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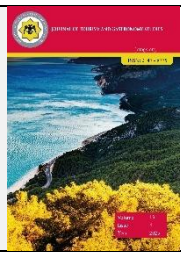

Sustainability in Large-Scale Hotel Kitchens: A Cross-Sectional Observational Study on Knowledge, Attitudes, And Practices

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Abstract

Sustainable food and beverage services are essential to address environmental challenges and promote resource efficiency, with hotel kitchens serving as key intervention points. This study examines the knowledge, attitudes, and practices of kitchen staff in large-scale hotels in Kayseri, Türkiye, comparing Green and Non-Green establishments. A 55-question survey assessed demographics, waste management, material usage, sustainable operations, customer communication, and eco-friendly technology adoption. Results showed that staff in Green Hotels had significantly greater knowledge ($p < 0.01$) and more frequent implementation of practices such as waste segregation ($p = 0.02$), energy conservation, and use of energy-efficient appliances ($p < 0.05$). Training gaps existed in both hotel types, with cost concerns and insufficient institutional support as main barriers ($p = 0.04$). Positive attitudes toward sustainability were observed across respondents but were better translated into action in Green Hotels. The study highlights the importance of certification programs and targeted training to advance sustainable practices and improve efficiency in hotel kitchens.

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INTRODUCTION

Sustainability is a fundamental concept that promotes environmentally responsible living, conserves natural resources, and ensures a more livable world for future generations (Sutton, 2004). In the hospitality sector, particularly within hotel kitchens, sustainability encompasses a range of eco-friendly practices. These practices include minimizing resource consumption, optimizing energy efficiency, and improving waste management in food services (Qi, 2024). As the global population continues to grow, with a corresponding rise in food demand, the importance of sustainable practices in food services becomes even more critical, not only for environmental preservation but also for promoting community health by ensuring access to safe, nutritious, and responsibly sourced food.

The alarming scale of global waste generation further highlights this need. In 2016, approximately 2.1 billion tons of waste were produced worldwide, a figure projected to reach 3.4 billion tons by 2050 (Kaza, Yao, Bhada-Tata, & Van Woerden, 2018). Within this context, hotel kitchens have a pivotal role in minimizing waste, especially through effective management of organic and recyclable materials (Juvan, Grün, & Dolnicar, 2023). According to the Food and Agriculture Organization (FAO), Türkiye generates approximately 26 million tons of food waste annually, with 53% of fruits and vegetables lost before reaching consumers (Turkish Waste Prevention Foundation, 2020). Such data underscore the urgency for improved food supply chain management, and more efficient utilization of resources within hotel kitchens.

In response to these challenges, hotels have begun to adopt sustainable measures, in-cluding staff training on food waste prevention, maintaining optimal storage conditions, and donating surplus food to minimize losses (Kattiyapornpong, Ditta-Apichai, & Chuntamara, 2023). The growing awareness of environ-mentally responsible production and consumption has given rise to "Green Management" principles and the spread of "Green Hotel" practices (Akatay & Aslan, 2008; Ertaş & Doğan, 2021). These initiatives promote sustainability through waste reduction, energy conservation, and the use of renewable energy sources (Çilingir & Erkılıç, 2021; Güleç & Ünlüönen, 2022). By aligning with green marketing trends, such establishments cater to environmentally conscious consumers and enhance their brand image.

The concept of "Green Kitchens" extends these sustainability principles to hotel food services. These kitchens employ a variety of environmentally friendly practices, ranging from energy-efficient lighting and water-saving technologies to composting organic waste and using recyclable materials (Savaş, 2018; Wang, Chen, Lee, & Tsai, 2013). Such practices not only minimize the envi-ronmental footprint of hotel kitchens but also play a critical role in achieving overarching sustainability goals (Chan, Okumus, & Chan, 2017; Mesci, 2014). Leadership from organizations like the Green Restaurants Association and pilot projects initiated by entities such as the World Wide Fund for Nature (WWF)-Türkiye provide valuable guidance and motivation for the industry (Yazıcıoğlu & Aydın, 2018).

This study aims to advance the adoption of sustainable practices in large-scale hotel kitchens by assessing the knowledge, attitudes, and practices of kitchen staff regarding sustainability. The findings are expected to inform the development of targeted training programs and improve the overall sustainability of hotel operations.

Materials and Methods

Study Design

A cross-sectional study surveyed hotel kitchen staff knowledge, attitudes, and practices regarding sustainability: this study compared and examined the kitchen staff working in Green and Non-Green large-scale hotels in Kayseri.

Study Area, Sample Size, and Sampling

As of 2022, the total number of tourism establishments certified by the Ministry of Culture and Tourism of the Republic of Türkiye is 4,830. Of these, 441 establishments (9.13%) have received an environmentally friendly accommodation certificate (Green Star), and the number of Green Hotels in Kayseri is 8 (Leppink, Stoffers, Kleefstra, & Van Dormalen, 2016) . These hotels constitute the universe of our study. Although the study aimed to reach the entire population, one of the five-star hotels was excluded due to its location in Erciyes and being outside the ski season. Additionally, one of the four-star hotels was not included as managerial approval could not be obtained.

The study sample consists of kitchen staff from two five-star hotels in Kayseri with an environmentally friendly hotel certificate (Radisson Blu, Wyndham Grand) and four other hotels with similar service standards but without environmental certification, including three four-star hotels (Novotel, Holiday Inn, Divan City) and one five-star hotel (Ommer). Data was collected from a total of seventy-five (n=75) staff in the six hotels where data was collected. Thirty (n=30) of the staff work at Green hotels, while the remaining 45 (n=45) are employed in four- and five-star Non-Green Hotels. There is at least one chef in the staff distribution in the kitchen. The areas where other staff work is divided into more or fewer sections, such as breakfast section, cold, hot, patisserie, bellboy, demi, a la carte, etc., depending on the hotel's capacity and kitchen size.

Instrument for Data Collection

The research data was collected through a survey consisting of 55 questions, structured into seven sections:

1. Sociodemographic Information: This section examines participants' age, gender, educational background, profession, and years of experience.

2. Waste-Related Questions: This section investigates:

- The most common type of waste generated in hotel kitchens,
- The specific food products contributing most to food waste,
- The causes and stages of food waste generation,
- Whether waste results from equipment usage,
- Whether waste is sorted by type,
- Actions taken to minimize waste,
- The presence of waste management initiatives,
- Types of food and other waste subjected to recycling,
- Whether customer plate waste is analyzed.

3. Quantity of Ingredients Used in Menus: This section evaluates the weekly consumption of meat, fish, poultry, dairy products, legumes, vegetables, and animal fats.

4. Sustainable Kitchen Practices: This section explores:

- Considerations in food procurement,
- Frequency of purchasing and efforts to reduce it,
- Awareness of seasonal product use,
- Perspectives on sourcing local ingredients,
- Collaboration with environmentally certified suppliers and the sustainability of local products,
- Awareness of the Mediterranean diet and its contribution to sustainability.

5. Customer-Related Questions: This section examines whether customers are informed about environmentally friendly practices and the feedback received.

6. Environmentally Friendly Kitchen Practices: This section investigates:

- The impact of green kitchens on material consumption in the industry,
- The relationship between ecologically friendly kitchens and economic efficiency,
- The link between sustainable kitchen practices and energy consumption, as well as non-renewable resources,
- The added value of sustainable kitchen practices for businesses,
- Challenges encountered in implementing green kitchen practices and potential solutions.

7. General Questions: This section includes:

- The hotel's star rating,
- Whether energy-saving appliances are used,
- The extent of energy efficiency in lighting systems.

The study assesses and compares the knowledge, attitudes, and behaviors of hotel staff from both Green and Non-Green hotels regarding sustainable kitchen practices based on their survey responses.

Statistical Analysis

Categorical variables are defined as n (%), and the relationship between categorical variables is evaluated using chi-square analysis. Pearson chi-square test is applied if the expected frequencies in 2x2 tables are above 25. Fisher exact test is used when the expected frequency of at least one cell is below 5. Yates' continuity correction is applied when the expected frequency of at least one cell is between 5 and 25. If the number of eyes with an expected frequency below 5 in the RxC tables does not exceed 20% of the total number of eyes, the Pearson Chi-Square test is used. If the number of eyes with an expected frequency below 5 exceeds 20% of the total number of eyes, the Exact Chi-Square test (Fisher-Freeman-Halton Exact Test) is used. The data were organized in Microsoft Office Excel spreadsheets. Data was analyzed using statistical software from TURCOSA (Turcosa Analytics Ltd Co. Türkiye). The statistical significance level was accepted as $p<0.05$.

Ethical Aspects

The study was approved by the Erciyes University Social and Humanities Ethics Committee (no. 264, 4 Jul 2023). Participants were informed about the aims and methodologies of the study, and if they agreed to participate, they signed an Informed Consent Form.

Findings

Sustainability awareness of staff: Questions related to the sociodemographic study area were examined under the headings of waste management, materials used in menus, sustainable food, customer, environmentally friendly kitchen, and general questions.

Sociodemographic Characteristics of The Staff

The sociodemographic variables obtained through a survey of 75 kitchen staff are presented in Table 1. More than half of the participants (65.3%; n=49) were male, and the majority (52.1%; n=38) were between 18 and 25 years old. Regarding education level, most participants (65.8%; n=46) were high school or university graduates, while 17.2% (n=12) had completed primary school or lower education. It was found that most participants (88.0%; n=66) had 0–5 years of experience in their current position, whereas 12.0% (n=9) had 6–10 years of experience. Most participants reported receiving mass feeding systems training (77.3%; n=58) and heard of the Green Hotel concept (72.0%; n=54). No statistically significant differences between the two groups regarding general descriptive characteristics were observed, indicating that the groups were comparable in analysis.

Table 1. General Descriptive Characteristics of Staff in Green and Non-Green Hotels.

Variables		Green Hotel		Total	*p*
		Yes (n=30)	No (n=45)	(n=75)	
Gender	Male	21 (70.0)	28(62.2)	49(65.3)	0.656
	Female	9(30.0)	17(37.8)	26(34.7)	
Age	18-25	14(48.3)	24(54.5)	38(52.1)	0.742
	26-35	5(17.2)	8(18.2)	13(17.8)	
	36-45	9(31.0)	9(20.5)	18(24.7)	
	46-55	1(3.4)	3(6.8)	4(5.5)	
Education Level	Literate	1(3.6)	2(4.8)	3(4.3)	0.954
	Primary School	3(10.7)	6(14.3)	9(12.9)	
	Middle School	6(21.4)	6(14.3)	12(17.1)	
	High School	11(39.3)	19(45.2)	30(42.9)	
	University	7(25.0)	9(21.4)	16(22.9)	
Years of Work Experience	0-5	24(80.0)	42(93.3)	66(88.0)	0.144
	6-10	6(20.0)	3(6.7)	9(12.0)	
Training in Mass Catering Systems	Yes	24(80.0)	34(75.6)	58(77.3)	0.652
	No	6(20.0)	11(24.4)	17(22.7)	
If yes, was the training beneficial?	Yes	26(86.7)	41(93.2)	67(90.5)	0.431
	No	4(13.3)	3(6.8)	7(9.5)	
Have you heard of the Green Hotel concept?	Yes	23(76.7)	31(68.9)	54(72.0)	0.637
	No	7(23.3)	14(31.1)	21(28.0)	
Was the training on the Green Hotel concept beneficial?	Yes	20(69.0)	30(68.2)	50(68.5)	0.944
	No	9(31.0)	14(31.8)	23(31.5)	

Data are expressed as n (%). P-values were calculated as a result of chi-square analysis.

Assessment of Waste Management Practices

Food waste sources, causes, and management practices are presented in Table 2. The primary causes of food waste included overproduction, serving size, and ineffective product tracking. Overproduction was reported as a cause of food waste by 40% of Green Hotels and 60% of Non-Green Hotels (p=0.999). At the same time, serving size was significantly more problematic in Non-Green Hotels, with 100% of respondents indicating it as a cause (p=0.037). Ineffective product tracking was also critical in Non-Green Hotels (p=0.037). Most of the reasons for the participants who chose the other option were that it is more than people can consume. Other answers included waste from use, the short lifespan of greenery, yellow and rotten leaves not visible in bulk purchases, and waste that cannot be reused due to keeping food in the buffet for a long time.

Regarding the stage of waste occurrence, Green Hotels experienced more waste during the service stage (52.6%), while Non-Green Hotels reported higher waste during kitchen preparation (77.4%) (p=0.010). Additionally, Green Hotels demonstrated better waste separation practices, with 93.1% of respondents separating waste by type, compared to 68.9% in Non-Green Hotels (p=0.014). Most participants stated that the waste is separated according to their types and that household waste should be kept appropriately, recycled, and used in separate waste bins (glass, plastic, paper, etc.). Other answers include each section having its garbage bin, separating bottles, bread and other products, recyclable and non-recyclable waste, oils, and bread. The use of appropriate tools in the kitchen was another distinguishing factor, with 83.3% of Green Hotels acknowledging that food waste resulted from inadequate equipment, compared to 54.5% in Non-Green Hotels (p=0.010).

When the answers of the staff regarding the reasons are examined, the answers include waste generation due to the inability to adjust the amount as a result of not using appropriate tools in portioning, vegetable wastes resulting from not using appropriate tools and equipment (for example, vegetables left on the grater as a result of not using a suitable grater), spoiled products resulting from not having a suitable storage area, and waste sticking to the pan and remaining in the pan as a result of not using the appropriate pan. Furthermore, Green Hotels were more proactive in analyzing plate scraps, with 79.3% of respondents reporting this practice, compared to only 50% in Non-Green Hotels (p=0.012). These findings underscore the more advanced food waste management strategies implemented in Green Hotels, especially in waste separation and equipment usage, which could be key areas for improvement in Non-Green Hotels.

Table 2. Food Waste Sources, Causes, and Management Practices in Green and Non-Green Hotels

Variables		Green Hotel		Total	*p*
		Yes (n=30)	No (n=45)	(n=75)	
*In which food products does food waste occur most?	Meat Products	0(0.0)	1(100.0)	1(100.0)	0.999
	Vegetables	4(26.7)	11(73.3)	15(100.0)	0.239
	Bread	17(47.2)	19(52.8)	36(100.0)	0.220
	Side Dishes (Rice/Vegetables)	3(25.0)	9(75.0)	12(100.0)	0.341
	Breakfast Foods	3(33.3)	6(66.7)	9(100.0)	0.733
	Fried Foods	4(30.8)	9(69.2)	13(100.0)	0.455
	Oils	6(40.0)	9(60.0)	15(100.0)	0.999
	Vegetables	4(26.7)	11(73.3)	15(100.0)	0.239

Table 2. Food Waste Sources, Causes, and Management Practices in Green and Non-Green Hotels (cont.)

*What do you think are the causes of food waste?	Overproduction	6(40.0)	9(60.0)	15(100.0)	0.999
	Serving Size	0(0.0)	7(100.0)	7(100.0)	0.037
	Lack of Hygiene	1(50.0)	1(50.0)	2(100.0)	0.999
	Ineffective Product Tracking	0(0.0)	7(100.0)	7(100.0)	0.037
	Excessive Variety	2(11.1)	16(88.9)	18(100.0)	0.004
	Does not suit palate taste	0(0.0)	3(100.0)	3(100.0)	0.270
	Keeping Meals Waiting for a Long Time at the Open Buffet	5(45.5)	6(54.5)	11(100.0)	0.746
	Other	15(55.6)	12(44.4)	27(100.0)	0.039
*At which stage does the most waste occur?	Service	20(52.6)	18(47.4)	38(100.0)	0.024
	Kitchen-Preparation	7(22.6)	24(77.4)	31(100.0)	0.010
	Storage	3(60.0)	2(40.0)	5(100.0)	0.383
Does food waste occur as a result of not using appropriate tools and equipment in the kitchen?	Yes	25(83.3)	24(54.5)	49(66.2)	0.010
	No	5(16.7)	20(45.5)	25(33.8)	
Does type separate wastes?	Yes	27(93.1)	31(68.9)	58(78.4)	0.014
	No	2(6.9)	14(31.1)	16(21.6)	
*What are the products that are recycled in food and other waste?	Meat Products	3(37.5)	5(62.5)	8(100.0)	0.999
	Vegetables	7(53.8)	6(46.2)	13(100.0)	0.262
	Bread	11(35.5)	20(64.5)	31(100.0)	0.503
	Side Dishes (Rice/Vegetables)	0(0.0)	9(100.0)	9(100.0)	0.009
	Breakfast Foods	12(60.0)	8(40.0)	20(100.0)	0.033
	Fried Foods	0(0.0)	2(100.0)	2(100.0)	0.514
	Oils	10(43.5)	13(56.5)	23(100.0)	0.683
	Frozen Products	1(33.3)	2(66.7)	3(100.0)	0.999
	Others	1(50.0)	1(50.0)	2(100.0)	0.999
What do you do to create less waste and residue?	Portion Reduction	3(10.0)	7(15.6)	10(13.3)	0.285
	Less Variety	0(0.0)	3(6.7)	3(4.0)	
	Production as Required	27(90.0)	35(77.8)	62(82.7)	
Do you analyze your customers' plate scraps?	Yes	23(79.3)	22(50.0)	45(61.6)	0.012
	No	6(20.7)	22(50.0)	28(38.4)	

Data are expressed as n (%). *: indicates multiple choice questions, and separate line percentages are given for each option. p values were calculated as a result of chi-square analysis.

Weekly Consumption of Key Ingredients in Menus

Weekly consumption patterns of key ingredients in Green and Non-Green Hotels are presented in Table 3. Weekly ingredient consumption patterns analysis revealed statistically significant differences between Green and Non-Green Hotels. For red meat, while 23.3% of Green Hotels reported serving it “once or twice daily” compared to 29.5% in Non-Green Hotels, a striking contrast was observed in the “once a week” category, with only 3.3% of Green Hotels versus 25.0% of Non-Green Hotels reporting this frequency (p=0.046). In terms of dairy consumption, 51.1% of Non-Green Hotels indicated that milk is served “every meal,” yet only 46.7% of Green Hotels did so; notably, Green Hotels reported a much higher frequency of milk service “3-5 days per week” (33.3% vs. 4.4%), whereas Non-Green Hotels had a higher proportion offering milk “once a week” (22.2% vs. 3.3%), with these differences reaching significance (p=0.005). Vegetable consumption was relatively high in both groups, with 73.3% of Green Hotels serving vegetables daily, compared to 66.7% of Non-Green Hotels (p=0.201). However, no significant differences were observed in the consumption of poultry, legumes, and animal fats (p values of 0.587, 0.283, and 0.534, respectively), suggesting that these ingredients are consumed similarly across both types of hotels.

These findings highlight that Non-Green hotels tend to consume more meat, fish, and dairy products more

frequently, particularly in comparison to Green hotels, where the consumption of vegetables is more prevalent. Furthermore, these variations are statistically significant in some categories, such as red meat (p=0.046) and milk (p=0.005), underlining the differences in ingredient usage between the two hotel types.

Table 3. Weekly Consumption Patterns of Key Ingredients in Green and Non-Green Hotels

Weekly Usage In The Menu		Green Hotel		Total (n=75)	*p*
		Yes (n=30)	No (n=45)		
Red Meat Product	Every meal	10(33.3)	10(22.7)	20(27.0)	0.046
	Once or twice a day	7(23.3)	13(29.5)	20(27.0)	
	Once a day	0(0.0)	0(0.0)	0(0.0)	
	3-5 times a week	12(40.0)	10(22.7)	22(29.7)	
	Once a week	1(3.3)	11(25.0)	12(16.2)	
Fish Product	Every meal	4(13.3)	8(18.2)	12(16.2)	0.105
	Once or twice a day	2(6.7)	9(20.5)	11(14.9)	
	Once a day	2(6.7)	0(0.0)	2(2.7)	
	3-5 times a week	7(23.3)	4(9.1)	11(14.9)	
	Once a week	15(50.0)	23(52.3)	38(51.4)	
Chicken Product	Every meal	11(36.7)	13(29.5)	24(32.4)	0.587
	Once or twice a day	4(13.3)	10(22.7)	14(18.9)	
	Once a day	2(6.7)	2(4.5)	4(5.4)	
	3-5 times a week	11(36.7)	12(27.3)	23(31.1)	
	Once a week	2(6.7)	7(15.9)	9(12.2)	
Milk Product	Every meal	14(46.7)	23(51.1)	37(49.3)	0.005
	Once or twice a day	3(10.0)	7(15.6)	10(13.3)	
	Once a day	2(6.7)	3(6.7)	5(6.7)	
	3-5 times a week	10(33.3)	2(4.4)	12(16.0)	
	Once a week	1(3.3)	10(22.2)	11(14.7)	
Legumes	Every meal	11(36.7)	16(37.2)	27(37.0)	0.283
	Once or twice a day	3(10.0)	7(16.3)	10(13.7)	
	Once a day	2(6.7)	0(0.0)	2(2.7)	
	3-5 times a week	8(26.7)	16(37.2)	24(32.9)	
	Once a week	6(20.0)	4(9.3)	10(13.7)	
Vegetables	Every meal	22(73.3)	30(66.7)	52(69.3)	0.201
	Once or twice a day	1(3.3)	6(13.3)	7(9.3)	
	Once a day	1(3.3)	2(4.4)	3(4.0)	
	3-5 times a week	2(6.7)	6(13.3)	8(10.7)	
	Once a week	4(13.3)	1(2.2)	5(6.7)	
Animal-based Fat	Every meal	10(33.3)	18(41.9)	28(38.4)	0.534
	Once or twice a day	2(6.7)	6(14.0)	8(11.0)	
	Once a day	1(3.3)	3(7.0)	4(5.5)	
	3-5 times a week	7(23.3)	8(18.6)	15(20.5)	
	Once a week	10(33.3)	8(18.6)	18(24.7)	

Data are expressed as n(%). p values were calculated as a result of chi-square analysis.

Sustainable Food Procurement and Practices in Kitchen Operations

Key differences and similarities in sustainability practices are presented in Table 4. Regarding food procurement, both hotel types strongly emphasize freshness, with 63.3% of Green hotels and 52.3% of Non-Green hotels considering it a priority. However, the difference is not statistically significant (p=0.558). However, Green hotels show a significantly higher tendency to reduce the frequency of their purchases (64.3% vs. 19.0%, p<0.001), particularly in categories such as meat products (5.6% vs. 25.0%, p=0.018) and frozen products (16.7% vs. 0.0%, p=0.018). Regarding seasonal product consumption, both groups exhibit a similar commitment, with 85.7% of Green hotels and 88.1% of Non-Green hotels paying attention to this aspect, with no significant difference (p=0.999). Regarding local product sourcing, most of both groups show a positive perspective (93.1% for Green hotels vs. 87.5%

for Non-Green hotels), but this difference is not statistically significant (p=0.690). Interestingly, regarding sustainability awareness, Green hotels do not demonstrate superior knowledge to Non-Green hotels. For instance, awareness of the Mediterranean diet (75.9% vs. 69.0%, p=0.530), water footprint (55.2% vs. 45.2%, p=0.411), and carbon footprint (55.2% vs. 61.0%, p=0.627) is not significantly different across the two groups. These findings suggest that while Green hotels engage in more sustainable practices, especially regarding purchase frequency reduction and specific product categories, their knowledge and awareness of sustainability concepts are not significantly higher than those in Non-Green hotels.

Table 4. Sustainable Food Procurement in Green and Non-Green Hotels

		Green Hotel		Total (n=75)	*p*
		Yes (n=30)	No (n=45)		
What factors do you consider in food procurement?	Cheap	0(0.0)	3(6.8)	3(4.1)	0.558
	Fresh	19(63.3)	23(52.3)	42(56.8)	
	Local	2(6.7)	3(6.8)	5(6.8)	
	Sustainable	9(30.0)	15(34.1)	24(32.4)	
How frequently do you make purchases?	Daily	4(13.3)	16(35.6)	20(26.7)	0.068
	Weekly	23(76.7)	22(48.9)	45(60.0)	
	Monthly	3(10.0)	6(13.3)	9(12.0)	
	3 Months	0(0.0)	1(2.2)	1(1.3)	
Have you considered reducing the frequency of your purchases?	Yes	18(64.3)	8(19.0)	26(37.1)	<0.001
	No	10(35.7)	34(81.0)	44(62.9)	
In which category have you reduced the frequency of your purchases?	Meat Products	1(5.6)	2(25.0)	3(11.5)	0.018
	Vegetables	2(11.1)	0(0.0)	2(7.7)	
	Bread	2(11.1)	3(37.5)	5(19.2)	
	Side Dishes (Rice/Vegetables)	2(11.1)	1(12.5)	3(11.5)	
	Breakfast Foods	0(0.0)	1(12.5)	1(3.8)	
	Fried Foods	0(0.0)	0(0.0)	0(0.0)	
	Oils	0(0.0)	1(12.5)	1(3.8)	
	Frozen Products	3(16.7)	0(0.0)	3(11.5)	
	All of them	8(44.4)	0(0.0)	8(30.8)	
Do you pay attention to seasonal product consumption?	Yes	24(85.7)	37(88.1)	61(87.1)	0.999
	No	4(14.3)	5(11.9)	9(12.9)	
Do you have a positive perspective on sourcing local products?	Yes	27(93.1)	35(87.5)	62(89.9)	0.690
	No	2(6.9)	5(12.5)	7(10.1)	
Are local products sustainable?	Yes	27(93.1)	39(92.9)	66(93.0)	0.999
	No	2(6.9)	3(7.1)	5(7.0)	
Do you work with suppliers that have sustainability policies?	Yes	22(75.9)	27(64.3)	49(69.0)	0.300
	No	7(24.1)	15(35.7)	22(31.0)	
Are you familiar with the Mediterranean diet?	Yes	22(75.9)	29(69.0)	51(71.8)	0.530
	No	7(24.1)	13(31.0)	20(28.2)	
Does the Mediterranean diet contribute to sustainable food practices?	Yes	22(78.6)	31(75.6)	53(76.8)	0.775
	No	6(21.4)	10(24.4)	16(23.2)	
Are you aware of the meaning of water footprint?	Yes	16(55.2)	19(45.2)	35(49.3)	0.411
	No	13(44.8)	23(54.8)	36(50.7)	
Does reducing water footprint contribute to food waste management?	Yes	12(44.4)	16(41.0)	28(42.4)	0.782
	No	15(55.6)	23(59.0)	38(57.6)	
Are you familiar with the meaning of carbon footprint?	Yes	16(55.2)	25(61.0)	41(58.6)	0.627
	No	13(44.8)	16(39.0)	29(41.4)	
Does reducing carbon footprint contribute to food waste management?	Yes	17(58.6)	22(56.4)	39(57.4)	0.855
	No	12(41.4)	17(43.6)	29(42.6)	

Data are expressed as n(%). p values were calculated as a result of chi-square analysis.

Customer Awareness and the Impact of Environmentally Friendly Kitchen Practices

Customer Awareness and the Impact of Environmentally Friendly Kitchen Practices are presented in Table 5. While a higher proportion of Green hotels inform their customers about their sustainable practices (73.3% vs. 61.9%), this difference is not statistically significant (p=0.310). However, Green Hotels receive significantly more customer feedback regarding these practices than Non-Green Hotels (71.4% vs. 36.6%, p=0.004), suggesting a higher level of interaction and responsiveness to sustainability efforts. Additionally, Green Hotels firmly believes that an eco-friendly kitchen reduces material consumption in the industry (93.3% vs. 74.4%, p=0.038). In contrast, perceptions regarding economic efficiency (93.3% vs. 83.7%, p=0.292), energy consumption reduction (82.8% vs. 74.4%, p=0.404), and added business value (86.7% vs. 92.9%, p=0.440) do not significantly differ between the two groups. These findings indicate that while Green hotels engage more actively in sustainability communication and recognize the impact of eco-friendly kitchens on material efficiency, the overall perceptions of economic and operational benefits are similar across both hotel types.

Table 5. Environmental Communication and Perceived Benefits of Eco-Friendly Kitchens in Green and Non-Green Hotels

		Green Hotel		Total (n=75)	*p*
		Yes (n=30)	No (n=45)		
Do you inform your customers about the environmentally friendly practices implemented in your business?	Yes	22(73.3)	26(61.9)	48(66.7)	0.310
	No	8(26.7)	16(38.1)	24(33.3)	
Do you receive customer feedback regarding the environmentally friendly practices in your business?	Yes	20(71.4)	15(36.6)	35(50.7)	0.004
	No	8(28.6)	26(63.4)	34(49.3)	
Does the use of an eco-friendly kitchen contribute to a reduction in material consumption within the industry?	Yes	28(93.3)	32(74.4)	60(82.2)	0.038
	No	2(6.7)	11(25.6)	13(17.8)	
Does an eco-friendly kitchen enhance economic efficiency?	Yes	28(93.3)	36(83.7)	64(87.7)	0.292
	No	2(6.7)	7(16.3)	9(12.3)	
Does an eco-friendly kitchen reduce energy consumption and the use of non-renewable resources?	Yes	24(82.8)	32(74.4)	56(77.8)	0.404
	No	5(17.2)	11(25.6)	16(22.2)	
Does an environmentally friendly kitchen provide added value to your business?	Yes	26(86.7)	39(92.9)	65(90.3)	0.440
	No	4(13.3)	3(7.1)	7(9.7)	

Data are expressed as n(%). p values were calculated as a result of chi-square analysis.

Discussion

Evaluating kitchen staff's knowledge, attitudes, and behaviors regarding environmentally friendly kitchen practices in Green hotel kitchens is a relatively unexplored area. In this context, the research population initially comprised four four- and five-star hotels.

The demographic composition of kitchen staff plays a crucial role in understanding the workforce dynamics of Green and Non-Green hotels. Recent studies have shown that, particularly in kitchen operations, younger employees adapt more quickly to sustainability training and are more willing to adopt advanced practices (Alcorn, Vega, Irvin, & Paez, 2021; Burlea-Schiopoiu, Shoukat, Shah, Ahmad, & Mazilu, 2022; Leppink et al, 2016). There is a growing consensus in the field that younger employees show more interest in sustainable kitchen practices and actively embrace these practices. Leppink et al. (2016) found that younger employees have higher participation rates in sustainable kitchen practices than older employees. Our study found that the majority of participants were male

(65.3%), with a sizable portion being in the 18–25 age range (52.1%), and no significant difference was observed between groups (p=0.488). Educational levels were also similar, with 65.8% of participants having at least a high school or university degree, indicating the necessity of tailoring sustainability training to the educational background of employees (McDonagh, O'Donovan, Moran, & Ryan, 2024).

Furthermore, work experience was concentrated mainly in the 0–5 years range (88.0%), suggesting that kitchen staff are in the early stages of their careers and may have limited depth of knowledge regarding sustainability (Pellegrini, Rizzi, & Frey, 2018). These findings highlight the need for sustainability training that conveys theoretical knowledge and focuses on developing practical skills. The higher adaptation of younger staff to sustainability practices can largely be attributed to intrinsic motivation, familiarity with technology, and a proactive attitude toward learning. In this context, the demographic characteristics of kitchen staff should be considered as a determining factor in shaping sustainability-focused training and innovation processes. In the future, strategic kitchen management and employee-focused sustainability policies will be key to the sector's long-term goals.

The hotel industry is estimated to be responsible for approximately 45% of the total municipal solid waste generated by commercial sector facilities (Han, Lee, Trang, & Kim, 2018). This high proportion further emphasizes the need for effective waste management practices to reduce the environmental impact of hotels. Studies on food waste management in the hospitality sector have shown that categorizing waste into specific groups provides a strategic approach to supporting sustainability efforts. Papargyropoulou et al. (2016), classified food waste as 'preventable,' 'inevitable,' and 'potentially redistributable,' aiding source identification and targeted prevention strategies. Similarly, a study by Spio-Kwofie, Hayford &Fosu (2024) conducted in three-star hotels in the Takoradi Metropolis highlighted the importance of effective waste segregation systems. It was suggested that hotels should provide training materials for both staff and guests to enhance recycling opportunities. In line with these findings, our study also revealed that waste segregation practices were significantly higher in Green hotels (93.1% versus 68.9%, p=0.014).

Plate waste was more frequently analyzed in Green hotels (79.3% vs. 50.0%, p=0.012), directly contributing to reduced overall food waste. The results highlight the critical role of waste segregation practices in improving waste management efficiency. Both hotel groups faced challenges in sustainable waste management, notably inadequate staff training, limited management support, and resource shortages, hindering the process. These findings align with those of other studies. In Langkawi Island hotels, food waste segregation and composting were limited by space constraints, inadequate infrastructure, and lack of management support (Kasavan, Mohamed, Halim, Yusof, & Siron, 2022). This suggests Green hotels may face similar barriers when adopting sustainable waste management practices.

On the other hand, a study conducted by Langgat et al. (Langgat, Ramdani, Pavic, & Tok, 2023) in 3–5 star hotels in Malaysia, involving 169 hotel managers, examined the determinants of sustainable kitchen practices. The findings revealed that ease of use and senior management support promoted sustainable practices such as waste management and community support initiatives, enhancing hotel staff performance. Additionally, in Southern Italy's Apulia region, Lagioia, Amicarelli, Strippoli, Bux, & Gallucci (2024) surveyed ten hotel managers to assess attitudes toward sustainability and food waste management. The study found that sustainability scores also increased as the number of stars increased, but food waste management attitudes were lower as the number of rooms increased. This indicates that large-scale operations face more complex challenges in implementing sustainability practices (Luo, Chau, Fan,

& Chen, 2021). Similarly, in Thai hotels, Srijuntrapun, Sukwong, & Marshall (2022) found small-scale businesses managed food waste more effectively than large-scale ones, examining policies, planning, supply chains, and disposal methods.

Additionally, Kilibarda, Djokovic, & Suzic, (2019) highlighted efficient food inventory management and portion control as key to preventing food waste, discussing prevention, reduction, and recycling strategies in the hotel sector. All these findings in the literature support our study and highlight the encouraging role of certification in improving sustainable waste management processes. However, to further enhance the efficiency of the process, the development of additional training programs and increased management support remain necessary.

The literature highlights that quality factors are prioritized over cost in sustainable procurement decisions (Da Silva et al., 2023; García-González, Achón, Carretero Krug, Varela-Moreiras, & Alonso-Aperte, 2020; Kayabaşı, Ebeoğlugil, & Özkuk, 2016; Rejman, Kaczorowska, Halicka, & Laskowski, 2019; Ronto, Saberi, Carins, Papier, & Fox, 2022; Yemez & Akca, 2024). In this context, a study by Winata, Bagiastuti, Wendri, & Septevany (2023) on Anantara Uluwatu Bali Resort revealed that the hotel, in alignment with its sustainability goals, preferred energy-efficient and environmentally friendly kitchen equipment. During the procurement process, the hotel collaborated with companies with environmental certifications and selected low-carbon footprint products. Additionally, staff were trained in sustainable kitchen management, ensuring the efficient use of equipment, which subsequently reduced energy consumption and waste, ultimately leading to cost savings in the long run. Similarly, a study conducted at Le Meridien Bali Jimbaran (Andyani, Triyuni, & Puspita, 2023) analyzed the role of green purchasing strategies in increasing environmental awareness in kitchen product procurement. This process prioritized reducing disposable materials and transitioning to recyclable products. However, factors such as prohibitive costs, procurement challenges, and limited supplier options hindered the complete optimization of the process. Our study aligns with the literature in this regard.

Both Green and Non-Green Hotels prioritize the freshness of food supplies (63.3% vs. 52.3%, $p=0.558$). However, Green Hotels were observed to reduce their purchase frequency significantly (64.3% vs. 19.0%, $p<0.001$). This difference is particularly notable in meat products (5.6% vs. 25.0%, $p=0.018$) and frozen products (16.7% vs. 0.0%, $p=0.018$). There are studies in the literature supporting these findings. For example, a study by Damaianti, Farradia, Shafi, Arzaman, & Salleh (2023) found that hotels address environmental concerns and customer expectations by sourcing local food, reducing reliance on high-footprint products like red meat, and making menu choices based on carbon footprint to promote sustainability. In this regard, Green Hotels adopt procurement strategies in line with sustainability goals, but Non-Green Hotels also have the potential to reduce waste by embracing similar approaches (Kassim, 2023).

These findings highlight that sustainable procurement strategies significantly reduce environmental impacts and generate cost savings in the long term. However, it should be noted that challenges such as high costs, limited supplier options, and logistical barriers influence hotels' adoption of sustainable procurement practices. Therefore, for the process to be more effectively carried out, it is necessary to increase management support and encourage sustainability-oriented policies within the supply chain. One limitation of this study is that the food procurement process was not analyzed in detail. However, given the limited research on hotel kitchen staff's knowledge, attitudes, and behaviors on food procurement and food miles, this study is an essential starting point to address this gap.

Menu design is widely recognized as a critical factor in reducing the carbon footprint of food service operations (Gaber Fahim, Elsayed Qoura, Mowad, & Gomaa, 2023; Wejwithan, Knoflacher, & Sintunawa, 2018). Gaber Fahim et al.'s study (2023) highlights that environmentally conscious establishments increase the proportion of vegetarian options in their menus while reducing meat servings, aligning with sustainability principles. This approach is regarded as a strategy consistent with nutritional awareness and environmental sustainability goals.

This study's weekly component consumption analysis reveals significant differences in the use of red meat and dairy products. According to the findings, red meat consumption is notably lower in Green Hotels; only 3.3% report serving red meat once a week, compared to 25.0% in Non-Green Hotels ($p=0.046$). A similar trend is observed in dairy consumption. While 33.3% of Green Hotels report serving dairy products 3–5 times per week, this rate is 4.4% in Non-Green Hotels ($p=0.005$). Conversely, dairy consumption occurs almost at every meal in Non- Green Hotels, with 46.7% in Green Hotels and 51.1% in Non-Green Hotels. These findings demonstrate that hotels' food supply strategies directly reflect sustainable dietary approaches. Specifically, reducing red meat consumption is considered a development aligned with sustainability efforts, as it is associated with a lower environmental impact.

On the other hand, both hotel groups exhibit elevated levels of vegetable consumption, with no significant difference between the groups ($p=0.201$). This indicates that while Green Hotels significantly change animal-based food consumption to meet sustainability goals, they exhibit similar trends in plant-based food consumption. The findings suggest that Green Hotels minimize their environmental impacts by reducing red meat consumption and optimizing dairy consumption within their sustainable food supply strategies. Consistent with similar studies, these results indicate that hotels make sustainability-focused decisions in menu design and that environmental responsibility awareness can shape food consumption habits. One limitation of this study is that examples of sustainable menus were not examined in detail. However, given the limited research on menu awareness in Green Hotels in the literature, this study is a pioneering contribution to the field.

Sustainable practices are more commonly implemented in Green Hotels; however, research indicates that employees' knowledge levels regarding sustainability concepts do not differ significantly across these establishments. Specifically, no statistically significant differences were observed between Green and Non-Green Hotels staff regarding topics such as the Mediterranean diet (75.9% vs. 69.0%, $p=0.530$), water footprint (55.2% vs. 45.2%, $p=0.411$), and carbon footprint (55.2% vs. 61.0%, $p=0.627$). This study reveals that while Green Hotels are more effective in implementing sustainable practices, their staff's knowledge and attitude levels do not significantly differ from those in Non-Green Hotels. In contrast, Rodríguez-García, Ferrero-Ferrero, & Fernández-Izquierdo (2023) showed that integrating sustainability principles into hotel operations, supported by certification processes, fosters sustainable practices and boosts employee participation. Comparable results are consistent with other studies in the literature. For instance, Soliman's research (2020) in Alexandria examined food waste management in hotel kitchens and identified knowledge and application gaps in sustainability through surveys with 253 kitchen staff. The study highlighted the need for training programs and the implementation of smart waste management systems to address these gaps. Likewise, Yayla, Keles, Silik, & Akbulut (2024) found in Antalya's five-star hotels that environmental strategies significantly increased sustainability awareness and green employee behavior, especially in Green Star-certified establishments. This finding indicates that corporate environmental policies are critical in shaping employee behavior.

Additionally, a study by Lim, Teoh, & Kuar (2024) in Malaysia found that sustainability practices were directly related to personal values, environmental awareness, and sustainability attitudes among hotel employees. However, the study also showed that lack of knowledge was one of the most significant barriers to the widespread adoption of these practices. This suggests that sustainability principles should be supported by corporate policies and environmental regulations and raising employee awareness. When these findings are considered together, it is clear that training programs to improve hotel staff's knowledge of sustainability are essential. Increasing sustainability awareness in both Green and Non-Green Hotels is critical to reducing environmental impacts and fostering the effective adoption of sustainable practices.

Green Hotels are suggested to have the potential to establish stronger interactions with environmentally conscious customers. However, this engagement depends not only on customer awareness but also on hotel managers' and employees' knowledge and attitudes toward eco-certifications, a key determining factor (Mensah & Ampofo, 2021; Rassiah, Mohd Nasir, Khan, & Munir, 2022). In this context, a study by Boronat-Navarro and Pérez-Aranda (2020) assessed the sustainability awareness and eco-certification perceptions among hotel guests from different nationalities. According to the study findings, customers more willing to pay for Green Hotels also exhibited increased loyalty toward the hotel brand. Similarly, Yılmaz, Üngüren, & Kaçmaz (2019) found that attitudes toward eco-labels among 408 hotel managers in 83 establishments varied with personal and professional characteristics.

Furthermore, it was found that sustainable management practices significantly differed between eco-labeled and non-eco-labeled hotels. On the other hand, a study by Lin, Zhou, Zheng, Jiang, & Nguyen (2023) investigated how hotel environmental Corporate Social Responsibility (CSR) initiatives affect customer perceptions and behaviors. An online survey of 749 participants in China found that effective environmental communication in high-star hotels boosts customer loyalty and promotes wider adoption of sustainable practices. These findings align with those of Olya, Altinay, Farmaki, Kenebayeva, & Gursoy (2021), Modica, (Modica, Altinay, Farmaki, Gursoy, & Zenga (2020), Godovykh, Fyall, & Baker (2024), Assaker & O'Connor (2023), and Han et al (2018), where the studies showed that the level of customer participation in sustainability initiatives and their knowledge about these practices directly affected their booking preferences and brand loyalty.

Consistent with some of the findings in the literature, our study results indicate that Green Hotels are more likely to provide information about sustainability practices to their customers than Non-Green Hotels (73.3% vs. 61.9%, p=0.310). However, this difference was not statistically significant. Nevertheless, when evaluating customer feedback responses, it was found that Green Hotels had a higher level of engagement (71.4% vs. 36.6%, p=0.004). These results suggest that Green Hotels apply sustainability-focused communication strategies more effectively and assess customer feedback.

Conclusions

In conclusion, this study highlights the critical role of sustainable food and beverage services in mitigating the environmental impact of hotel kitchens. The findings reveal that employees in Green Hotels exhibit a higher level of knowledge and more consistent implementation of sustainable practices, such as waste segregation and energy conservation, compared to those in Non-Green Hotels. Despite these positive trends, both groups encounter common challenges, including inadequate training opportunities, financial constraints, and limited institutional support.

Despite generally positive attitudes toward sustainability among employees in both Green and Non-Green Hotels, the practical translation of these attitudes into actions was more evident in certified establishments. These findings highlight the need to strengthen sustainability efforts in hotel kitchens by institutionalizing staff education, fostering organizational commitment, and implementing supportive policy frameworks.

This study makes a significant contribution to the existing literature by shifting the focus from consumer preferences for sustainable hotels to the often-overlooked perspectives of hotel employees—their knowledge, attitudes, and behaviors regarding sustainability. Given the limited research in this area, these findings fill a notable gap and provide a foundation for future investigations.

Future research should expand the scope to diverse geographical regions, enabling a more comprehensive understanding of the long-term impacts of sustainability practices in the hospitality sector. Additionally, exploring the effectiveness of specific training programs and policy interventions may further enhance the adoption of sustainable practices in hotel kitchens.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author, M.Ç. The data are not publicly available due to their containing information that could compromise the privacy of research participants.

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Declaration

All authors of the article contributed equally to the article process. The authors have no conflicts of interest to declare. The study was approved by the Erciyes University Social and Humanities Ethics Committee (no. 264, 4 Jul 2023). Participants were informed about the aims and methodologies of the study, and if they agreed to participate, they signed an Informed Consent Form.

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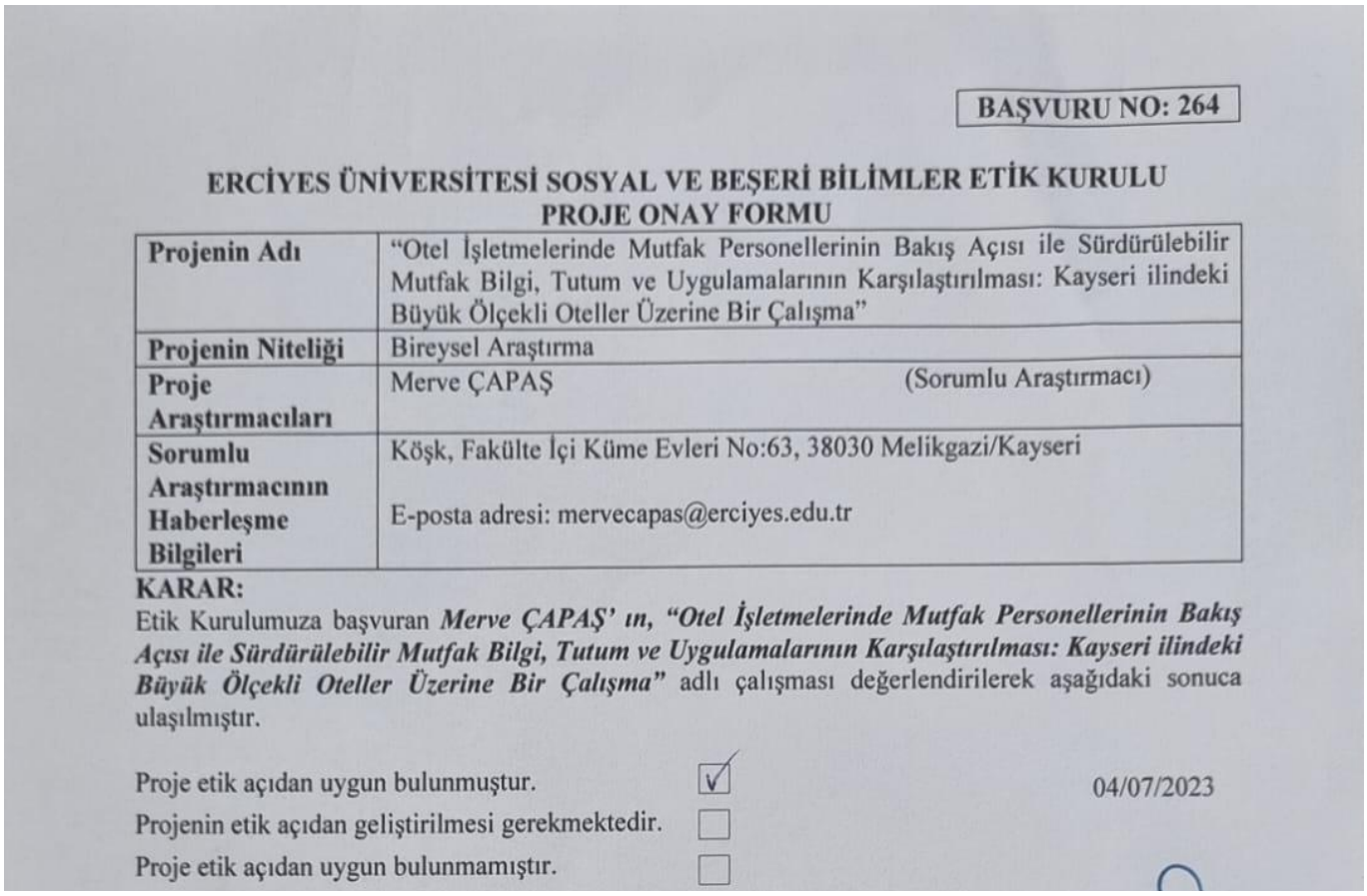
Appendix 1. Ethics Committee Permission



BAŞVURU NO: 264

ERCİYES ÜNİVERSİTESİ SOSYAL VE BEŞERİ BİLİMLER ETİK KURULU
PROJE ONAY FORMU

Projenin Adı	"Otel İşletmelerinde Mutfak Personellerinin Bakış Açısı ile Sürdürülebilir Mutfak Bilgi, Tutum ve Uygulamalarının Karşılaştırılması: Kayseri ilindeki Büyük Ölçekli Oteller Üzerine Bir Çalışma"
Projenin Niteliği	Bireysel Araştırma
Proje Araştırmacıları	Merve ÇAPAŞ (Sorumlu Araştırmacı)
Sorumlu Araştırmacının Haberleşme Bilgileri	Köşk, Fakülte İçi Küme Evleri No:63, 38030 Melikgazi/Kayseri E-posta adresi: mervecapas@erciyes.edu.tr

KARAR:
Etik Kurulumuza başvuran ***Merve ÇAPAŞ' ın, "Otel İşletmelerinde Mutfak Personellerinin Bakış Açısı ile Sürdürülebilir Mutfak Bilgi, Tutum ve Uygulamalarının Karşılaştırılması: Kayseri ilindeki Büyük Ölçekli Oteller Üzerine Bir Çalışma"*** adlı çalışması değerlendirilerek aşağıdaki sonuca ulaşılmıştır.

Proje etik açıdan uygun bulunmuştur. ☑ 04/07/2023
Projenin etik açıdan geliştirilmesi gerekmektedir. ☐
Proje etik açıdan uygun bulunmamıştır. ☐