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Feel-Guided Farming: Inclusive Ergonomics in Indoor Grey Oyster Mushroom Cultivation for Psychological Well-Being of Visually Impaired Community Farmers

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Abstract

This study explores the role of inclusive ergonomics in promoting safety, accessibility, and psychological well-being among visually impaired individuals engaged in indoor grey oyster mushroom (Pleurotus sajor-caju) cultivation. Conducted as part of an Inclusive Agriculture pilot project in Klang Valley, Malaysia, the qualitative research involved thirteen visually impaired community farmers. Data collection included environmental analysis, virtual walkthroughs, ergonomic audits, and focus group discussions. Findings revealed that conventional cultivation layouts, which are largely sight-dependent, as totally not suitable as they posed barriers to safe movement, task completion, and hazard control. Through participatory adaptations, modifications were made to spatial layouts, reach zones, tool placement, and ventilation systems, thereby improving physical accessibility and reducing occupational risks such as spore exposure. Beyond physical safety, the study identified significant psycho-social benefits, including autonomy, reduced anxiety and safety concerns, sense of belonging and social inclusion, and greater self-acceptance. Farmers reported a reconstructed self-identity as capable agricultural contributors rather than being defined by disability. The research highlights how inclusive ergonomic design, when applied in agricultural settings, can transform farming into a "feel-guided" system that enhances both productivity and well-being. These findings contribute to the growing discourse on inclusive agriculture and underscore the importance of integrating ergonomic principles with participatory design for marginalized communities.

Keywords: Inclusive Ergonomics, Visual Impairment, Agriculture, Psychological Well-Being

Introduction

Agriculture has traditionally been perceived as a sight-dependent occupation. The physical cultivation activities are first-highhandedly perceived as suitable for only able and sighted persons. Consequently, visually impaired individuals have often been excluded from many agroentrepreneurial activities. Such discrimination limits both their economic opportunities and participation in sustainable income generation activities. However, recent advances in inclusive ergonomics have widened the opportunities for this particular group. Inclusive

ergonomics involves designing workspaces, tools, and systems that are accessible, safe, and comfortable for individuals of all abilities, ensuring equitable participation and productivity.

Studies have shown the benefits of providing PWD with employment in the agricultural sector. It fosters self-sufficiency in food production and independence amidst increasing living costs (International Labor Organisation, 2022; World Vision International, 2024). Nevertheless, in Malaysia, inclusive agricultural initiatives are still under way and newly explored, with community-based models attempting to address the exclusion of visually impaired persons from economic and social activities. A study by Rosmiza, Zaiman, Aizan Sofia and Sarmila (2026) on 56 respondents involved in agricultural projects from six Community-Based Rehabilitation (CBR) centers in Selangor exhibited that institutional support, including motivations and subsidies; helps encourage more PWDs' involvement in the agricultural sector. However, the study also found that provision of credit and financing services, assistance and support, ineffective extension advisory services, and the lack of agricultural equipment and innovations tailored to PWD needs were among the challenges.

Thus, the Inclusive Agro community project is another initiative of agricultural pilot project based on a collaboration between Universiti Putra Malaysia and the Malaysian Association for the Blind to address the above mentioned challenges. It represents an early attempt to extend ergonomic principles to home-based mushroom cultivation systems. This initiative sought not only to address physical accessibility but also to examine the psychological and social dimensions of participation.

Theoretically, the study draws on environmental ergonomics (Rohles, 1985) and participatory adaptation frameworks (Das, 2020) to explain how spatial cues can substitute vision in agricultural work systems. It also integrates perspectives on psychosocial well-being, which emphasize the therapeutic potential of purposeful engagement in farming activities (Scott et al., 2022; Bandar et al., 2022). Within this context, the study aims to identify how inclusive ergonomic strategies contribute to both occupational safety and psychological empowerment of visually impaired farmers.

An inclusive design approach extends beyond ensuring physical accessibility. It also incorporates cognitive and sensory dimensions to establish work environments that are equitable (Das, 2020). This shift involves applying concepts from traditional environmental ergonomics which is concerned with the interaction of physical, biological, and adaptive factors in agricultural contexts, to specifically adapt to the distinctive physical and psychological requirements of individuals with visual impairments working in indoor cultivation systems (Rohles, 1985; Awasthi et al., 2019).

Such a perspective requires careful evaluation of how vision loss affects task execution, communication practices, and safety, thereby informing the creation of ergonomic strategies tailored to these needs (Lorenzini et al., 2023).

Integration of inclusive design principles in agricultural activities does not only improve accessibility but also enhance psychological well-being and self-acceptance among visually impaired farmers. Participation in cultivation provides therapeutic value by engaging the senses, building a sense of community, and offering meaningful tasks that contribute to

personal dignity and self-worth (Scott et al., 2022; Kwan et al., 2024). Shared farming activities strengthen peer support systems, reduce social isolation, and help participants reframe their identities beyond the lens of disability. Over time, self-acceptance is fostered through skill mastery, renewed connection with the natural environment, and recognition of one's contributions to collective outcomes (Bandar et al., 2022).

Methodology

Research Design

This qualitative study employed environmental analysis, virtual walkthroughs, ergonomic audits, and focus group discussions (FGDs) to examine the ergonomic and psychosocial implications of mushroom cultivation among visually impaired participants.

Participants

Thirteen visually impaired community farmers from the Klang Valley participated. Selection was facilitated through collaboration with the Malaysian Association for the Blind.

Environmental Analysis and Virtual Walkthroughs

The assessment focused on key ergonomic and environmental parameters relevant to indoor mushroom cultivation, including microclimatic conditions such as temperature (23-27°C), relative humidity (85%–90% during spawn run and 90-95% during fruiting), and ventilation potential, spatial layout and accessibility (e.g., reach distances, walkways, shelf placement), and potential physical hazards such as uneven flooring, low-hanging structures or contamination risks. In addition, the analysis also identified spore accumulation as a specific occupational hazard; inadequate ventilation in enclosed areas was observed to increase the risk of spore concentration, which may cause respiratory discomfort and allergic reactions, particularly when mushrooms are in the fruiting stage. Structured checklists and video documentation via WhatsApp ensured consistency across sites.

Given the geographical dispersion of participants and accessibility considerations, the research team employed virtual walkthroughs to systematically assess the physical conditions of each location. These walkthrough sessions were jointly conducted by the researchers in collaboration with members of the UPM–MAB volunteer squad, who acted as on-site facilitators and guides for visually impaired participants.

The research team used structured observation checklists and real-time video documentation via WhatsApp to ensure consistency across sites. Findings from these assessments informed the subsequent design of cultivation setups and the adaptation of necessary assistive features to optimize safety, accessibility, and environmental suitability for the visually impaired farmers.

Findings from the environmental analysis directly informed a series of participatory adaptations tailored to each site. Through a collaborative process between the researchers, volunteer squad, and visually impaired farmers, low-cost and locally available modifications were designed and implemented. These included repositioning cultivation racks to establish clear and unobstructed pathways, introducing natural or mechanical ventilation options such as installing small exhaust fans or opening window panels to mitigate excessive relative humidity and disperse airborne spores, water spray bottles, and cultivation bags to enhance

spatial orientation and reduce handling errors. In some cases of medical history of asthma or sinusitis, protective face masks were recommended for use during harvesting to reduce exposure to spores.

Overall, the environmental analysis and virtual walkthroughs not only ensured the suitability of the indoor settings for mushroom cultivation but also facilitated the co-creation of inclusive ergonomic solutions that improve safety, accessibility, and productivity for visually impaired farmers.

Ergonomics Audits

The preparation and planning stage clearly specifies that the audit is focused indoor cultivation activities performed by visually impaired individuals at home-based settings. The specific focus areas are environmental ergonomics, task ergonomics, safety, accessibility. The ergonomic checklist covered: (1) space, movement and layout (width of aisles, clearance between shelves and walls, ability to move without collision, position of shelving, height of substrate) (2) reach zones and accessibility, (3) movement and manual handling, (4) airflow and ventilation (ventilation fan, direction of airflow), (5) lighting, (6) biological hazards (spores, contamination), (7) tools usability, and (8) posture and task duration.

Online focus group discussion via Zoom platform was also conducted to give opportunity to the grey oyster mushroom farmers to narrate their experiences, challenges as well as perspectives in the process of cultivating the grey oyster mushrooms as visually impaired individuals.

Data Analysis

Qualitative data were thematically analyzed to identify recurring patterns related to environmental adaptations, hazard mitigation, and psychosocial outcomes.

Result and Discussion

The findings from the environmental analysis, ergonomic audits, and participatory adaptations highlighted the significant impact of inclusive ergonomics on the safety, accessibility, and usability of indoor grey oyster mushroom cultivation for visually impaired farmers. Three major themes emerged from the Focus Group Discussion (FGD): (i) environmental and spatial adaptations, (ii) hazard mitigation strategies, and (iii) psychological well-being.

Environmental and Spatial Adaptations

Across all thirteen participating households, conventional layouts were found to be unsuitable. There were barriers in movement and spatial orientation. The repositioning of cultivation racks into straight, passable pathways enabled the visually impaired farmers to navigate by touch while reducing collision risks. Adjustments in shelving heights allowed participants to access substrate bags within their reach zone. Such adjustment also allows minimizing awkward postures and unnecessary bending. These modifications were consistent with principles of reach zone optimization in ergonomic design, aligning with past findings that inclusive layouts enhance safe mobility and task efficiency (Lorenzini et al., 2023).

Hazard Mitigation Strategies

Spore accumulation was identified as a recurrent occupational hazard during the fruiting stage. Poor ventilation cases had led to respiratory discomfort for some participants with pre-

existing sinusitis or asthma. The installation of exhaust fans and the use of natural airflow through window panels significantly reduced spore density and improved air quality. Protective face masks were recommended to reduce health risks. These findings support prior literature emphasizing the importance of environmental ergonomics to minimize biological hazards in enclosed agricultural systems (Awasthi et al., 2019).

Psychological Well-Being

Participatory focus group discussions revealed that the inclusive ergonomic adaptations developed a sense of independence and psychological well-being among visually impaired farmers. Participants reported feeling more confident upon cultivation tasks completion without having to rely too much on assistance. Importantly, the inclusive design fostered psychological well-being, echoing Bandar et al.'s (2022) findings on the role of purposeful agricultural engagement in enhancing self-acceptance and social belonging among visually impaired individuals.

Autonomy

Farmers reported greater independence in performing tasks (watering, harvesting, arranging racks) without constant external help. This enhanced sense of mastery contributes to psychological empowerment.

"Before experiencing the grey oyster mushroom cultivation for the first time at home, I thought I would need someone to guide and help me in watering or harvesting them. But after the racks were rearranged and the tools were placed within my reach, I discovered that I can actually do it myself! Such experience truly builds the confidence in me. I can actually take care and cultivate the mushrooms myself. The harvesting time never fails to give me a great feeling!"

Reduced Anxiety and Safety Concerns

Modifications in layout, reach zones, and ventilation lowered stress related to movement, spore exposure, and task completion, thereby improving perceived safety and reducing cognitive load.

"Before this, I am not sure of the spores' effect on me. Due to my medical history of having sinus, I fear that the spores would cause something like short of breath. However, the researchers ensure that shelves were at the right height, that it feels safer and easier to work. I don't have to worry so much about the spores too due to right ventilation. I can focus better on taking care of the mushrooms."

Sense of Belonging and Social Inclusion

Participation in the project provided meaningful work, shared responsibility, and interaction with peers and volunteers, which contributed to reduced feelings of isolation.

"Joining this project together with UPM friends who are the researchers and volunteers makes me feel like I am part of something valuable. When we work on the grey oyster mushroom cultivation and share with our friends and UPM team our photos of cultivation process, harvesting photos, experiences and challenges, I feel happy and connected."

Self-Acceptance and Identity Beyond Disability
Engaging in productive agricultural activity allowed participants to reconstruct self-image not as "disabled" but as capable contributors to food production. This resonates with Bandar et al. (2022) on the psychosocial value of purposeful engagement.

"When I take care of the mushrooms, it gives me the first-time experience and sense of being a farmer. Never in my life have I ever imagine to be a mushroom cultivator. This work experience gives me joy not only to me but also to my family. It helps me accept myself better."

Overall, the results demonstrate that ergonomic interventions tailored to sensory impairments not only reduce risks but also enhance the psychosocial well-being of participants. This underscores the importance of integrating inclusive design principles into small-scale agricultural systems to achieve broader goals of equity, safety, and sustainability.

Conclusion
This novel study on the first ever inclusive grey oyster mushroom inclusive agro-project demonstrates that integrating inclusive ergonomic principles into small-scale agricultural systems enhances safety, accessibility, and psychosocial well-being among visually impaired community farmers. By embedding participatory adaptation into design processes, mushroom cultivation was transformed into a "feel-guided" system that supports independence, reduces occupational risks, and fosters psychological resilience.

The implications extend beyond mushroom farming to broader community development and disability inclusion policies. When ergonomic design is integrated with participatory methods, agricultural activities can be restructured into inclusive systems that support equitable livelihoods for marginalized populations. Future research may expand this approach to other agricultural contexts and disability groups, thereby advancing the discourse on inclusive ergonomics in sustainable development.

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