as taste, availability, and affordability continue to overshadow health-driven motivations. Despite the growing trend toward healthier lifestyles, many consumers remain attached to traditional sugar due to its familiarity and sensory appeal. This gap between awareness and actual adoption reflects the need for improved communication of benefits, better product development, and stronger market penetration.

The Kruskal–Wallis and Mann–Whitney results confirm that neither consumption patterns nor influencing factors differ significantly across categories, indicating that consumer choices are largely homogeneous regardless of awareness levels. This suggests that plant-based sweeteners have not yet achieved mainstream acceptance comparable to sugar or artificial sweeteners. To enhance adoption, manufacturers must focus on improving taste profiles, reducing prices, and creating greater visibility across markets.

In conclusion, natural plant-based sweeteners hold strong potential in a health-conscious society, but their adoption is still emerging. With sustained awareness efforts, product innovation, and market support, these sweeteners can become widely accepted as healthier sugar alternatives in modern lifestyle diets.

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