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A study on the acid lime product preparation and storage methods followed in the households of Vijayapura District, Karnataka, India

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Abstract

This study explores household practices for the utilization and storage of acid lime, with a focus on the distinctions between rural and urban households. The analysis reveals significant variations in the preparation and preservation methods employed for ripe and unripe acid limes. Pickles emerged as the most common product prepared by rural households, with 64.67% using ripe fruits for this purpose, compared to only 30.67% of urban households. Conversely, urban households showed a higher preference for juice preparation, with 58% using ripe fruits for this purpose, highlighting the influence of lifestyle and convenience. Chutney and sambar preparation were less common across both demographics. Among unripe acid limes, pickles were again the predominant product, prepared by 60% of rural and 62% of urban households. Additionally, urban households demonstrated a higher tendency to make chutney and powder from unripe fruits compared to their rural counterparts. The study also analysed storage practices, uncovering marked differences in methods. Urban households predominantly relied on refrigeration (62%), reflecting better infrastructure access and a preference for modern methods. In contrast, rural households favoured traditional storage options, such as cane baskets (48.67%), emphasizing cost-effectiveness and resourcefulness. Plastic baskets were also commonly used, particularly in rural areas, while polythene covers saw moderate usage in both groups, with higher adoption in urban households. These findings indicate the interplay of socio-economic factors, lifestyle and infrastructure in shaping household practices. The study underscores the importance of tailored extension programs and market strategies to address the needs of diverse demographic groups, promoting optimal utilization and storage of acid limes while minimizing waste. By understanding the underlying preferences and constraints, targeted innovations such as ready-to-use products and affordable storage solutions can bridge the gap between traditional and modern practices. This research contributes to a comprehensive understanding of acid lime utilization and preservation, paving the way for sustainable advancements in agricultural production and household food management.

Keywords: Acid lime, product preparation, storage methods

Introduction

The Kagzi lime variety, originating from the Vijayapura district, has earned the prestigious Geographical Indication (GI) tag, recognizing its distinctiveness and importance (Kumar *et al*., 2017) [6]. In the district, Indi taluka stands out with 4,681 hectares dedicated to lime cultivation, resulting in a production of 107,601 metric tons and a productivity rate of 22.98 metric tons per hectare. In comparison, Sindagi taluka cultivates 1,496 hectares, yielding 31,592 metric tons at a productivity rate of 21.11 metric tons per hectare (Government of Karnataka, Department of Horticulture, 2021). Acid lime, a versatile and widely cultivated citrus fruit, plays a significant role in the dietary and economic aspects of households in rural and urban areas. Its unique flavor and nutritional properties make it a preferred ingredient for a variety of culinary preparations, ranging from pickles and juices to chutneys and powders. However, the utilization and storage practices of acid lime exhibit notable variations between rural and urban households, shaped by differences in lifestyle, resource availability and infrastructure (El-sherbirny *et al*., 1977) [3]. Understanding these practices is essential for promoting optimal use, minimizing waste and developing targeted interventions to enhance efficiency and sustainability. By analyzing the patterns of acid lime usage and storage in diverse settings, this study seeks to uncover the socio-economic factors influencing these practices. The findings aim to provide insights into improving value addition, storage methods and agricultural extension programs, ensuring a holistic approach to the management and utilization of acid lime (Cooner *et al*., 1988) [1].

Materials and Methods

The study was conducted during the year 2023-24 in the Vijayapura district of Karnataka, India, to examine the purchasing behaviour and quality preferences of households for acid lime fruits. Specific parameters, such as fruit colour and appearance, were assessed following the DUS

(Distinctness, Uniformity and Stability) guidelines for citrus crops. Additionally, data on fruit maturity were collected based on the purchasing habits of the households.

A structured interview schedule was developed to align with the study's objectives and variables. The schedule was designed through consultations with experts and by reviewing relevant literature. It underwent pretesting in a non-sample area to ensure its applicability and relevance. Necessary adjustments were incorporated into the final schedule based on the pretesting results.

Statistical Tools Employed

To analyse the collected data, the following statistical measures were utilized (Panse and Sukhtame, 1954) [9]:

1. **Mean:** The arithmetic mean was calculated to summarize data by dividing the total sum of observations by the number of observations. This measure was used to classify independent variables into categories of low, medium and high levels. Formula: $$\bar{X} = \frac{\sum X}{N}$$ Where:
   - X¯\bar{X} = Mean
   - ∑X\sum X = Sum of all observations
   - NN = Number of observations
2. **Frequency:** Frequency analysis was performed to determine the distribution patterns of respondents across selected variables, allowing a clearer understanding of their importance based on respondents' perceptions.
3. **Percentage:** Percentages were calculated to facilitate simple comparisons of data.
4. **Standard Deviation:** Standard deviation was employed to measure the extent of data dispersion around the mean. This tool was instrumental in categorizing variables into low, medium and high groups

Formula: $$SD = \sqrt {\frac{\sum (X - \bar{X})^2}{N}}$$ Where:

- SDSD = Standard Deviation
- XX = Individual observations
- X¯\bar{X} = Mean
- NN = Number of observations

Results and Discussion

The data in Table 1 illustrates distinct preferences and practices between rural and urban households in utilizing ripe and unripe acid limes for food preparation. These differences highlight the socio-cultural and economic factors influencing culinary choices in both settings.

Rural vs. Urban Preferences for Ripe Fruits

Pickles were notably the most common product among rural households using ripe fruits, with 64.67% of them preparing this item. This preference could stem from traditional practices, the need for long-term preservation, or limited access to fresh produce storage facilities. In contrast, urban households showed a lower inclination towards preparing pickles (30.67%), possibly due to easier access to commercially available options. Instead, urban households leaned towards juice production (58%), a quicker and more convenient option that reflects their fast-paced lifestyle. The preparation of chutney and sambar was relatively minimal in both groups, suggesting these items are secondary in terms of preference (Kumar *et al*., 2017) [6].

Utilization of Unripe Acid Limes

When it came to unripe fruits, pickles continued to dominate as the most popular product in both rural (60%) and urban (62%) households. This consistency might be due to the acidic profile of unripe fruits, which aligns well with pickle-making. However, urban households exhibited a higher tendency to use unripe fruits for chutney (18%) compared to rural ones (9.33%). This difference could indicate a broader diversity in urban culinary practices. The preparation of powder from unripe fruits was minimal in both settings, possibly due to the specialized effort and equipment required (Kaul and Saini, 2000) [5].

Implications and Insights Overall, the findings underline that pickles and juice are the most prepared products from acid limes, albeit with notable rural-urban differences. Rural households prioritize traditional and preservation-centric practices, while urban ones lean towards convenience and diversity in utilization (Devi *et al*., 2015) [2]. These patterns could serve as valuable insights for developing tailored extension programs, market strategies and educational initiatives aimed at promoting acid lime utilization effectively across different demographic groups (Jittanit *et al*., 2013) [4]. These preferences not only mirror lifestyle and cultural variations but also underline the potential for targeted innovation to cater to specific consumer needs. For example, developing ready-to-use pickle kits or freshly packaged juice options could bridge the gap between traditional practices and modern convenience (Mavinalli *et al*., 2024 in Guva) [7].

Table 1: Products prepared from acid lime by households (N=300)

Sl. No.	Characteristics	Rural (n_1=150)		Urban (n_2=150)	
		f	%	f	%
a. Ripe acid lime					
1.	Pickle	97	64.67	46	30.67
2.	Juice	41	27.33	87	58.00
3	Chutney	12	8.00	17	11.33
4	*Sambar*	7	4.67	5	3.33
b. Unripe acid lime					
1.	Powder	05	03.33	09	06.00
2.	Pickle	90	60.00	93	62.00
3.	Chutney	14	09.33	27	18.00

Multiple responses are possible, f - Frequency, % - Percentage

The data presented in Table 7 highlights significant differences in the storage practices for acid lime between rural and urban households, reflecting varying lifestyles, infrastructure access and preferences.

Refrigeration vs. Traditional Methods

Urban households demonstrate a clear preference for refrigeration, with 62% employing this method. This reliance is indicative of better access to modern infrastructure and convenience-oriented practices. Refrigeration ensures longer shelf life and preserves the quality of acid limes, aligning with urban households' demand for freshness and their comparatively higher economic capacity. In contrast, only 27.33% of rural households utilize refrigeration, possibly due to limited availability of refrigerators or electricity. The disparity underscores the urban-rural gap in technological adoption

and resource accessibility. On the other hand, rural households show a strong preference for traditional storage methods, with cane baskets being the most used at 48.67%. This practice emphasizes the resourcefulness and cost-efficiency of rural communities, where natural and locally available materials are adapted for everyday use. Cane baskets, though effective for short-term storage, may be less efficient for long-term preservation compared to refrigeration (Tavallai and Zareiyan, 2018) [9]. Interestingly, only 6.66% of urban households use cane baskets, further highlighting the shift towards modern storage methods in urban areas.

Plastic Baskets and Polythene Covers

Plastic baskets serve as another popular storage option, utilized by 43.33% of rural households and 23.33% of urban ones. Their widespread use in rural areas suggests their affordability and ease of access. Urban households may prefer alternatives that cater to their emphasis on aesthetics and convenience, reducing reliance on plastic baskets. The use of polythene covers reveals more nuanced differences, with 16.67% of rural respondents and 28% of urban respondents adopting this method. Polythene covers are lightweight and adaptable but may not offer the same protection against spoilage as refrigeration (Thamisel *et al*., 2015) [10]. Their higher use in urban households could suggest a need for portable and quick storage solutions (El-Sherbiny *et al*., 1977) [3].

Table 2: Household storage practices followed for acid lime by households (N=300)

Sl. No.	Parameters	Rural (n_1=150)		Urban (n_2=150)	
		f	%	f	%
1	Refrigeration	41	27.33	93	62.00
2	Cane basket	73	48.67	10	6.66
3	Plastic basket	65	43.33	35	23.33
4	Polythene cover	25	16.67	42	28.00

Multiple responses are possible, f - Frequency, % - Percentage

Conclusion

The study highlights significant differences in the utilization and storage practices of acid lime between rural and urban households, shaped by socio-economic factors and accessibility to resources. Rural households predominantly rely on traditional methods, emphasizing cost-effectiveness and adaptability, while urban households favor modern, convenience-driven practices like refrigeration. Pickles and juice emerge as the most prepared products, reflecting varying culinary preferences. These insights underscore the need for tailored interventions, such as promoting affordable storage solutions and developing value-added products, to bridge the rural-urban divide. Such initiatives can enhance acid lime utilization, minimize waste and support sustainable agricultural practices.

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