

# EVALUATING COMPLIANCE WITH FOOD SAFETY AND HYGIENE PROCEDURES AT THE KITCHEN OF LEVEL-2 FIELD HOSPITAL NO. 6 – SOUTH SUDAN

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## ABSTRACT

**Objective:** This study was conducted to assess the level of compliance and effectiveness of food safety and hygiene (FSH) procedures at the kitchen of Level-2 Field Hospital No. 6 (L.2FHN.6) in Bentiu, South Sudan.

**Subjects and Methods:** The study employed a cross-sectional descriptive design. The subjects included the entire system of processes related to food hygiene and safety at the kitchen of L.2FHN.6, observed from January 1 to April 30, 2025.

**Results:** All 24 kitchen staff members achieved 100% compliance in all personal hygiene criteria. In the food preparation and processing group, two criteria — “no cross-contamination between raw and cooked food” and “separate zones and utensils for raw and cooked food”—reached 100% compliance. In contrast, “retaining food samples” had 0% compliance, indicating a significant shortcoming. Regarding cold storage, three criteria achieved full compliance, while refrigerator stability reached 91.67%. For input material management, three out of four criteria were met (100%), with visual inspection of incoming goods slightly lower (95.83%). Food consumption behavior and pest control achieved 100% compliance across all five evaluated criteria.

**Conclusion:** The results confirm high compliance levels in personal hygiene, food storage, and pest control at L.2FHN.6. However, notable issues remain in retaining post-processing food samples and stabilizing the cold chain to ensure overall food safety.

**Keywords:** Food safety and hygiene, field hospital, United Nations peacekeeping mission, South Sudan.

## 1. INTRODUCTION

Food safety and hygiene (FSH) play a fundamental role in protecting community health, particularly in healthcare settings where the risk of foodborne disease outbreaks is significant [1]. In field hospitals deployed in challenging environments, such as South Sudan—where extreme climate conditions, limited water sources, and potentially contaminated food are major concerns—ensuring food safety becomes even more critical. It is essential not only for preventing infections and food poisoning but also for maintaining the health of medical personnel performing international

missions [2]. According to the World Health Organization (WHO), an estimated 600 million people worldwide suffer from foodborne illnesses annually, with approximately 420,000 resulting deaths, highlighting the global scale and severity of the issue [3].

At Level 2 Field Hospital No. 6, comprehensive FSH assurance measures have been developed and implemented, including sanitation assessments of the kitchen environment, food processing protocols, food storage monitoring, staff health surveil-

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lance, and oversight of collective dining behavior. However, the level of compliance with these processes has yet to be systematically and objectively assessed. Evaluations aligned with international standards, such as the Codex Alimentarius and the Food Safety and Quality Management System (FSQMS) of the United Nations Mission in South Sudan (UNMISS), are needed [4], [5]. Such evaluations help identify existing gaps, enabling timely corrections and continuous improvement of hygiene protocols. Therefore, this study was conducted to assess the compliance with food safety and hygiene procedures at Level 2 Field Hospital No. 6 during its deployment in the United Nations peacekeeping mission in South Sudan.

## 2. MATERIALS AND METHODS

### 2.1. Study Design

A cross-sectional descriptive study combining quantitative methods with structured direct observation.

### 2.2. Study Duration and Location

The study was conducted from March 1st to April 30th, 2025, at the kitchen of Level 2 Field Hospital No. 6 (L.2FHN.6), Bentiu, South Sudan.

### 2.3. Study Subjects

The study targeted the entire food safety and hygiene system (FSH) being implemented at the field hospital kitchen, including physical infrastructure, human resources, and operational processes.

### 2.4. Data Collection Tools

A checklist consisting of 24 criteria was used, divided into 5 thematic groups:

- (1) personal hygiene;
- (2) food preparation and processing;
- (3) food storage and cold chain;
- (4) inventory and raw material management;
- (5) food service behavior and environmental hygiene.

### CONTINGENT MONTHLY FOOD SAFETY / HYGIENE ASSURANCE CHECK LIST

Contingent	VIETNAM LEVEL 2 HOSPITAL
Location	BENTIU
Date	21 <sup>st</sup> April, 2025

Food Safety and Quality Management System is the bedrock to any successfully Food Rations operation and its Supply Chain management. These are key indicators to current UN Food rations operations policy.

The objective of this Monthly inspection regime by the Contingents' (TCCs/FPUs) Hygiene / Medical Officers' is to ensure compliance to UNMISS Food Safety & Quality Management system (FSQMS) that includes general maintenance and good hygienic practices (GHP) - personnel, food, kitchen and environmental hygiene; premises / facilities, fire safety, storage & stock control, waste management, cold chain maintenance and pest control management.

Find below the Check-list to be used for the effective verification and validation of Food safety / Hygiene practices by contingents. This report MUST be completed by the Contingent's Hygiene Officer and submitted to Rations Unit at the end of each calendar month. COMMENTS ARE MANDATORY for each item.

1. Premises, Equipment and Facility				
PEF QUESTIONS	Yes	No	N/A	COMMENTS (MANDATORY)
1.1 Are buildings, fixtures & physical facilities in good repair?	x			Kitchen is constructed for permanence use. Serving and dining are done in prefabricated structure.
1.2 Are work or washing up areas reasonably clean?	x			Working areas were cleaned daily. The floor was cleaned 2 times per day.
1.3 Are scales use to weigh foods tested for accuracy?	x			They have 2 weigh scales. The electrical technician checks the accuracy monthly.
1.4 Are food crates & pallets cleaned & sanitized?	x			Pallets and crates are regularly cleaned and dried before being used.
1.5 Are adequate toilet facilities available & in clean condition?	x			Toilet facilities are available and cleaned daily. Two hand washing sinks and ablation floor are broken, need to be replaced.
1.6 Are suitable hand-washing facilities available?	x			Yes, hand-washing facilities are available at ablation units, kitchen and dining room.
1.7 Are portable water, soap, sanitizer & disposable towel available at hand washing	x			Soaps and sanitizer are provided at hand washing facilities. There is no disposable towels at the hand

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Figure 1. Sample FSQMS-Based Food Safety Assessment Form Used at L.2FHN.6 According to United Nations Standards

### 2.5. Data Collection Methods

Structured direct observation was conducted three times per week for eight consecutive weeks. Each criterion was evaluated as “compliant” or “non-compliant.” For some requirements, verification was supplemented by documentation (e.g., logs, sample retention forms) and interviews with responsible staff.

### 2.6. Criteria Framework

The checklist criteria were developed based on international guidelines from the World Health Organization (WHO) – “Five Keys to Safer Food,” Codex Alimentarius standards, and the Food Safety and Quality Management System (FSQMS) protocols adopted by the United Nations Mission in South Sudan (UNMISS) [3], [5].

### 2.7. Variables and Study Indicators

- Primary variable: Compliance rate with food safety and hygiene standards.
- Secondary variables: Compliance rate within each thematic group.
- Indicators: Percentage of “compliant” items out of total assessed items; analyzed both overall and by group

### 2.8. Data Analysis

Collected data were aggregated and calculated as

the percentage of compliance for each criterion and group. Strengths and weaknesses were identified to inform recommendations for improvement.

### 2.9. Ethical Considerations

This study adhered to the ethical principles of scientific research. All data were collected in a non-invasive manner, with no impact on human health. The command board approved the study of Level 2 Field Hospital No. 6.

### 3. RESULT

Through research, we found that periodic microbiological and parasitological testing results of kitchen staff at L.2FHN.6. All tested indicators, including Malaria (RDT and Microscopy), Hepatitis A (HAV IgM), Hepatitis B (HBs Ag), Hepatitis C (HCV Ab), Hepatitis E (HEV IgM), Typhoid (Widal), Rotavirus (Stool), and *Vibrio cholerae* (Stool microscopy), returned negative results. This indicates that there were no signs of infection from major foodborne or epidemiologically relevant pathogens at the time of testing.

**Table 1. Personal Hygiene of Kitchen Staff**

No.	Criterion	Number Passed / Total	Compliance Rate (%)
1	Handwashing before food preparation	24/24	100%
2	Wearing a uniform, gloves, and proper hair cover	24/24	100%
3	No jewelry, short, and clean nails	24/24	100%
4	Proper use of face masks	24/24	100%
5	No symptoms of infectious diseases (fever, cough, diarrhea...)	24/24	100%
6	Valid periodic health certificate ( $\leq 6$ months)	24/24	100%

Table 1 shows the compliance results of 24 kitchen staff members regarding personal hygiene standards. All six assessed criteria were fully met, with a 100% compliance rate. These included: handwashing before food preparation, wearing a uniform and proper protective gear, no jewelry, trimmed and clean nails, adequate use of face masks, absence of symptoms of infectious

diseases, and possession of valid periodic health certificates. These results demonstrate full compliance with personal hygiene requirements in food handling operations at the facility.

**Table 2. Food Processing and Preparation Process**

No.	Criterion	Number Passed / Total	Compliance Rate (%)
1	No cross-contamination between raw and cooked food	24/24	100%
2	Separate areas and utensils for raw and cooked food	24/24	100%
3	Raw materials washed with safe water (RO water)	22/24	91.67%
4	Utensils disinfected regularly	22/24	91.67%
5	Sensory inspection of food before cooking	22/24	91.67%
6	Compliance with the food processing manual	23/24	95.83%
7	Retention of food samples after processing	0/24	0%

Among the seven criteria evaluated in Table 2 for the food processing and preparation process, two criteria achieved a 100% compliance rate, namely "No contamination from uncooked food preparation" and "Separation of raw and cooked food preparation areas." The remaining criteria had compliance rates ranging from 91.67% to 95.83%, except "Retention of food samples after processing," which recorded a 0% compliance rate (0/24 instances). Specifically, three criteria shared a compliance rate of 91.67%: "Use of safe water source," "Regular disinfection of tools," and "Sensory inspection of food before processing." The criterion "Compliance with processing manual" achieved a compliance rate of 95.83% (23/24).

**Table 3. Food Storage and Cold Chain**

No.	Criterion	Number Passed / Total	Compliance Rate (%)
1	Stored in sealed packaging with clear labeling	23/24	95.83%
2	Raw and cooked foods are separated	24/24	100%
3	Freezers/ refrigerators function stably	22/24	91.67%
4	No expired food items	23/24	95.83%
5	Storage shelves are dry and clean	24/24	100%
6	The temperature log of the cold chain is maintained daily	24/24	100%

The results show that 3 out of 6 criteria achieved 100% compliance, including: "Raw and cooked foods separated," "Storage shelves are dry and clean," and "Temperature log of cold chain maintained daily." Two criteria — "Stored in sealed packaging with clear labeling" and "No expired food items" — both recorded a 95.83% compliance rate (23/24), while the criterion "Freezers/refrigerators function stably" had a rate of 91.67% (22/24).

**Table 4. Management of Raw Materials and Stored Goods**

No.	Criterion	Number Passed / Total	Compliance Rate (%)
1	Invoices/ certificates of origin of raw materials	24/24	100%
2	Sensory inspection of raw materials before storage	23/24	95.83%
3	Logbooks and records of import/export history	24/24	100%
4	No use of materials without labels or unclear expiration dates	24/24	100%

Among the four criteria, 3 achieved a perfect compliance rate of 100%, including: "Invoices/certificates of origin of raw materials," "Logbooks and records of import/export history," and "No use of materials without labels or unclear expiration dates." The remaining criterion — "Sensory inspection of raw materials before storage" — had a compliance rate of 95.83% (23/24).

**Table 5. Eating Behavior & Pest Control**

No.	Criterion	Number Passed / Total	Compliance Rate (%)
1	Eating in the designated dining area	24/24	100%
2	No outside food is brought into the kitchen	24/24	100%
3	Drinking water is boiled and stored in sealed containers	24/24	100%
4	Regular supervision of eating behavior	24/24	100%
5	Insect and rodent control systems in place (cockroaches, rats)	24/24	100%

All five criteria in this group achieved a 100% compliance rate, reflecting strict adherence to collective dining practices and pest control measures. All aspects, including "Eating in designated dining area," "No outside food brought into the kitchen," "Drinking water is boiled and stored in sealed containers," "Regular supervision of eating behavior," and "Insect and rodent control systems," were fully implemented at all observation times.

#### 4. DISCUSSION

The results from Table 1 show that all 24 kitchen staff at L.2FHN.6 achieved a 100% compliance rate for the criterion "Handwashing before food preparation." This reflects high awareness of personal hygiene and strict adherence to food safety regulations. Compared to the study by Todd et al. [4], handwashing compliance rates in food processing facilities often range from 60–80%, which is significantly lower than that observed at L.2FHN.6. This difference may be attributed to regular training programs, strict supervision, and a strong hygiene culture at the facility, where personal



hygiene is emphasized as a key factor in preventing cross-contamination. This result also aligns with international food safety standards, such as Codex Alimentarius, which emphasize the role of personal hygiene in ensuring food quality.

The criterion “Storing food samples after processing” in Table 2 recorded a 0% compliance rate (0/24 observations), a notably concerning result. This finding contrasts with other criteria, such as “No cross-contamination between raw and cooked food,” which achieved 100%. According to Gould et al. [6], storing food samples is essential for traceability in food poisoning incidents, and the typical compliance rate exceeds 90% in well-managed facilities. The lack of compliance at L.2FHN.6 may be due to a lack of specific guidance, the absence of dedicated storage space, or limited awareness about the importance of this criterion. This result highlights an urgent need for immediate corrective action to ensure the capability to trace food safety incidents in the future.

Table 3 shows that the criterion “Separation of raw and cooked food” achieved a 100% compliance rate, demonstrating strict control in food storage practices. This result is consistent with the findings of Todd et al. [1], who emphasized that separating raw and cooked foods is a key measure to prevent cross-contamination by bacteria such as Salmonella or E. coli. The absolute compliance observed at L.2FHN.6 can be attributed to well-established infrastructure, including separate storage areas and scheduled inspections. However, the criterion “Stable operation of refrigerators/freezers” only reached 91.67%, indicating a need for improvement in equipment maintenance to ensure uninterrupted cold chain operation, a crucial element in preventing food spoilage.

The criterion “Availability of invoices/certificates from suppliers” in Table 4 also achieved 100% compliance, demonstrating transparency and tight control over supply sources at L.2FHN.6. This result aligns with the findings of Gould et al. [6], who emphasized that the traceability of ingredient origins is crucial to effective food safety management. Absolute compliance indicates that the logistics system at the facility is standardized and that staff are highly aware of legal documentation requirements. However, the criterion “Sensory inspection of ingredients before storage” showed a 95.83% compliance rate, indicating a need for further training to ensure all ingredients are thoroughly evaluated before use.

Table 5 shows that the criterion “Presence of insect and rodent control systems” reached 100% compliance, reflecting the effectiveness of environmental sanitation measures at L.2FHN.6.

This result is consistent with the study by Todd et al. [4], which emphasized that pest control is a key factor in preventing foodborne contamination. The high compliance may stem from the application of professional pest control services, the use of safe chemicals, and regular hygiene checks. This result also reflects confidence in the facility's hygienic food processing environment, helping to prevent the transmission of pathogens from pests to food during preparation and storage.

## 5. CONCLUSION

The study conducted at Level 2 Field Hospital No. 6, South Sudan, demonstrated that 100% of the kitchen staff complied with personal hygiene and pest control regulations, ensuring food safety. The food preparation and processing procedures had high compliance rates (91.67–100%), except for the food sample retention criterion, which had a 0% compliance rate and requires immediate improvement. Food storage and the cold chain were well maintained, with 3 out of 6 criteria achieving full compliance (100%). The management of incoming materials was transparent, with most criteria reaching 100% compliance. These results indicate a high level of adherence to food safety standards; however, certain limitations need to be addressed to enhance the effectiveness of food safety management further.

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