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Research Paper

Mushroom cultivation and rural development in sivaganga district of tamil nadu

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ABSTRACT

Mushrooms have been consumed for centuries and are recognized for their nutritional and economic potential. Their low-cost inputs, high yields, and ability to grow on agricultural waste make them an attractive agricultural venture, especially for rural communities. In Tamil Nadu, mushroom farming has seen growth due to favorable climatic conditions and increasing demand for nutritious food. The current study focuses on farm women in the Sivaganga district, particularly mushroom farmers from four self-help groups (SHGs). Using both primary and secondary data collection methods, the study evaluates these women's role performance, awareness levels, and training needs in mushroom farming. Primary data was gathered through structured interviews, focus group discussions, and observations, while secondary sources included government reports and SHG records. The study assessed key activities such as spawn procurement, production processes, and post-harvest management, as well as the women's access to resources and credit. Findings from the study led to the development of a multi-stakeholder, gender-sensitive entrepreneurship model for mushroom farming. This study is aims to enhance the skills and income of farm women, empowering them to become successful agripreneurs. The combined use of primary and secondary sources ensured a comprehensive analysis of the socio-economic dynamics in mushroom farming.

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1. INTRODUCTION

Mushrooms are the fruiting bodies of edible fungi, primarily from the Basidiomycotina group. Historical records suggest that they have been consumed as food since around 3000 B.C., according to ancient Indian texts. Over the centuries, mushrooms have been enjoyed in various countries, including Greece, Egypt, and France. The Greeks and Romans famously referred to mushrooms as "food for the gods," and during that time, people foraged them from the wild. Commercial cultivation began in early 18th-century France, becoming a thriving industry by 1850 in Paris. In India, the first successful cultivation of the common mushroom (Agaricus bisporus) took place in Himachal Pradesh in 1961, leading to a gradual rise in popularity across the country. Research has shown that mushrooms enhance human nutrition and are often touted as the "delight of the diabetic." Known as the "ultimate health food," they can be consumed in various forms—fresh, pickled, dried, powdered, or canned. Their cultivation has grown rapidly due to their nutritional and medicinal benefits, as well as their low-cost inputs and high yields. Mushrooms contain over 90 percent of water, less than one percent of fat, and are rich in Vitamin B, Vitamin D, copper, selenium, and low in sodium [1].

Mushrooms are an economical crop to cultivate, requiring minimal resources and space. They can be grown year-round and globally from low-cost materials. There is significant potential for producing highly nutritious and flavorful food from readily available and inexpensive substrates [2]. Additionally, mushrooms are environmentally friendly, as they can transform lignocellulosic waste into food, animal feed, and fertilizers [3], [4]. However, mushroom consumption and production remain low compared to other crops, and investment in the mushroom industry is limited [5]. Among all protected crops worldwide, mushrooms have the highest gross value per area cultivated, yet their total gross value is only about one-third that of wheat. The study of mushroom science is still relatively new, and the industry remains small compared to other agricultural sectors, resulting in restricted investment [6].

Mushroom production in India began in the 1970s, but advancements in environmental control technologies and a better understanding of cropping systems have significantly boosted output. By 2010, button mushrooms comprised 89 percent of total mushroom production, with oysters at six percent, milky mushrooms at one percent, and other varieties making up four percent. Currently, the total production of white button mushrooms in India, from both seasonal and high-tech cultivation methods, is estimated at 94,676 metric tons, accounting for approximately 73 percent of the country's overall mushroom production.

Mushroom cultivation is emerging as a lucrative agricultural venture in Tamil Nadu, driven by the state's favorable climate and growing demand for mushrooms as a nutritious food source. Tamil Nadu, with its warm and humid conditions, provides an ideal environment for cultivating varieties like Oyster, Milky, and Button mushrooms. Farmers in districts such as Salem, Erode, and Coimbatore have embraced mushroom farming due to its low investment, short cultivation cycles, and high returns. Training programs and government schemes, such as the National Horticulture Mission, have further supported mushroom growers by offering financial aid, technical guidance, and market linkages. Many women entrepreneurs, especially in rural areas, have taken up mushroom farming, contributing to family incomes and creating employment opportunities. In recent years, mushroom farming has gained traction as a sustainable agricultural practice, as it requires minimal land and water resources.

The use of agricultural waste, such as paddy straw, for mushroom production also promotes eco-friendly farming [7]. With increasing consumer awareness about the health benefits of mushrooms, including their rich protein and vitamin content, the mushroom industry in Tamil Nadu holds significant potential for growth and expansion in the future [8]. However, the condition of mushroom cultivation in Sivaganga district of Tamil Nadu is need to be understand.

2. RELATED WORK

Mushrooms are widely recognized as a nutritious and safe food option for individuals of all ages, from children to the elderly. They provide a valuable source of protein while containing low levels of

carbohydrates and fats. As such, their primary economic significance lies in their role as a food source for human consumption [9], [10]. Recently, there has been growing recognition of mushrooms as an excellent protein source, prompting increased efforts to promote their cultivation as a commercial venture to improve protein availability [11].

In addition to their nutritional benefits, mushrooms have substantial economic importance for various reasons [12], [13]. First, they offer a profitable agricultural opportunity, requiring minimal initial investment and yielding high returns, making them an attractive option for small-scale farmers seeking to diversify their income [14]. Furthermore, the global demand for both culinary and medicinal mushrooms enhances their export potential, allowing producers to access international markets.

The mushroom industry is also labor-intensive, generating numerous job opportunities in cultivation, processing, and marketing, particularly in rural areas [15], [16]. Additionally, mushrooms support sustainable agriculture by utilizing agricultural waste products as substrates, thereby aiding environmental conservation efforts. Their significant nutritional value helps address food security concerns by providing essential nutrients [17]. Finally, the rising interest in medicinal mushrooms has fueled research and development, leading to advancements in pharmaceuticals and nutraceuticals, further enhancing their economic impact.

Mushroom Cultivation in India

India is home to a diverse array of wild mushrooms that significantly contribute to the country's biodiversity. Beyond being a delicacy, mushrooms are an essential part of the diet for many people in India, owing to their nutritional benefits and economic value. They provide livelihoods for local communities in rural areas and hold considerable economic importance. Mushrooms are collected, consumed, and traded, generating income for many [10], [15], [16], [13].

- **Key Mushroom Varieties in India**
- **Agaricus Bisporus (Button Mushroom):** The most widely cultivated and consumed mushroom globally, including in India. It is a significant source of protein and vitamins for vegetarians and generates substantial income for growers.
- **Morchella Esculenta (Morel Mushroom):** Highly prized for its unique flavor and texture, morels command high prices in both domestic and international markets, benefiting local economies.
- **Termitomyces spp. (Termite Mushroom):** These mushrooms appear during the monsoon season and have a symbiotic relationship with termite mounds. Valued for their delicious taste, they provide income for tribal communities that collect and sell them.
- **Astraeus Hygrometricus (Rugda):** Indigenous communities in Jharkhand, Odisha, West Bengal, and Chhattisgarh gather this mushroom from nearby Sal forests during June and July. After collection, it is washed and prepared as a vegetable, known for its enjoyable flavor and nutritional richness.
- **Cantharellus Cibarius (Chanterelle Mushroom):** Renowned for its golden color and distinct flavor, this mushroom is foraged from India's wild forests and is considered a culinary delicacy. The collection and sale of chanterelles support the livelihoods of forest-dependent communities.
- **Amanita Spp:** Historically significant, these mushrooms are still valued in certain regions of India for their exceptional taste and their role in local food traditions and economies.
- **Russula Spp:** Collected from the wild for their edibility and nutritional value, these mushrooms are part of traditional diets in many forested areas of India.

Mushroom Cultivation in Tamil Nadu

1. **Production Volume:** Tamil Nadu is among the top states for mushroom production in India, contributing significantly to the country's total output. As of recent estimates, the state produces around 20,000 metric tons of mushrooms annually, primarily focusing on button and oyster varieties.

2. **Leading Varieties:**
   - Button Mushroom: The most cultivated variety, accounting for approximately 70 percent of total production.
   - Oyster Mushroom: Gaining popularity due to its nutritional benefits, constituting about 20-25 percent of production.
   - Milky Mushroom: A smaller yet notable segment, especially among niche markets.

3. **Cultivation Techniques:** Farmers in Tamil Nadu have increasingly adopted modern techniques, including:
   - Controlled Environment Agriculture: This method enhances yield and quality through optimized growing conditions.
   - Use of Agricultural Waste: By utilizing substrates like paddy straw and sugarcane bagasse, farmers are able to reduce costs and increase sustainability.

4. **Economic Contribution:** Mushroom farming provides employment to thousands in rural areas, particularly benefiting women and smallholder farmers. It also serves as a supplementary income source.

5. **Market Demand:** The demand for mushrooms in urban markets has been rising due to health trends and culinary uses. This growing market is encouraging more farmers to engage in mushroom cultivation.

6. **Government Support:** The Tamil Nadu government has initiated various programs to promote mushroom cultivation, including training programs and financial assistance for new growers.

Mushroom farming has transformed the lives of many women in India. While often viewed as a small-scale venture, it has the potential to significantly boost the rural economy. It is crucial to provide farm women with relevant information, including the advantages and challenges of mushroom cultivation, to encourage them to grow mushrooms at home with minimal initial investment [18]. For women seeking to earn an income, mushroom cultivation is a simple, viable, and profitable option. As an agricultural activity, it is particularly well-suited for women, offering a pathway to economic empowerment and social independence [19], [20]. Rural women can engage in this venture without sacrificing their household responsibilities, as it is low-cost, requires less labor, and can serve as a form of employment in both semi-urban and rural areas. This initiative can be instrumental in empowering women and improving their status in a male-dominated society. To elevate their circumstances from poverty to prosperity, it is essential to provide ample support, such as vocational training, entrepreneurship development programs, financial assistance, and skill enhancement initiatives [21]. By fostering self-reliance and self-employment, mushroom farming can ensure a steady income for families while empowering women in the process [22].

3. METHODOLOGY

This study aimed to evaluate the role performance of farm women involved in mushroom farming in the Sivaganga district of Tamil Nadu, focusing on their awareness levels and training needs. A mixed-methods approach was employed, integrating both qualitative and quantitative research methods to ensure a comprehensive analysis of the socio-economic dynamics at play in mushroom cultivation.

1. Sample Selection

The study targeted a sample of 50 women mushroom farmers drawn from four self-help groups (SHGs) in the Sivaganga district. The selection of participants was based on their involvement in mushroom farming, ensuring that the sample included diverse experiences and perspectives. Participants were recruited through a combination of purposive sampling, aimed at including women actively engaged in

mushroom production, and convenience sampling, based on their availability and willingness to participate.

2. Data Collection Methods

Primary Data

Primary data was collected through multiple methods to gather comprehensive insights into the experiences and challenges faced by the women:

- **Structured Interviews:** Individual interviews were conducted using a pre-designed questionnaire that encompassed both closed and open-ended questions. This format allowed for the collection of quantitative data on participation in various activities (e.g., spawn procurement, production processes, and marketing) and qualitative insights into their role performance and challenges faced in mushroom farming.
- **Focus Group Discussions (FGDs):** FGDs were organized with groups of 8-10 women to facilitate discussions about shared experiences, perceptions of their roles in mushroom farming, and awareness of available resources. The discussions were guided by a facilitator who ensured that all voices were heard and that the conversation remained focused on the study's objectives.
- **Direct Observations:** Researchers conducted on-site observations of the mushroom farming activities carried out by the participants. This allowed for a better understanding of the production processes, environmental conditions, and the actual involvement of women in various farming activities.

Secondary Data

- **Government Reports:** Official documents and publications from local agricultural departments provided contextual information on policies, support mechanisms, and the overall landscape of mushroom farming in Tamil Nadu.
- **Self-Help Group Records:** Records from the SHGs included details about training programs attended by the members, financial assistance received, and participation rates in various agricultural activities.
- **Literature Review:** Relevant academic articles, research studies, and market analysis reports were reviewed to gather existing knowledge on mushroom farming, particularly in relation to women's participation and economic empowerment.

3. Variables Examined

The study assessed various role performance variables, including:

- **Access to Resources:** Evaluation of the women's access to critical inputs such as quality spawn, agricultural waste materials, and information regarding farming techniques.
- **Credit and Financial Resources:** Analysis of their access to financial support through SHGs and government schemes, including loans and grants for mushroom cultivation.
- **Physical Assets:** Assessment of the physical resources available to the women, such as land, equipment, and infrastructure necessary for mushroom production.
- **Training Needs:** Identification of specific areas where the women expressed a need for further training, such as production techniques, post-harvest management, and marketing strategies.

4. Data Analysis

Data collected from structured interviews and FGDs were coded and analyzed using both qualitative and quantitative methods. Descriptive statistics were used to summarize quantitative data, while thematic analysis was employed for qualitative data, allowing for the identification of key themes related to the women's experiences, challenges, and training needs.

The combined use of primary and secondary data sources facilitated a robust analysis of the socio-economic dynamics influencing mushroom farming and enabled the formulation of informed recommendations.

5. Development of the Entrepreneurship Model

Based on the findings, a multi-stakeholder, gender-sensitive entrepreneurship model for mushroom farming was developed. This model aims to enhance the skills and income of farm women, empowering them to become successful agripreneurs. The model emphasizes collaboration among various stakeholders, including government agencies, NGOs, research organizations, and the women themselves, to create a supportive ecosystem for sustainable mushroom farming.

4. RESULTS AND DISCUSSION

The data collected from the participating women involved in mushroom farming regarding their engagement, level of awareness, access to and control over farm resources, credit, physical resources, and perceived training needs have been analyzed and are presented in the following Table 1, Table 2.

Table 1. The degree to women farmers is aware about mushrooms cultivation

Awareness level	Fully Aware (%)	Partially Aware (%)	Not Aware (%)
Identifying the kind of Mushroom	78	18	4
Disease Control	86	14	-
Duration of Crop	92	08	-
Management of Pest	94	06	-
Production of Spawn	88	12	-
Availability of Market	92	8	-
Governments Schemes	84	12	4
Preparing value added products	72	16	12

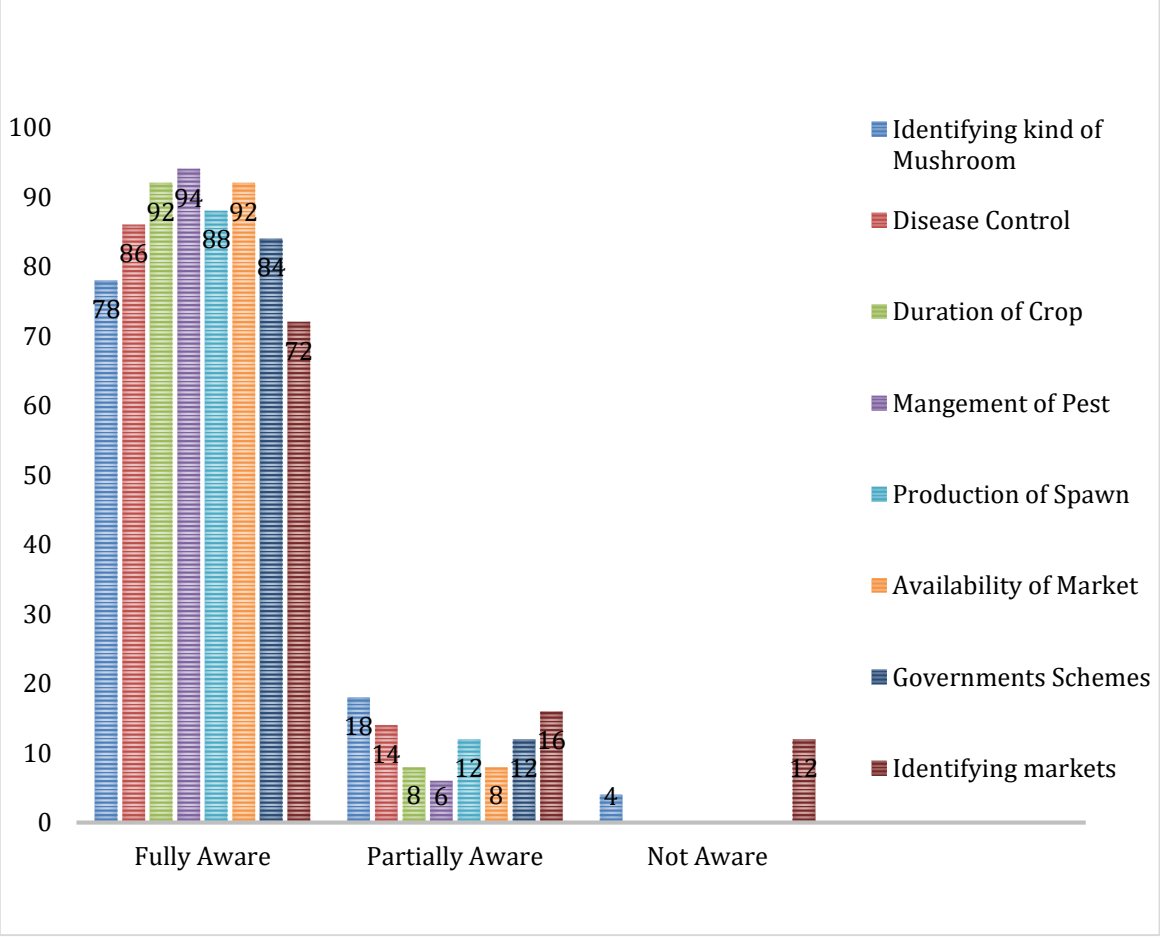


Figure 1. Women Farmers is Aware on Mushrooms Cultivation

The awareness level of farm women, as shown in Table 1, indicates that the majority were fully aware of pest management (94%), crop duration (92%), and market availability (92%). Awareness was slightly lower for identifying mushroom types (78%), disease control (86%), spawn production (88%), government schemes (84%), and preparing value-added products (72%). Similarly, they were partially aware of most other activities required for mushroom farming. In contrast, 12 percent were not aware of how to prepare value-added products, which highlights the need for technical knowledge and skill upgrades among farm women.

Table 2. Women farmers' perceived training needs in mushroom cultivation

Training needs	Fundamentally Required (%)	Moderately Required (%)	Not Required (%)
Production of spawn	64	24	14
Disease control	78	16	06
Post-harvest management	82	18	-
Harvesting	54	24	-
Marketing	88	12	-
Storage	52	22	26

The findings in Table 2 highlight the perceived training needs of farm women in mushroom farming. Post-harvest management and marketing emerged as the top priorities, followed by disease control and production, with the highest percentages. Harvesting and storage were identified as key areas of concern, with 54 percent and 52 percent of respondents, respectively, highlighting their importance. Training on market information sources and marketing channels for mushrooms, as well as value-added mushroom products, should be provided, especially to SHG women, through various electronic platforms.

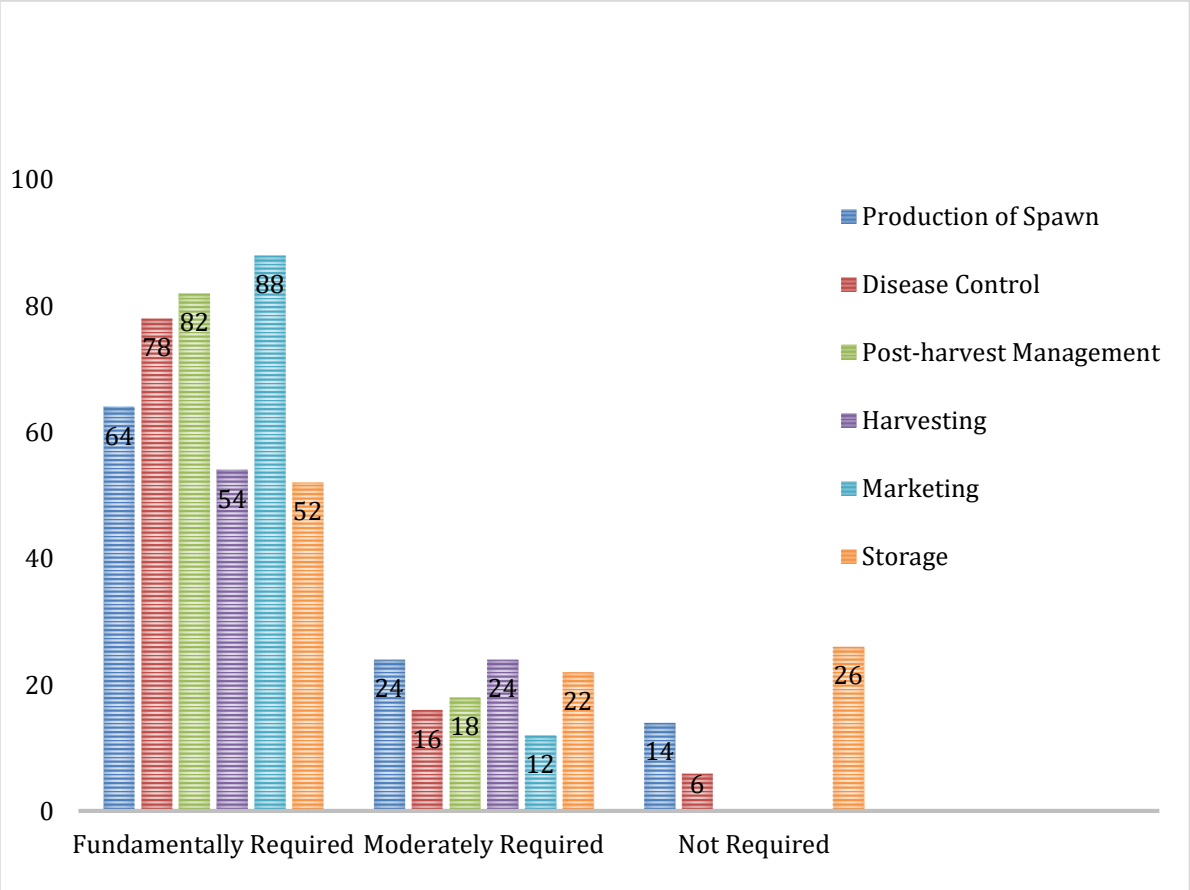


Figure 2. Women Farmers' Perceived Training Needs in Mushroom Cultivation

The role of input providers, such as research organizations (Central Government, State Government, and private entities), is to produce and supply quality inputs to the next stakeholders—government and private input suppliers. Input suppliers then collect inputs, such as spawn, from research organizations and distribute them to various users, including individual women farmers, Women SHG groups, and Women FPOs [23].

Women farmers, or input users, cultivate mushrooms using seeds provided by the input suppliers. For efficient production, critical needs such as skill-based capacity building programs, access to credit, and market linkages are essential. Once the mushrooms are produced, they are supplied by the input users to various market channels, including wholesalers, traders, and retailers. Input users may also sell directly to retailers, ensuring profitable income. Retailers, including businesses like restaurants, then provide the product to the end consumers. In this way, the entire value chain becomes a profitable enterprise for all stakeholders involved [24].

5. CONCLUSION

The economic significance of mushrooms goes beyond their direct applications in various industries; they also play a vital role in promoting sustainable agricultural practices and environmental conservation. Mushroom cultivation offers economic opportunities for tribal communities, small-scale farmers, and entrepreneurs, thereby contributing to rural development and food security [25]. As research continues into their nutritional, medicinal, and ecological benefits, the global value of mushrooms is expected to grow. However, the mushroom sector faces several challenges, including limited knowledge and inadequate production techniques among farmers, as well as insufficient infrastructure within the industry. It is essential to develop sustainable production methods that enhance market linkages and add value throughout the supply chain [26].

Mushroom farming is poised to become a profitable enterprise in the coming years, improving the socio-economic conditions of farm families and addressing employment challenges in rural and semi-urban areas, particularly for women. This profession is particularly accessible to women, providing a steady income for rural households. Farm women can engage in mushroom cultivation as an entrepreneurial venture through self-help groups. Their involvement is especially significant in tasks such as packaging, grading, sorting, and harvesting.

Women farmers have demonstrated a high level of awareness regarding the mushroom varieties commonly cultivated in their areas and expressed a strong need for training in post-harvest management and marketing. Mushroom cultivation holds great potential for empowering farm women, enhancing their family income, and contributing to the rural economy as well as the national economy through exports to countries with high demand for mushrooms. The robust international market for mushrooms can inspire women to adopt this crop as a primary focus for cultivation, ultimately transforming their fortunes and prospects [27].

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Author Contributions Statement

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Vijayachandrika C	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	
Elizabeth Rani R	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓

C: **C**onceptualization
M: **M**ethodology
So: **So**ftware
Va: **Va**lidation
Fo: **Fo**rmal analysis
I: **I**nvestigation
R: Resources
D: Data Curation
O: Writing- **O**riginal Draft
E: Writing- Review& **E**diting
Vi: **Vi**sualization
Su: **Su**pervision
P: **P**roject administration
Fu: Funding acquisition

Conflict of Interest Statement

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Informed Consent

All participants were informed about the purpose of the study, and their voluntary consent was obtained prior to data collection.

Ethical Approval

The study was conducted in compliance with the ethical principles outlined in the Declaration of Helsinki and approved by the relevant institutional authorities.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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