Evaluation of the Nutritional Quality and Food Safety of Meals Served in Hospital Canteens in Bujumbura, Burundi

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Abstract
Hospital catering is an important component of patient care. It must simultaneously meet the requirements of nutritional quality, food safety, and acceptability. However, data on the quality of meals served in Burundian healthcare facilities remain limited. This study aimed to assess the nutritional quality and food safety of meals served in the canteens of three national referral hospitals in Bujumbura and identify the main factors associated with their inadequacy.
A descriptive cross-sectional study with an analytical component was conducted in the canteens of Prince Regent Charles Hospital (HPRC), Kamenge Military Hospital (HMK), and Prince Louis Rwagasore Clinic (CPLR) from October 1, 2025, to March 31, 2026. A total of 216 participants were recruited using stratified sampling, including 54 canteen staff members, 54 healthcare professionals involved in nutrition, and 108 patients or accompanying persons. Eighteen complete meals were assessed using a weighted checklist comprising 20 criteria grouped into five dimensions: nutritional value, food safety, dietary diversity, presentation, and taste. The acceptability threshold was set at 75%. Data were analyzed using Stata MP 17. None of the 18 meals assessed reached the acceptability threshold. The overall mean score was 0.57 ± 0.05, with a gradient of HPRC (0.62) > HMK (0.57) > CPLR (0.53). The mean scores were 0.58 ± 0.04 for nutritional value, 0.65 ± 0.06 for food safety, 0.50 ± 0.04 for dietary diversity, 0.55 ± 0.04 for presentation, and 0.58 ± 0.05 for taste. Food safety was strongly correlated with overall quality (r = 0.82; p = 0.001), as was nutritional value (r = 0.76; p = 0.003). Personnel hygiene was non-compliant in all three facilities (SS4 = 0%). Furthermore, 99.1% of observations indicated the absence of a dietetics service, 93.5% indicated the absence of adequate operational standards, and 83.2% indicated a lack of hygiene/HACCP training. External monitoring was virtually nonexistent.
The nutritional quality and food safety of meals served in the three hospital canteens studied were inadequate, reflecting systemic shortcomings. Strengthening personnel hygiene, establishing or operationalizing dietetics services, providing continuous HACCP training, developing operational standards, and implementing a regular quality control system are priorities for sustainably improving hospital catering in Burundi.

Keywords : *hospital catering ; nutritional quality; food safety; hospital canteens; food hygiene;*

1. Introduction

Hospital catering is an important component of patient care and recovery. Beyond meeting dietary needs, it should contribute to maintaining or improving nutritional status, support wound healing and recovery processes, and prevent the worsening of malnutrition. The quality of hospital meals therefore relies on several complementary dimensions, including nutritional adequacy, food safety, dietary diversity, and meal acceptability [1–5].

Food safety is a particular concern in healthcare settings. Hospitalized patients may be more vulnerable to infections because of their age, underlying illnesses, immune status, or medical procedures. The use of contaminated raw materials, improper food-handling practices, inadequate handwashing, breaks in the hot or cold chain, and the absence of control procedures may increase the risk of food contamination [1,2,8,9]. Good hygiene practices and hazard control based on the Hazard Analysis and Critical Control Points (HACCP) approach are therefore essential components of mass catering, particularly in hospital food services [26].

Similarly, the nutritional quality of hospital meals is critical to patient care. Hospital malnutrition is common in many settings and may be associated with increased morbidity, mortality, length of hospital stay, and healthcare costs [3,4,28,29]. Hospital meals should therefore provide adequate amounts of energy and nutrients while ensuring sufficient dietary diversity and being adapted to patients' specific nutritional needs.

In low- and middle-income countries, several constraints can compromise the quality of hospital catering services. These include inadequate infrastructure, unsuitable equipment, supply difficulties, a lack of specialized nutrition personnel, insufficient training of kitchen staff, and inadequate supervision and monitoring mechanisms [6–10,31–37].

In East Africa, healthcare systems also face organizational and institutional constraints that may affect the quality of catering services. The absence of standardized procedures, insufficient training of food handlers, and deficiencies in water, sanitation, and hygiene can increase the health risks associated with hospital meals [6–9,32].

In Burundi, despite the existence of a regulatory framework governing food hygiene, specific data on hospital catering remain limited. Available national documents highlight shortcomings in clinical nutrition, kitchen hygiene, and the organization of food services [12–16]. This issue is particularly important because hospitalized patients constitute a population for whom food safety and the nutritional adequacy of meals must be ensured to especially rigorous standards.

Against this background, the present study was conducted in three national referral hospitals in Bujumbura: Prince Regent Charles Hospital (HPRC), Kamenge Military Hospital (HMK), and Prince Louis Rwagasore Clinic (CPLR).

The objective of this study was to assess the nutritional quality and food safety of meals served in the canteens of these three facilities and to identify the main institutional, human, logistical, and structural factors that may explain the observed shortcomings.

2. Materials and Methods

2.1. Study Design, Setting, and Period

This was a descriptive cross-sectional study with an analytical component conducted in the canteens of three national referral hospitals in Bujumbura : Prince Regent Charles Hospital (HPRC), Kamenge Military Hospital (HMK), and Prince Louis Rwagasore Clinic (CPLR). The overall study covered the period from October 1, 2025, to March 31, 2026. Direct meal assessments were conducted during November 2025, from November 3 to 28. Meals were observed during the usual lunch service, between 11:30 a.m. and 2:00 p.m. At the time of the study, HPRC had 424 beds, HMK had 405 beds, and CPLR had approximately 250 beds.

2.2. Study Population and Sampling

The study population comprised three categories of stakeholders directly involved in hospital catering: (1) canteen and kitchen staff, (2) healthcare professionals involved in hospital

nutrition, and (3) patients or accompanying persons consuming meals served by the canteens. The planned sample size was 216 participants. A stratified sampling approach was used. The 216 participants were distributed as follows: 54 canteen staff members (25%), 54 healthcare professionals involved in nutrition (25%), and 108 patients and/or accompanying persons (50%). The distribution across the facilities was proportional to their estimated relative size: 86 participants at HPRC, 76 at HMK, and 54 at CPLR. Within each stratum, participants were selected using purposive or convenience sampling, depending on their availability and presence during the data collection period.

2.3. Meal Assessment

Eighteen complete meals were assessed : seven at HPRC, six at HMK, and five at CPLR. Each meal corresponded to the lunch normally served to consumers, without any modification for the purposes of the study. A structured checklist comprising 20 criteria was used. The criteria were grouped into five dimensions :

1. Nutritional value: 6 criteria, weight 2;
2. Food safety : 6 criteria, weight 3;
3. Dietary diversity : 3 criteria, weight 1;
4. Presentation : 2 criteria, weight 1;
5. Taste : 3 criteria, weight 1.

The criteria were coded as binary variables: 1 for compliance and 0 for non-compliance.
The nutritional value criteria included portion adequacy, the presence of a protein source, the presence of vegetables or fruits, the presence of a starchy food, the quality of fats, and the control of salt and added sugars.
The food safety criteria included serving temperature, holding or transportation time, cleanliness of equipment and surfaces, personnel hygiene, traceability and labeling, and the absence of abnormalities or foreign bodies.
Three food safety criteria were considered critical: SS1, SS4, and SS6. Non-compliance with any of these criteria automatically resulted in the meal being classified as unacceptable, regardless of its overall weighted score. The acceptability threshold was set at 75% of the maximum weighted score.

2.4. Assessment of Taste Satisfaction

A supplementary taste satisfaction survey was conducted among 162 consumers. Satisfaction was assessed using a five-point scale ranging from 1 to 5. Participants were recruited from the three facilities: 64 at HPRC, 57 at HMK, and 41 at CPLR. A score of $\geq 3/5$ was considered to indicate moderate to high satisfaction.

2.5. Data Collection on Associated Factors

A structured questionnaire, a direct observation checklist, and a semi-structured interview guide were used to document factors potentially influencing meal quality. The variables examined included: (1) infrastructure and equipment, (2) access to water and essential resources, (3) separation of work areas, (4) staff qualifications and training, (5) hygiene knowledge and practices, (6) procurement and stock management, (7) the existence of standards and procedures, (8) the budget allocated to catering, (9) the availability of a dietetics service, and (10) supervision and quality control. A pre-test was conducted among 22 participants in hospital departments that were not included in the main study sample.

2.6. Statistical Analysis

The data were entered, cleaned, and analyzed using Stata MP 17. Descriptive analyses included frequencies, proportions, means, and standard deviations. Associations between the quality

dimensions and the overall score were examined using correlation coefficients. Chi-square (χ^2) tests were used to compare taste satisfaction across the facilities. Proportion tests were also used to compare selected institutional variables against predefined reference levels. Statistical significance was set at $p < 0.05$.

2.7. Ethical Considerations

The necessary authorizations were obtained from the hospital facilities concerned. Participants were informed about the study objectives, the confidentiality of the information collected, and the voluntary nature of their participation. Informed consent was obtained before administering questionnaires or conducting interviews.

It should be noted that the biochemical and microbiological analyses initially planned could not be performed because of technical and material constraints. Consequently, the assessment of meal quality relied primarily on structured observation and consumer satisfaction.

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3. Results

3.1. Overall Meal Quality

A total of 18 meals were assessed across the three hospital facilities : seven at HPRC, six at HMK, and five at CPLR. None of the meals assessed reached the acceptability threshold of 75%. Thus, all meals (100%) were classified as unacceptable according to the assessment checklist used. The overall mean meal quality score was 0.57 ± 0.05. The highest score was observed at HPRC (0.62), followed by HMK (0.57) and CPLR (0.53). The ranking of the facilities according to their overall scores was therefore HPRC > HMK > CPLR.

Table 1. Overall meal quality scores by facility

Facility	Number of meals assessed	Mean overall score	Acceptable meals (≥75%)	Unacceptable meals (<75%)
HPRC	7	0.62	0 (0%)	7 (100%)
HMK	6	0.57	0 (0%)	6 (100%)
CPLR	5	0.53	0 (0%)	5 (100%)
Overall	**18**	**0.57 ± 0.05**	**0 (0%)**	**18 (100%)**

These findings show that meal unacceptability was observed in all three facilities and was therefore not limited to a single hospital canteen.

3.2. Scores for the Different Dimensions of Meal Quality

The mean scores for the different dimensions assessed are presented in Table 2. None of the dimensions reached the acceptability threshold of 0.75. Food safety had the highest mean score (0.65 ± 0.06), followed by nutritional value and taste, with scores of 0.58 ± 0.04 and 0.58 ± 0.05, respectively. Presentation had a mean score of 0.55 ± 0.04. Dietary diversity was the lowest-performing dimension, with a mean score of 0.50 ± 0.04. Across all dimensions, HPRC had the highest scores, followed by HMK and then CPLR.

Table 2. Mean scores for the different dimensions of meal quality by facility

Dimension	HPRC	HMK	CPLR	Overall
Nutritional value	0.62	0.58	0.55	0.58 ± 0.04
Food safety	0.71	0.65	0.60	0.65 ± 0.06
Dietary diversity	0.54	0.50	0.47	0.50 ± 0.04
Presentation	0.59	0.55	0.52	0.55 ± 0.04
Taste	0.63	0.57	0.53	0.58 ± 0.05
Overall quality	0.62	0.57	0.53	0.57 ± 0.05

However, the relatively higher food safety score does not mean that this dimension was satisfactory, since its mean score remained below the 0.75 threshold.

3.3. Food Safety of Meals

Analysis of the critical food safety criteria revealed varying levels of compliance across the criteria examined. Compliance with the serving temperature criterion (SS1) was 83% across all facilities. The absence of foreign bodies or critical abnormalities (SS6) was observed in 100% of meals. In contrast, compliance with the personnel hygiene criterion (SS4) was zero in all three facilities. This finding represents an important aspect of the food safety situation observed.

Table 3. Compliance with critical food safety criteria for meals

Critical criterion	HPRC (%)	HMK (%)	CPLR (%)	Overall (%)
SS1 – Compliance with serving temperature requirements	86	83	80	**83**
SS4 – Compliance with personnel hygiene requirements	0	0	0	**0**
SS6 – Absence of foreign bodies/abnormalities	100	100	100	**100**

The mean food safety score was 0.65 ± 0.06, with scores of 0.71 at HPRC, 0.65 at HMK, and 0.60 at CPLR. A strong, positive, and statistically significant correlation was observed between food safety and overall meal quality ($r = 0.82$; $p = 0.001$).

3.4. Nutritional Value of Meals

The mean nutritional value score was 0.58 ± 0.04. HPRC had the highest score (0.62), followed by HMK (0.58) and CPLR (0.55). No meal reached the 75% acceptability threshold. Nutritional value was strongly and significantly associated with overall meal quality ($r = 0.76$; $p = 0.003$). These findings indicate that the nutritional dimension was an important component of the overall quality of the meals assessed.

3.5. Dietary Diversity, Presentation, and Taste

Dietary diversity had the lowest mean score (0.50 ± 0.04). The scores were 0.54 at HPRC, 0.50 at HMK, and 0.47 at CPLR. Presentation had a mean score of 0.55 ± 0.04, while taste had a mean score of 0.58 ± 0.05. All three dimensions were significantly associated with overall meal quality. The strongest association was observed for taste ($r = 0.69$; $p = 0.008$), followed by dietary diversity ($r = 0.64$; $p = 0.015$) and presentation ($r = 0.58$; $p = 0.026$).

Table 4. Correlations between the different dimensions and overall meal quality

Dimension	Correlation coefficient (r)	p-value	Strength of association
Food safety	0.82	0.001	Strong
Nutritional value	0.76	0.003	Strong
Taste	0.69	0.008	Moderate to strong
Dietary diversity	0.64	0.015	Moderate
Presentation	0.58	0.026	Moderate

Food safety was therefore the dimension most strongly associated with overall meal quality, followed by nutritional value.

3.6. Consumer Satisfaction with Taste

Among the 162 consumers interviewed, 105 (64.8%) reported a taste satisfaction score of ≥3/5, while 57 (35.2%) had a score below 3/5. The proportion of consumers reporting satisfaction was 68.8% at HPRC, 64.9% at HMK, and 58.5% at CPLR.

Table 5. Consumer satisfaction with taste by facility

Facility	Consumers interviewed (n)	Satisfaction ≥3/5, n (%)	Satisfaction <3/5, n (%)
HPRC	64	44 (68.8)	20 (31.2)
HMK	57	37 (64.9)	20 (35.1)
CPLR	41	24 (58.5)	17 (41.5)
Overall	**162**	**105 (64.8)**	**57 (35.2)**

The difference in taste satisfaction among the three facilities was not statistically significant ($\chi^2 = 10.15$; $p = 0.118$). However, a substantial contrast was observed between consumer perceptions and the objective assessment of meals: although 64.8% of consumers reported at least moderate satisfaction with taste, none of the 18 meals assessed reached the overall quality threshold of 75%.

3.7. Staff Training and Competencies

Analysis of human factors revealed a substantial training deficit among staff. Of the 107 observations relating to kitchen and canteen personnel, 18 (16.8%) concerned individuals who had received hygiene/HACCP training, compared with 89 (83.2%) for whom no such training was reported. The situation was also unfavorable regarding nutrition training, the absence of which was reported in 90.7% of observations.

Table 6. Main institutional, human, and material factors associated with meal quality

Indicator	Compliant/Available, n (%)	Non-compliant/Absent, n (%)
Hygiene/HACCP training	18 (16.8)	89 (83.2)
Nutrition training	—	90.7%
Structured dietetics service	0.9%	99.1%
Compliant/operational regulatory framework	6.5%	93.5%
External inspection conducted	0.9%	99.1%
Structured quality control system	0%	100%
Availability of drinking water	86.1%	13.9%

These findings highlight substantial shortcomings in staff competencies and institutional mechanisms that could contribute to improving meal quality.

3.8. Dietetics Service

The existence of a structured dietetics service was very limited in the facilities studied. Of the 107 observations, 106 (99.1%) indicated the absence of such a service, while only one observation (0.9%) indicated partial availability.

Table 7. Organization and functioning of the dietetics service

Variable	Category	CPLR (N=26)	HMK (N=37)	HPRC (N=44)	TOTAL (N=107)	Overall mean
Existence of a dietetics service	0 – Absent	26 (100%)	36 (97.3%)	44 (100%)	106 (99.1%)	0.01
	1 – Partially available	0 (0%)	1 (2.7%)	0 (0%)	1 (0.9%)	
Total		**26 (100%)**	**37 (100%)**	**44 (100%)**	**107 (100%)**	
Qualifications of dietetics personnel	0	10 (38.5%)	15 (40.5%)	18 (40.9%)	43 (40.2%)	0.60
	1	16 (61.5%)	22 (59.5%)	26 (59.1%)	64 (59.8%)	
Total		**26 (100%)**	**37 (100%)**	**44 (100%)**	**107 (100%)**	
Involvement in menu development	0 – None	26 (100%)	37 (100%)	44 (100%)	107 (100%)	0.00
Nutritional monitoring of patients	0 – None	26 (100%)	37 (100%)	44 (100%)	107 (100%)	0.00
Collaboration with other departments	0 – None	26 (100%)	37 (100%)	44 (100%)	107 (100%)	0.00

The involvement of a dietetics service in menu development, nutritional monitoring of patients, and collaboration with other departments was absent across all observations.

3.9. Standards, Supervision, and Quality Control

The study also revealed substantial shortcomings in the regulatory framework and quality control mechanisms governing hospital catering.

Table 8. Regulatory framework and implementation of standards

Variable	CPLR	HMK	HPRC	TOTAL (N=107)	Overall mean
Existence of official nutritional standards – None	92.3% (24)	91.9% (34)	95.5% (42)	**93.5% (100)**	0.07
Official standards – Partial	7.7% (2)	8.1% (3)	4.5% (2)	**6.5% (7)**	
Application of standards in meal planning – None	100%	100%	100%	**100% (107)**	0.00
Adequacy of standards to patients' needs – No	100%	100%	100%	**100%**	0.00
Staff awareness of guidelines – None	100%	100%	100%	**100%**	0.00
Monitoring and evaluation of standards implementation – None	92.3%	91.9%	95.5%	**93.5%**	0.07

Thus, 93.5% of observations reported the absence of official nutritional standards. Furthermore, no observations reported that such standards were applied in meal planning, adapted to patients' needs, or communicated to staff through awareness-raising activities.

Table 9. Supervision and quality control

Variable	Category	TOTAL (N=107)	Overall mean
Regular internal supervision	0 – None	53 (49.5%)	0.50
	1 – Partial	54 (50.5%)	
External inspection visits	0 – None	106 (99.1%)	0.01
	1 – Partial	1 (0.9%)	
Methods used for quality control	0 – None	107 (100%)	0.00
Monitoring of non-compliance and corrective actions	1 – Partial	107 (100%)	1.00
Existence of inspection traceability records	0 – None	107 (100%)	0.00

External inspection visits were virtually nonexistent, with only 0.9% of observations reporting an inspection, compared with 99.1% reporting no external inspection. Similarly, no observations reported the existence of a structured quality control method or a system for documenting and tracing inspections. Proportion tests conducted on the main institutional variables were statistically significant ($p < 0.001$).

Table 10. Proportion tests for the main institutional variables

Variable	Target proportion	Overall observed proportion	z	p-value
Existence of official nutritional standards	0.50	0.0654 (6.5%)	-8.991	**<0.001**
External inspection visits	0.30	0.0093 (0.9%)	-6.561	**<0.001**

3.10. Availability of Resources

The availability of material resources was relatively satisfactory for several indicators. Adequate access to drinking water was reported in 86.1% of observations. Treated water was adequately available in 93.5% of observations, and electricity was available in 100% of cases.

Table 11. Availability of essential resources

Variable	Category	CPLR (N=54)	HMK (N=76)	HPRC (N=86)	TOTAL (N=216)	Overall mean
Access to drinking water	1 – Partial	7 (13.0%)	11 (14.5%)	12 (14.0%)	30 (13.9%)	1.86
	2 – Adequate	47 (87.0%)	65 (85.5%)	74 (86.0%)	186 (86.1%)	
Availability of treated water	2 – Adequate	51 (94.4%)	71 (93.4%)	80 (93.0%)	202 (93.5%)	1.94
Water pressure in facilities	2 – Adequate	46 (85.2%)	60 (78.9%)	68 (79.1%)	174 (80.6%)	1.81
Access to electricity	2 – Adequate	54 (100%)	76 (100%)	86 (100%)	216 (100%)	2.00

Despite the relatively satisfactory availability of certain resources, compliance with hygiene practices remained inadequate. In particular, adequate access to drinking water (86.1%) contrasted with the zero compliance rate for the personnel hygiene criterion (SS4).

The analysis of the results highlights the inadequate overall quality of the meals served in the three hospital facilities studied. All 18 meals assessed scored below the 75% acceptability threshold, with an overall mean score of 0.57 ± 0.05. Food safety was the dimension with the

highest mean score, but it also remained below the acceptability threshold. Personnel hygiene was the main critical area, with a compliance rate of 0%. Furthermore, dietary diversity was the lowest-performing dimension.

The results also revealed several structural shortcomings, including low levels of staff training in hygiene/HACCP and nutrition, the absence of a structured dietetics service, limited availability of official nutritional standards, an almost complete absence of external inspections, and the lack of a structured quality control system.

Finally, a discrepancy was observed between the objective assessment and consumers' perceptions : although 100% of the meals were classified as unacceptable according to the weighted assessment checklist, 64.8% of the consumers surveyed reported a level of taste satisfaction of ≥3/5. Taken together, these findings show that the quality of hospital meals depends on a combination of **nutritional, food safety, organoleptic, human, and institutional dimensions**, several of which present substantial shortcomings in the facilities studied.

4. Discussion

The main finding of this study was the universal non-compliance of the meals assessed. None of the 18 meals examined across the three hospital canteens reached the 75% threshold. The overall mean score of 0.57 ± 0.05 indicates multidimensional shortcomings affecting food safety, nutritional value, dietary diversity, presentation, and taste simultaneously. This situation is particularly concerning in a hospital setting, where food is an integral component of patient care. The literature highlights that hospital malnutrition may contribute to increased complications, longer hospital stays, and higher mortality [3,4,28,29]. Hospital catering should therefore not be regarded as merely a food service, but rather as an integral component of the healthcare system.

4.1. Food Safety: A Major Determinant

Food safety was the strongest statistical determinant of overall meal quality, with a correlation coefficient of $r = 0.82$ ($p = 0.001$). This finding is consistent with the food safety and hazard control principles recommended by the Codex Alimentarius [26]. This dimension is particularly important in hospital settings because of the vulnerability of many patients. The most concerning finding was the zero compliance rate for criterion SS4, which relates to personnel hygiene, across all three facilities. This situation indicates that the human factor represents a critical point in the catering system.

This finding is particularly noteworthy given that drinking water was available in 86.1% of observations. There is therefore a paradox between the availability of an essential resource and the poor level of hygiene practices. This observation suggests that the shortcomings are not attributable solely to infrastructure, but also to knowledge, behavior, supervision, and the effective implementation of procedures. Studies conducted in other African settings have similarly highlighted the importance of food handlers' practices in controlling contamination risks [2,8,9,31,37].

4.2. Nutritional Value and Dietary Diversity

Nutritional value was the second major determinant of overall meal quality, with $r = 0.76$ ($p = 0.003$). The mean score of 0.58 remained substantially below the acceptability threshold. This inadequacy is particularly concerning in a context where patients' nutritional requirements may increase or change because of illness, surgery, infection, or medical treatment. The low dietary diversity score, with a mean of only 0.50, further reinforces this finding.

The absence of dietetics professionals in almost all observations is likely to be an important organizational factor. A functional dietetics service could improve menu planning, portion

adjustment, consideration of specific nutritional needs, and nutritional monitoring of patients. These findings are consistent with evidence reported in other African countries, where the nutritional quality of hospital meals remains constrained by inadequate nutritional planning and a lack of specialized professionals [34–37].

4.3. Better Perceived Taste Satisfaction Than Objective Meal Quality

An interesting finding was the contrast between consumer perceptions and the objective assessment. Nearly two-thirds of consumers (64.8%) reported being satisfied or moderately to highly satisfied with the taste of the meals. Nevertheless, none of the meals met the overall acceptability criteria. This finding shows that sensory satisfaction is not a sufficient indicator of nutritional quality and food safety. A meal may be considered acceptable in terms of taste while still presenting shortcomings in hygiene, dietary diversity, or nutritional composition.

The observed correlations nevertheless confirm that taste, dietary diversity, and presentation contribute to the overall perception of meal quality. Taste, in particular, showed a significant correlation of 0.69 with the overall score. Patient satisfaction therefore remains important, but it should be considered complementary to an objective assessment based on nutritional and food safety criteria.

4.4. Staff Training Deficits

The training deficit represents another major finding. More than eight out of ten kitchen staff members had not received hygiene/HACCP training. This situation may directly affect food handling, cleaning, storage, and serving practices. However, training should be designed as an ongoing, practical process rather than a one-off activity.

Training should cover, in particular: proper handwashing; prevention of cross-contamination; temperature control; cleaning and disinfection; food storage; waste management; HACCP principles; traceability; and appropriate actions to take when non-compliance is identified.

4.5. Institutional Failures

The findings show that the observed shortcomings cannot be attributed solely to kitchen staff. The near-total absence of dietetics services, inadequate regulatory standards, training deficits, and lack of quality control indicate systemic institutional failures.

The finding that dietetics services were absent in 99.1% of observations is particularly important. Without specialized personnel, nutritional planning is likely to remain empirical and may fail to adequately account for patients' specific needs. Similarly, the absence of operational procedures limits the institution's ability to clearly define responsibilities, expected standards, critical control points, and corrective measures. Finally, the lack of quality control deprives facilities of a mechanism for identifying shortcomings and monitoring progress.

4.6. Implications for Hospitals in Bujumbura

The findings suggest that improving hospital catering cannot rely on a single intervention. An integrated approach is required. This should include establishing functional dietetics services; developing operational standards and procedures; providing continuous staff training in hygiene and HACCP; introducing regular internal inspections; strengthening external inspections; improving menu planning; monitoring the nutritional quality of meals; and implementing a system for traceability and the management of non-compliance.

4.7. Study Limitations

This study has several limitations that should be considered when interpreting the findings.

First, only 18 meals were assessed. Although the meals were distributed across the three facilities, this number limits the extent to which the findings can be generalized to all meals served in Burundian hospitals.
Second, the biochemical and microbiological analyses initially planned could not be performed. Consequently, the food safety findings should be interpreted as an assessment of compliance with observable practices and criteria, rather than as a direct measurement of microbiological contamination in food.
Third, some participants were selected using purposive or convenience sampling, which may have introduced selection bias.
Finally, because the study was conducted in three national hospitals in Bujumbura, its findings cannot be directly extrapolated to provincial hospitals or health centers without further studies.

5. Conclusion

This study shows that the nutritional quality and food safety of meals served in the canteens of the three national hospitals studied in Bujumbura are inadequate and reflect systemic shortcomings. None of the 18 meals assessed reached the 75% acceptability threshold. The overall mean score was 0.57 ± 0.05. Food safety was the dimension most strongly associated with overall meal quality ($r = 0.82$; $p = 0.001$), followed by nutritional value ($r = 0.76$; $p = 0.003$). Personnel hygiene represented the main critical food safety issue, with a zero compliance rate across all three facilities. This situation coexisted with relatively high availability of drinking water, suggesting that the shortcomings are also related to staff competencies, behaviors, supervision, and institutional organization.
The study also revealed a near-total absence of dietetics services, substantial deficits in hygiene/HACCP training, inadequate regulatory standards, and major weaknesses in quality control mechanisms. Improving hospital catering in Burundi therefore requires an integrated institutional approach. Establishing dietetics services, developing and implementing operational standards, providing continuous staff training, progressively introducing a HACCP-based approach, and implementing a documented quality control system should be prioritized. Further studies incorporating microbiological, biochemical, and quantitative nutritional analyses of meals, together with a larger sample of meals and healthcare facilities, would help complement and strengthen the findings of this initial assessment.

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