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Usability Evaluation of the Ergonomic F&B Service: A User-Centered Approach

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ABSTRACT

Food and beverage service operations frequently encounter challenges in maintaining safety and efficiency during the handling and serving processes. Traditional trays commonly cause spills, burns, and strain among workers, which may lead to reduced service quality and safety concerns in hospitality establishments. To address this, an ergonomic Food and Beverage (F&B) tray was developed to improve stability, comfort, and protection during service. The goal of this study was to determine the usability of the ergonomic tray in terms of design, stability, heat protection, safety, and overall usability. The study was conducted among 33 participants, comprising waiters, waitresses, bartenders, resort staff, and a restaurant manager from four selected resorts in Anda, Bohol: Anda Pearl Premier Resort, Island View Beachfront Resort, Parklane Bohol Resort and Spa, and Quinale Beach Resort. The researchers utilized a quantitative descriptive design with purposive sampling and employed a modified standardized questionnaire as the primary data-gathering tool. Most respondents were aged between 26-35 years old, consisting of 13 males and 6 females. The statistical treatments used in the analysis of gathered data were the Frequency, Count, Percentage, and Weighted Mean. The results revealed that the ergonomic tray was rated Highly Usable with an overall mean of 3.70. Among the five indicators, safety obtained the highest mean of 3.82, indicating that the tray effectively minimizes the risks of spills and burns, while ergonomic design recorded the lowest mean of 3.60, suggesting that further refinement in handle structure and weight balance may enhance user comfort. The findings suggest that the ergonomic tray is a practical and innovative tool that enhances worker safety and service efficiency in hospitality operations, promoting a more comfortable and reliable food and beverage service experience.

Keywords: *Hospitality Management, Ergonomic Tray, Usability, Quantitative Descriptive Research, Anda, Bohol*

INTRODUCTION

Ergonomics comes from the Greek words *ergo*, which means work, and *nomos*, which means health. It is a scientific discipline that optimizes human well-being and system performance by studying interactions between individuals and their work environments. It integrates theories, principles, and data to improve efficiency while minimizing health risks (Middlesworth, 2020). In essence, ergonomics can be described as the study and measurement of work (Singleton, 2020). Many industries worldwide have

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adopted ergonomic innovations to enhance worker productivity and reduce injury risks (Texas Department of Insurance, Division of Workers' Compensation, 2020). The hospitality sector, particularly the food and beverage (F&B) industry, requires workers to perform repetitive, labor-intensive tasks in fast-paced environments. Servers in hotels, resorts, and restaurants frequently carry heavy trays loaded with food and drinks while maneuvering through crowded spaces. These conditions increase the risk of musculoskeletal disorders (MSDs), including wrist, shoulder, and back injuries, which are prevalent among food service workers (Gan et al., 2024). Despite growing awareness of workplace ergonomics, physically demanding industries like F&B often lack tailored solutions, leaving workers vulnerable to discomfort, fatigue, and MSDs (Ayaga, 2024).

Studies highlight the prevalence of work-related injuries, particularly MSDs, among food service workers due to repetitive tasks and poorly designed equipment. International research emphasizes the need for well-designed tools to reduce injuries and improve job satisfaction (Odebiyi & Okafor, 2023). Ergonomic product design focuses on weight distribution, grip enhancement, and slip-resistant materials to minimize strain and prevent accidents (Agunos et al., 2022). For instance, a study in Singapore found that 35% of hospital food service workers reported workplace injuries, primarily muscle strain (Leong et al., 2024). Similarly, research in Ethiopia revealed that 81.5% of restaurant workers experienced work-related MSDs, with the upper and lower back, elbow, and wrist being the most affected areas. Risk factors included job dissatisfaction, age, and lower education levels, further emphasizing the need for ergonomic interventions in food service settings (Tegenu et al., 2020). Hospitality workers in the Philippines, particularly those in resort operations, also experience considerable ergonomic challenges. A study on occupational ergonomics and job satisfaction among resort housekeepers in Northern Cebu found that repetitive motion, awkward postures, and the use of improper tools negatively impact worker health and productivity (Dela Cerna et al., 2024). This highlights the need for ergonomic improvements not only in housekeeping but also in other hospitality-related job functions, such as food and beverage (F&B) service operations. Similarly, a study by Agunos et al. (2022) explored occupational safety and ergonomic risks among hospitality workers in Metro Manila. Their research found that 60% of respondents—primarily male, aged 21 to 30, and living in urban areas—faced high exposure to ergonomic hazards, including static postures, repetitive tasks, and awkward movements, as well as biological risks like bacteria and viruses. These findings reinforce the urgent need for ergonomic improvements in the hospitality industry to mitigate workplace injuries and enhance employee well-being.

Locally, Anda, Bohol, has emerged as a premier tourist destination, driving a growing demand for high-quality hospitality services. Resorts in Anda cater to both domestic and international guests, requiring staff to maintain efficiency and professionalism under physically demanding conditions. However, local F&B establishments lack ergonomic innovations in tray design, making this study highly relevant. By evaluating the usability of an ergonomic food tray among hospitality workers, this research aims to provide empirical data on how ergonomic enhancements can improve safety, efficiency, and service quality. We the BSHM students of BISU Candijay Campus understand the daily challenges faced by food service workers and the critical role ergonomics plays in their efficiency and well-being. Ultimately, this study aims to provide practical solutions that improve working conditions for hospitality employees while advancing ergonomic practices in the local F&B industry. Specifically, the research will assess the new tray's usability in terms of ergonomic design, stability, heat protection, and overall acceptability, contributing to a safer and more efficient work environment.

This study aims to evaluate the usability of an ergonomic food tray for Food and Beverage (F&B) service to improve server control, reduce physical strain, and minimize service-related accidents. It describes the participants' demographic profile and assesses the tray's usability in terms of ergonomic design, stability, heat protection, safety, and overall usability.

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METHODOS

Research Design

The researchers used a quantitative descriptive survey to assess the usability of an ergonomic food tray for the Food and Beverage (F&B) service. They will employ the survey method using a structured questionnaire as the primary data-gathering tool. The survey will collect data from F&B staff in resorts in Anda, Bohol, focusing on their evaluation of the tray's ergonomic design, stability, heat protection, safety, and overall acceptability. The gathered data will be analyzed to determine the tray's effectiveness in improving safety, efficiency, and user comfort in food service operations.

Research Environment

The research was conducted in Anda, Bohol, focusing on four selected resorts: Bugnaw Si-E Beach Resort, Anda Pearl Premier Resort, Parklane Bohol Resort and Spa, and Quinale Beach Resort. These resorts are chosen for their reputation in the hospitality industry and their commitment to providing quality Food and Beverage (F&B) services.

Research Respondents

The study employed a purposive sampling technique, selecting waiters, waitresses, restaurant managers, resort managers, and bartenders from various food and beverage (F&B) establishments in Anda, Bohol. Respondents from Bugnaw Si-E Beach Resort, Anda Pearl Premier Resort, Parklane Beach Resort and Spa, and Quinale Beach Bar will provide insights into the ergonomic challenges of traditional food trays, such as grip, balance, comfort, and physical strain. Their feedback will help assess how tray design affects service efficiency in different environments, including luxury resorts and fast-paced beachside settings. The data gathered will serve as a foundation for designing an ergonomic food tray that enhances comfort, reduces strain, and improves efficiency in F&B service operations.

Research Instruments

The researchers used a modified standardized questionnaire based on the study of Baldapan (2021) – Design and Development of Ecobangku from Medium Density Polyethylene Boards. The questionnaire will consist of two main parts: Part 1 will include the demographic profile, covering age, sex, and job position. Part 2 will evaluate the usability of the ergonomic food tray in F&B service, focusing on five key dimensions: ergonomic design, stability, heat protection, safety, and overall acceptability. Responses will be measured using a 4-point Likert scale, ensuring clear differentiation of perceptions without a neutral response option. The modifications made to the original standardized questionnaire will ensure that it aligns with the specific objectives of this research while maintaining validity and ease of use for respondents.

Research Procedure

The data gathered using a survey questionnaire designed to assess employees' perspectives on the usability of the ergonomic food tray for Food and Beverage (F&B) service. The researchers will employ a modified questionnaire to evaluate the tray based on ergonomic design, stability, heat protection, safety, and overall acceptability. The first step involves validation, verification, and endorsement of the survey questions by the research adviser. A transmittal letter, endorsed by the school administrator, will be sent to the Mayor of Anda, the tourism officer in charge, and the proprietors or managers of the selected resorts, formally seeking permission to conduct the study in their establishments.

Statistical Treatment

The statistical formula that was utilized in this study will involve using frequency count and percentage to analyze and interpret the demographic profile of the respondents, determining their age, sex, and job position. A weighted mean was used to analyze and interpret the participants' evaluation of the

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usability of ergonomic food tray, specifically in terms of ergonomic design, stability, heat protection, safety and overall usability.

RESULTS AND DISCUSSION

Demographic Profile

This section shows the participants' profile, which includes their age, sex, and job position. Analyzing these variables is essential because demographic characteristics may influence how the ergonomic F&B tray is perceived and evaluated. Age can affect strength and endurance, sex may play a role in workload distribution, and job position reflects the level of experience with food and beverage handling. Understanding these factors provides a clearer context for interpreting the usability results. The comprehensive data is presented in Table 1.

Table 1. *Demographic Profile of the Participants*

	Indicators	Frequency	Percentage
1.1	Age		
	18 – 25 years old	12	36.36
	26 – 35 years old	19	57.58
	36 – 45 years old	1	3.03
	46 – 55 years old	1	3.03
1.2	Sex		
	Male	20	60.61
	Female	13	39.39
1.3	Job Position		
	Waitress/Waiter	23	69.70
	Bartender	3	9.09
	Resort Staff	6	18.18
	Restaurants Manager	1	3.03

The table above shows the respondents' demographic profile in terms of age. The age bracket of 26–36 years old had the highest proportion at 57.58%, followed by 18–25 years old at 36.36%. Only a small portion belonged to the 36–45 years old (3.03%) and 46–55 years old (3.03%) groups, while none were 56 years old and above. This suggests that most participants belong to the young to early adult age group, which is consistent with the common age range of employees in the hospitality industry. According to Barakat (2018), individuals in this stage are characterized by adaptability, energy, and a willingness to take on physically demanding tasks—qualities that are advantageous in food and beverage service.

In terms of sex, the majority of respondents were male (60.61%), while female respondents accounted for 39.39%. This finding indicates a male-dominated workforce within the evaluated group. The Philippine Statistics Authority (2021) similarly reported that males comprise a larger share of the labor force at 61.1%, while the remaining 38.9% were females. This trend is also reflected in the study of Dharmayanti and Sriathi (2020), where 72.1% of respondents were male and 27.9% were female in hospitality-related work. However, the presence of a substantial number of female workers in this study also highlights growing gender diversity in the field.

With regard to job position, most of the respondents were waiters/waitresses (69.70%), followed by resort staff (18.18%), and bartenders (9.09%), while only one respondent (3.03%) held a managerial role. No responses were recorded under the "Other" category, indicating that all participants were concentrated within the listed job classifications. This suggests that the majority of perspectives gathered came from frontline service staff, who directly engage with ergonomic processes in F&B operations. Since these employees are the primary implementers of service delivery, their feedback is highly valuable in

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assessing the usability and effectiveness of ergonomic practices. The minimal representation of managerial positions suggests that the data largely reflects operational-level experiences rather than administrative viewpoints.

Overall, the demographic distribution suggests that the participants are primarily young, male, and frontline service providers. These characteristics imply that the results of the usability evaluation are grounded in the perspectives of employees who are actively engaged in the day-to-day demands of F&B service, making their insights crucial for a user-centered approach.

Table 2.1. *The level of usability of the Ergonomic F&B Tray based on participants' feedback in terms of Ergonomic Design*

	Indicators	Weighted Mean	Description
2.1	Ergonomics Design		
1.	The Handgrip F&B Tray design makes it easy to hold the tray securely.	3.73	Highly Usable
2.	The weight distribution makes it easy to balance items.	3.67	Highly Usable
3.	The tray reduces wrist or hand strain compared to traditional trays.	3.58	Highly Usable
4.	The tray is comfortable to hold for extended periods.	3.55	Highly Usable
5.	The handle position feels natural when carrying heavy loads.	3.48	Highly Usable
	Sub-composite Mean	3.60	Highly Usable

Legend: 3.26 – 4.00 (4) Highly Usable, 2.51 – 3.25 (3) Moderately Usable, 1.76 – 2.50 (2) Slightly Usable, 1.00 – 1.75 (1) Not Usable

Table 2.1 presents the results of the participants' evaluation of the usability of the ergonomic F&B tray in terms of ergonomic design. The sub-composite mean of 3.60 reflects the overall sentiment of respondents regarding the tray's ergonomic design. This average score suggests a general consensus that the tray design is highly usable, offering improved comfort and reduced strain compared to traditional trays. These findings align with Greggi et al. (2024), who conducted a systematic review and meta-analysis highlighting the impact of work-related activities on musculoskeletal health across various occupational sectors. Similarly, Gumasing and Espejo (2020) identified that kitchen workers in the Philippines experience musculoskeletal disorders due to factors such as poor facility design and awkward work postures, underscoring the importance of ergonomic interventions in mitigating physical strain in food service environments.

The highest weighted mean of 3.73 is associated with the indicator related to the handgrip design, which makes it easy to hold the tray securely. This result shows that respondents particularly valued the handgrip feature for the stability and ease it brings during carrying. Sheen et al. (2018) conducted a usability study and redesign of food trays, finding that participants rated the redesigned trays as more comfortable and easier to carry. Observations and prototype testing confirmed that user satisfaction improved when carrying, along with other usability criteria such as cleaning and storage, which were also addressed.

The lowest weighted mean of 3.48 pertains to the handle position when carrying heavy loads. Although still interpreted as "Highly Usable," this result suggests that handle positioning could be further optimized to reduce strain during heavier tasks. Du et al. (2020) identify awkward postures and physical effort as major ergonomic risk factors in ambulance and equipment design, suggesting that suboptimal equipment layout can lead to discomfort and increased risk of MSDs. Thus, while the tray design is effective overall, refinements in handle positioning likely have the potential to enhance its ergonomic benefits.

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Table 2.2 *The level of usability of the Ergonomic F&B Tray based on participants' feedback in terms of Stability*

	Indicators	Weighted Mean	Description
2.2	Stability		
1.	The grip allows me to carry the tray with better control and ease.	3.76	Highly Usable
2.	The tray's design enhances stability when carrying multiple items.	3.73	Highly Usable
3.	The tray allows me to move around safely even in busy environments.	3.70	Highly Usable
4.	The weight distribution of the tray helps prevent tilting or imbalance.	3.58	Highly Usable
5.	I feel less strain in my hand when carrying this tray compared to traditional trays.	3.39	Highly Usable
	Sub-composite Mean	3.63	Highly Usable

Legend: 3.26 – 4.00 (4) Highly Usable, 2.51 – 3.25 (3) Moderately Usable, 1.76 – 2.50 (2) Slightly Usable, 1.00 – 1.75 (1) Not Usable

Table 2.2 presents the results of the participants' evaluation of the usability of the ergonomic F&B tray in terms of stability. The sub-composite mean of 3.63 indicates a strong overall agreement among respondents that the Ergonomic F&B Tray significantly contributes to enhanced stability during use. This suggests that the tray effectively improves control, reduces physical strain, and maintains balance—factors essential for operational efficiency in busy food service environments. The consistently high ratings reflect positive user perceptions of how ergonomic design supports both comfort and job performance. Colim et al. (2020) demonstrated that ergonomic interventions in workstations can reduce physical effort and increase task control, supporting the idea that thoughtfully designed tools—like the Ergonomic F&B Tray—enhance both user comfort and operational efficiency.

The highest weighted mean of 3.76 corresponds to grip control—specifically, the indicator stating that the grip allows users to carry the tray with better control and ease. This suggests that participants feel most confident and competent when handling the tray, attributing much of its usability to the design of the grip. Du et al. (2020) identified excessive physical effort, awkward postures, and repetitive movement as key ergonomic risk factors in handle-type equipment, highlighting that poor design contributes to fatigue. Similarly, Tegenu et al. (2021) reported a high prevalence of musculoskeletal disorders among restaurant workers, emphasizing that inadequate ergonomic tools and work conditions increase strain and the risk of injury. Together, these studies support the idea that well-designed grips can enhance control, reduce fatigue, and improve user confidence, consistent with the high score observed for grip control in this study.

The lowest weighted mean of 3.39, though still interpreted as Highly Usable, pertains to the perception that the tray reduces hand strain compared to traditional trays. This relatively lower score suggests that while participants acknowledged an advantage in reduced strain, they may not have regarded it as a primary usability factor compared to stability and grip. Martinez et al. (2024), in their heuristic evaluation of exoskeletons, similarly found that certain ergonomic improvements were perceived as less significant when compared with other design features that directly affected usability. Likewise, while the tray offers ergonomic benefits, the results imply that further design refinement could enhance its ability to minimize physical fatigue.

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Table 2.3 *The level of usability of the Ergonomic F&B Tray based on participants' feedback in terms of Heat Protection*

	Indicators	Weighted Mean	Description
2.3	Heat Protection		
1.	The tray material protects my hand from heat when carrying hot beverages.	3.85	Highly Usable
2.	The handle remains cool even when carrying hot items.	3.81	Highly Usable
3.	The tray is suitable for serving both hot and cold items.	3.81	Highly Usable
4.	The heat-resistant features of the tray meet my expectations.	3.67	Highly Usable
5.	I do not feel discomfort when carrying warm or hot plates.	3.48	Highly Usable
	Sub-composite Mean	3.72	Highly Usable

Legend: 3.26 – 4.00 (4) Highly Usable, 2.51 – 3.25 (3) Moderately Usable, 1.76 – 2.50 (2) Slightly Usable, 1.00 – 1.75 (1) Not Usable

Table 2.3 presents the results of the participants' evaluation of the usability of the ergonomic F&B tray in terms of heat protection. The sub-composite mean of 3.72 indicates strong agreement among respondents that the Ergonomic F&B Tray effectively provides heat protection. This result places the tray in the Highly Usable category, suggesting that participants perceived it as reliable in minimizing discomfort and preventing burns during food service tasks. These findings underscore the importance of incorporating heat-resistant materials into food-handling tools. Watson et al. (2022) noted that material properties such as thickness, density, and air permeability significantly influence thermal comfort and safety, highlighting the relevance of these attributes in ergonomic design.

The highest weighted mean of 3.85 corresponds to the indicator regarding protection when carrying hot beverages. This suggests that participants were most confident in the tray's ability to prevent heat transfer to the hands, reflecting the effectiveness of its material composition. Kitchenfete (2023) discusses how silicone and other heat-resistant materials are used in kitchen utensils to improve safety and comfort, especially in contexts involving heat exposure. While not experimental, this supports the idea that material choice can play a significant role in user perception of protection and comfort.

The lowest weighted mean of 3.48, while still interpreted as Highly Usable, pertains to the comfort experienced when carrying hot or warm plates. This suggests that although the tray provides sufficient thermal protection, some minor discomfort remains, particularly during extended use. While Chen et al. (2018) focused on optimizing thermal insulation properties for high-temperature applications, their findings underscore the importance of material selection in thermal management. This highlights the potential for refining the tray's design to enhance user comfort by considering materials with improved thermal insulation characteristics.

Table 2.4 *The level of usability of the Ergonomic F&B Tray based on participants' feedback in terms of Safety*

	Indicators	Weighted Mean	Description
2.4	Safety		
1.	The tray's non-slip surface reduces the risk of spills and accidents.	3.94	Highly Usable
2.	The overall design ensures a secure and controlled serving experience.	3.81	Highly Usable
3.	The handle provides a firm grip, preventing accidental drops.	3.79	Highly Usable
4.	The tray material reduces the risk of burns when carrying hot items.	3.79	Highly Usable

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5.	I feel more confident using this tray in a fast-paced F&B setting.	3.79	Highly Usable
	Sub-composite Mean	3.82	Highly Usable

Legend: 3.26 – 4.00 (4) Highly Usable, 2.51 – 3.25 (3) Moderately Usable, 1.76 – 2.50 (2) Slightly Usable, 1.00 – 1.75 (1) Not Usable

Table 2.4 presents the results of the participants' evaluation of the usability of the ergonomic F&B tray in terms of safety. The sub-composite mean of 3.82 indicates strong overall agreement among respondents that the tray enhances safety during use. This suggests that the tray is effective in reducing risks such as spills and potential injuries, reflecting its value in food service operations where safety is critical. Agunos et al. (2022) conducted a comprehensive risk assessment of hospitality industry workers, identifying ergonomic factors—including proper weight distribution, slip-resistant surfaces, and improved grip—as significant contributors to reducing accidents and strain. These findings underscore the importance of integrating such ergonomic features into food service tools to enhance worker safety and operational efficiency.

The highest weighted mean of 3.94 corresponds to the indicator that the tray's non-slip surface reduces the risk of spills and accidents. This suggests that participants perceived the non-slip feature as a significant element in ensuring safety and stability. Brown (2010) patented a food tray design incorporating non-slip inserts and raised grips, which aim to enhance stability and reduce the likelihood of spills, highlighting the importance of anti-slip features in reducing workplace accidents. While the patent does not provide empirical user data, its design features align with the emphasis on non-slip surfaces in the current study.

The lowest weighted mean of 3.79, though still interpreted as Highly Usable, pertains to participants' confidence in using the tray in fast-paced environments. This slightly lower score suggests that while the tray enhances safety, there may be challenges in maximizing performance under pressure. Sheen et al. (2018) highlighted that ergonomic features, ease of use, and safety design in trays influence user experience, indicating that well-designed trays can help users feel more confident and secure even in dynamic or fast-paced settings. This underscores the importance of continuous ergonomic refinements to optimize both safety and performance.

Table 2.5 *The level of usability of the Ergonomic F&B Tray based on participants' feedback in terms of Overall Usability*

	Indicators	Weighted Mean	Description
2.5	Overall Usability		
1.	The tray design is functional and user-friendly.	3.79	Highly Usable
2.	I would prefer to use this tray over traditional serving trays.	3.76	Highly Usable
3.	I would recommend this tray to colleagues in the hospitality industry.	3.73	Highly Usable
4.	The tray improves my overall efficiency when serving.	3.64	Highly Usable
5.	The design of the tray meets my expectations.	3.61	Highly Usable
	Sub-composite Mean	3.71	Highly Usable

Legend: 3.26 – 4.00 (4) Highly Usable, 2.51 – 3.25 (3) Moderately Usable, 1.76 – 2.50 (2) Slightly Usable, 1.00 – 1.75 (1) Not Usable

Table 2.5 presents the results of the participants' evaluation of the usability of the ergonomic F&B tray in terms of overall usability. The sub-composite mean of 3.71 indicates strong overall agreement among respondents that the tray is highly usable in real service operations. This suggests that the tray not only provides ergonomic and safety benefits but also contributes to efficiency and comfort in food and beverage service. Dela Cerna et al. (2024) assessed the prevalence of ergonomic risks and perceived job satisfaction

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among resort housekeepers in Northern Cebu, Philippines. Their study highlighted that ergonomic designs directly improve job satisfaction and effectiveness in hospitality operations by minimizing strain and enhancing functionality. These findings underscore the importance of integrating ergonomic principles into food service tools to enhance both worker well-being and operational efficiency. The highest weighted mean of 3.79 relates to the statement that the tray design is functional and user-friendly. This suggests that participants valued the tray's intuitive design and ease of handling, which made it more practical compared to traditional trays. While Kern (2024) did not specifically address tray design, the study's emphasis on applying cognitive ergonomic principles to enhance user experience underscores the importance of intuitive and efficient design in improving service quality, consistent with participants' positive perceptions.

The lowest weighted mean of 3.61 pertains to the tray's ability to meet user expectations. Although this rating remains positive, it suggests that participants perceive opportunities for refinement, potentially in design, aesthetics, or additional features. Rohani et al. (2020) developed a smart buffet food tray incorporating sensors and automated lids, demonstrating how innovative features can enhance usability and better align products with user needs. This aligns with participants' feedback, indicating that integrating advanced features could further elevate the tray's functionality and user satisfaction.

Table 3 *Summary of the Level of Usability of the Ergonomic F&B Tray*

Indicators	Sub-composite Mean	Description
Safety	3.82	Highly Usable
Heat Protection	3.72	Highly Usable
Overall Usability	3.71	Highly Usable
Stability	3.63	Highly Usable
Ergonomics Design	3.60	Highly Usable
Composite Mean	3.70	Highly Usable

Legend: 3.26 – 4.00 (4) Highly Usable, 2.51 – 3.25 (3) Moderately Usable, 1.76 – 2.50 (2) Slightly Usable, 1.00 – 1.75 (1) Not Usable

Table 3 presents the overall usability of the ergonomic food and beverage (F&B) tray as assessed by the participants. The results indicate that all factors were consistently rated Highly Usable, with a composite mean of 3.70. This outcome reflects the tray's effectiveness in addressing the ergonomic and functional requirements of food and beverage service, supporting worker safety, comfort, and efficiency. Among the indicators, safety obtained the highest sub-composite mean of 3.82, demonstrating that participants strongly recognized the tray's ability to reduce risks such as spills, burns, and instability. This underscores the importance of safety as a critical element in the usability of service tools, as it directly enhances both user confidence and operational reliability in high-demand environments.On the other hand, ergonomic design received the lowest sub-composite mean of 3.60, although it still falls under the "Highly Usable" category. This suggests that while the tray already offers ergonomic advantages—such as improved handling and reduced strain—participants identified areas for refinement, particularly in weight distribution, grip structure, and adaptability to varied working conditions. This indicates that continued ergonomic innovation may further enhance long-term comfort and usability.

Overall, the findings affirm that the ergonomic tray is a highly functional and reliable tool in food service operations. These findings align with the work of Arlinghaus et al. (2019), who emphasized that ergonomic interventions in the hospitality industry reduce physical strain while improving productivity. Similarly, Dharmayanti (2020) highlighted that sustained ergonomic improvements are essential in ensuring usability and adaptability, corroborating participants' perception that the tray is both effective and beneficial, with room for further optimization.

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CONCLUSION

In conclusion, the study revealed that the ergonomic F&B tray is a practical and innovative tool for hospitality service. It successfully addressed key challenges associated with traditional trays, particularly in terms of safety, stability, and comfort, thereby improving service efficiency and enhancing worker confidence. The positive reception of the tray underscored its potential as a valuable ergonomic innovation in food and beverage operations.

Despite these positive evaluations, the study also highlighted notable areas for refinement, such as the need for an adjustable grip to allow easier hand-switching, the use of more durable and moisture-resistant materials to ensure longevity, and the application of the same ergonomic design to a larger circular tray to better suit actual service requirements.

Overall, while the tray was generally well-received and demonstrated strong potential for practical application in food and beverage operations, the study underscored the importance of implementing these refinements to maximize its usability and long-term effectiveness in real service environments.

Recommendations

In light of the findings and conclusions from the study usability evaluation of the ergonomic F&B service: a user-centered approach, the researchers proposed the following recommendations:

1. Future iterations of the ergonomic tray should integrate an adjustable or flexible grip system to allow users to switch hands easily and to accommodate different hand sizes.
2. The materials used in the tray's construction should be replaced with more durable and moisture-resistant alternatives to ensure long-term use, avoiding limitations encountered with temporary materials such as electrical tape.
3. The same ergonomic design should be applied to a larger circular tray, as requested by participants, to make it more functional and applicable in real service operations where larger trays are often required.
4. Lastly, future researchers may expand on this study by exploring the use of advanced materials, heat-resistant innovations, or other ergonomic enhancements that could further improve safety, efficiency, and usability in hospitality service tools.

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