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AVAILABILITY OF FOOD PREMISES AND INFRASTRUCTURE COMPLIANCE IN EL-OBEID BASIC SCHOOLS, NORTH KORDOFAN STATE, SUDAN

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ABSTRACT

A descriptive cross-sectional study was done to assess the food premises availability and infrastructure compliance in El-Obeid basic schools, North Kordofan State, Sudan, 2022. A total coverage approach was used, and 133 governmental basic schools were included. Data were collected using a structured pre-coded close-ended observation checklist and interview with schools' headmasters covering issues related to food premises in basic school. Data analyzed and processed using the Statistical Package of Social Sciences (SPSS) version 23.0 and Microsoft Excel (2010) software. The study found that more than two-third (75.2%) of schools lacked food premises. Artificial lighting in all (100%) food premises was insufficient. Approximately (81.8%) of food were stored under unsuitable conditions. About (72.7%) of food handlers in school's premises haven't health cards. Around (79.7%) of schools were surrounded by vendors, and all (100%) of food vendor's conditions were poor with exposure to insects and dust. The present study also showed that the majority (98.5%) of basic schools lacked hand washing facilities. These findings indicate the current school food environments pose significant risks of foodborne illness and compromise student health and safety. It's recommended that the necessity of joint cooperation between the Ministry of Health and Education to establish minimum standards for school food premises, provide hand washing facilities, mandate health cards for handlers, and regulate vender activities around schools.

KEY-WORDS: *Food Premises, Basic School, Assessment, Handling, El-Obeid, Kordofan, Sudan.*

INTRODUCTION

Food premises in basic schools play a critical role in ensuring student health, safety, and learning outcomes. These facilities include kitchens, food handling areas, and dining spaces where meals and snacks are prepared, stored, and served daily. Poor infrastructures and lack of designated food control areas increase the risk of foodborne illness, cross-contamination, and food spoilage, which directly affect children who are more vulnerable to infections due to developing immune systems [1]. Structural compliance of food premises is essential for food safety management. Floors, walls, ceiling, and ventilation must meet hygienic standards to prevent microbial growth and pest infestation. Smooth, crack-free floors and washable walls reduce pathogen harborage, while adequate lighting and ventilation improve working condition and prevent condensation that promotes mold growth. International standard such as Codex Alimentarius emphasize that food premises design is the first barrier against contamination [2, 3].

Appropriate facilities and procedures should be in place to ensure that: any necessary cleaning and maintenance is carried out effectively; and, an appropriate degree of personal hygiene is maintained [2, 3]. A healthy school food environment enables and encourages the school community (children, adolescents, families, school staff, etc.) to make food choices that contribute to better diets [3].

The availability of a dedicated food control/inspection area allows school authorities and health inspectors to verify food quality, storage, temperature, and hygiene practices before food reaches students. Without this space, monitoring becomes inconsistent and food safety violations my go undetected. Studies in low-resource settings show that schools lacking proper food handling areas report higher rates of diarrhea and absenteeism among pupils [4, 5]. Adequate food premises contribute to

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educational outcomes. Malnutrition and foodborne reduce concentration, attendance, and academic performance. providing safe, hygienic meal environments supports school feeding programs and improves nutritional status, especially in basic education where children spend 6-8 hrs. daily [6].

In 2002, UNESCO estimated that nearly 5 500 children die each day from bacteria in food. Unsafe food remains a widespread public health problem in all parts of the world. Surveys in New Zealand, Europe, and North America suggest that each year up to 10% of the population suffer from diseases caused by unsafe food. E. coli bacteria are a major cause of diarrhoea and kidney failure that can be fatal in children [7].In developing countries, a polluted environment, lack of a safe water supply and poor sanitation increase the likelihood of food contamination. Worldwide, most outbreaks result from improper food handling such as use of contaminated equipment; contamination by infected persons; use of contaminated raw ingredients; cross-contamination; and addition of toxic chemicals or use of food containing natural toxins[8]. Food for schoolchildren and staff is stored and prepared so as to minimize the risk of disease transmission. Food is handled and prepared with utmost cleanliness (hand are washed before Preparing food). The contact between raw foodstuffs and cooked food is avoided, Food is cooked thoroughly, Food is kept at safe temperatures, and Safe water and safe raw ingredients are used [9]. Food handlers must wash their hands after using the toilet and whenever they start work, change tasks, or return after an interruption. Soap and water should be available at all times during food preparation and handling; to ensure that handwashing is convenient [9].Food sold to children by street vendors or in cafes may be unsafe. School authorities should seek local solutions to protect school children from disease from this source [9].

Separate equipment and utensils (e.g. knives and cutting boards) should be used for handling raw foods or they should be washed and sanitized in between use. Food should be stored in containers to avoid contact between raw and prepared foods. It is particularly important to separate raw meat, poultry and seafood from other foods, while all parts of foods cooked must reach 70 °C to kill dangerous microorganisms. Cooked food to be served should be kept hot (more than 60 °C) before serving. Cooked food and perishable food should not be left at room temperature for more than2 hours, and should be prepared or supplied fresh each day. All food should be kept covered to protect it from flies and dust [9].

Smooth, impervious to moisture, easy to wash and keep in repair, vermin proof, metal corner guards, and light colors. Smooth, impervious to moisture, easy to clean, rodent proof, and fire resistant. Non-resilient quarry tile or slip resistant resinous epoxy with recessed floor drains. Curbs or gutters should surround areas under steamers, kettles and can washing equipment . Outside doors: Self-closing devices and locks. Lock and sound absorbing effect. Metal door frames. Walk-in refrigerators and freezers must have locking devices that can be opened from inside. Plan screens for all doors and windows. They should be high enough not to obstruct equipment placement and located for cross ventilation. Louvers, rather than windows are recommended for storage areas. Food preparation areas must be well lit. Light fixtures should include shatter resistant bulbs. Provide for the free circulation of air at the worker's level in all work areas. Dry storage areas should have outside ventilation, with no sunlight. Separate ventilation system from the rest of the school Separate temperature control for the kitchen area is desirable. The services of a food service consultant are recommended to help ensure that the correct sizes and numbers of appliances are provided. The equipment must be properly installed according to the manufacturer's instructions and any Department of Labor requirements. Strict attention must be given to the working space and safety space around each appliance. Plan the facility arrangement for efficiency of operation with emphasis on principles of motion and labor economy. General work areas should be arranged to allow overall flow of work in a straight line. The flow of material being processed should be continuous of direct in progress. The following diagram illustrates the Interrelationships of areas within the school lunch facility [10].

Personal hygiene and sanitation practices are thoroughly addressed in the new inspection regulatory initiatives. Among the watershed changes in responsibilities for production of safe food, food processors are responsible for developing their own individual procedures such that they meet the general regulatory requirements. Use plenty of soap and warm running water; rub hands together for at least 30 sec; and clean thoroughly between fingers and around fingernails, Do not pick up food with the fingers during food preparation unless absolutely necessary and never when serving. Use a serving spoon, fork, spatula, tongs, or disposable plastic gloves, Keep hands clean and fingernails short and clean. Keep fingers out of food, nose, and hair and off face, keep body and clothes clean and wear a head covering or hairnet, Pick up cups, spoons, knives, and forks by the handles and keep fingers out of glasses, cups, soup bowls, and dishes, Cover nose and mouth with a paper tissue when sneezing or coughing, then discard tissue and wash hands thoroughly. Cleanse and boil wiping cloths daily [11].The requirement for a food handler to have a medical examination prior to employment and periodically thereafter has been discussed and debated for some time. The medical examination and specimen collections are an important part of a food borne illness investigation. The infections which are likely to be transmitted by the food handlers are diarrhoeas, dysenteries, typhoid and paratyphoid fevers, enteroviruses, viral hepatitis, protozoa, cysts, eggs ostrepto and staphylococcal infections, and *Salmonellosis* [12].A safe and healthful school environment includes a safe physical plant, safe equipment, a safe school area, appropriate physical learning conditions, and an environment that meets privacy needs. Through a safe and healthful school environment, students and staff are protected from injury, disease, or adverse conditions that are associated with known risk factors. A positive school environment is considered key to healthy relationships in the school [13].

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MATERIALS AND METHODS

Study Design

A descriptive cross-sectional study was conducted to study the availability of Food Premises and Infrastructure Compliance in El-Obeid basic schools, *North Kordofan State*, *Sudan*, 2022.

Sample Size

A total coverage approach, was used for governmental basic schools in El-Obeid city. A total of 133 were included.

Sample techniques

El-Obeid City was divided into four equal quarters (Clusters). Schools were considered as strata within each quarter. The different numbers of schools were selected from each quarter of El-Obeid City following a process of total coverage for schools.

Table (1) shows the distribution of schools according to clusters, El-Obeid City.

Clusters	East	West	North	South	Total
Number of schools	30	36	29	38	133

Data Collection

Data were collected using the following tools:

- Observation checklist

A structured pre-coded, close-ended observation checklist: was used to collect data on food premises, handlers and food services in basic schools

- Interview

Semi-structured interviews were conducted with school headmasters to collect data related to food premises in basic schools.

Data Processing and Analysis

After data collection, all questionnaires were checked for completeness and coded. Data were analyzed and processed using the Statistical Package of Social Sciences (SPSS) version 23.0. and Microsoft Excel 2010 was used to present data in tables to figures.

Data presentation

The results of data analysis data were the presented in the form of tables and figures.

RESULTS

The study included133 basic Schools in El-Obeid, City. The results were presented in following tables and figures:

Table (2): Physical environment of food premises in El-Obeid basic Schools; (n= 133).

Variable	Frequency	Percent
Presence of food premises at school; (n = 133)		
Available	33	24.8%
Unavailable	100	75.2%
Food control area; (n= 33)		
Suitable	6	18.2%
Not suitable	27	81.8%
Floor (n = 33)		
Smooth	29	87.9%
With cracks	1	3%
No cover	3	9.1%
Walls (n= 33)		
Smooth	27	81.8%
With cracks	5	15.2%
Smooth but dirty	1	3%
Height (n = 33)		
Suitable	32	97%
Not suitable	1	3%
Ceiling (n = 33)		
Suitable	33	100%
Windows (n = 33)		
Suitable	20	60.6%
Not suitable	13	39.4%
Is natural ventilation sufficient? (n = 33)		
Yes	20	60.6%
No	13	39.4%
Is artificial ventilation sufficient? (n = 33)		

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Yes	0	0
No	33	100%
Is natural lighting sufficient? (n = 33)		
Yes	20	60.6%
No	13	39.4%
Is artificial lighting sufficient (n = 33)		
Yes	0	0
No	33	100%

Table (1) showed that only (24.8%) of schools had food control areas, of them (18.2%) were suitable and (81.8%) were not suitable. Regarding the physical structure, (87.9%) of the food premises had smooth floors, (3%) had floors with cracks, and (9.1%) had floor without false ceiling. For walls, (81.8%) were smooth, (15.2%) had cracks, and about (3%) were smooth but dirty. The height of (97%) of food premises was suitable. All the food premises ceiling were suitable. Concerning ventilation and lighting (60.6%) of the food premises had suitable windows for natural ventilation. natural lighting was sufficient in (60.6%) of premises and insufficient in (39.4%). All food premises (100%) had insufficient artificial ventilation artificial lighting.

Table (2): Condition of food storage and handling in food premises in El-Obeid basic schools; (n= 33).

Items	Frequency	Percent
How is domestic waste stored?		
Plastic packets	**16**	48.5%
Others determine (Shawalat)	17	51.5%
The condition of food storage:		
Suitable	6	18.2%
Not suitable	27	81.8%
The availability of furniture in the premises:		
Not available	33	100%
The eating and drinking utensils condition:		
Suitable	33	100%
General cleanliness of premises		
Clean	31	93.9%
Not clean	2	6.1%
The type of food provided in premises		
Sandwich	33	100%
Food handler's health cards		
Existence	9	27.3%
Not existence	24	72.7%

Table (2) showed that plastic bags availability in (48.5%) of food premises, while (51.5%) used others such as (Shawalat). Food was stored under suitable conditions in (18.2%) of premises. All food premises (100%) lacked furniture. Eating and drinking utensils were suitable in all premises (100%). Majority of (93.9%) premises were clean. All food provided at promises were Sandwiches. Less that third (27.3%) of food handlers had health cards while (72.7%) did not have health cards.

Table (3): Presence of street vendors around the El-Obeid basic schools; (n= 133).

Items	Frequency	Percent
Are there any street vendors around the school? (n= 133)		
Yes	106	79.7
No	27	20.3
What type of food do they sell? (n = 106)		
Sandwich	6	5.7%
Sandwich + ice-cream	100	94.3%
Under what conditions are the foods sold? (n = 106)		
Acceptable	0	0

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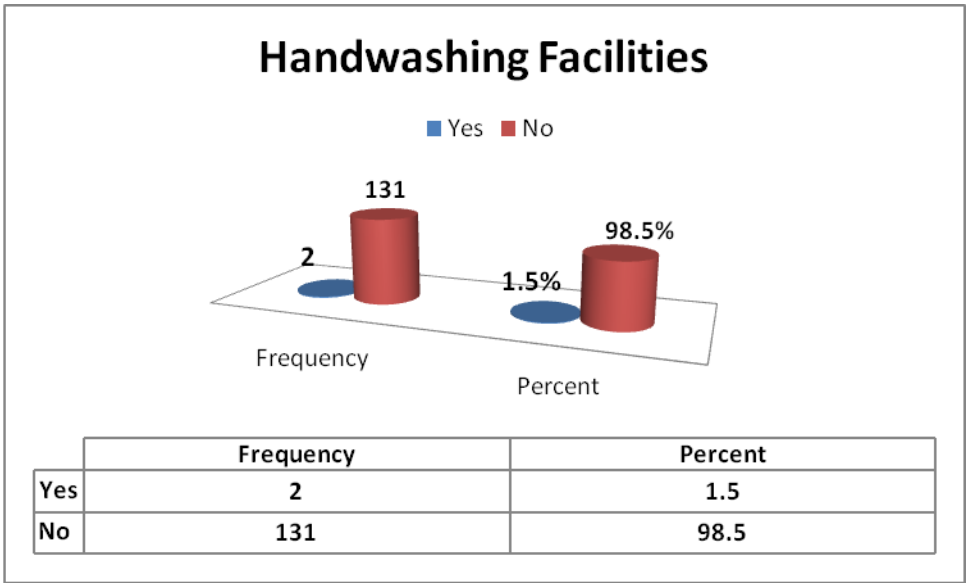
Bad	106	100%
What the personal hygiene level of street venders? (n = 106)		
Acceptable	91	85.8%
Bad	15	14.2%
Are fitness and health cards available for the street venders; (n = 106)		
Available	9	8.5%
Not available	97	91.5%

Table (3) showed that the street vendors (79.7%) were present around schools. Sandwiches and sandwiches with ice cream were major foods sold by the street vendors (5.7%) and (94.3%); respectively. The condition of food sold was rated as bad among all vendors (100%). Regarding personal hygiene only (8.5%) of vendors possessed fitness and health cards.



	Frequency	Percent
Yes	2	1.5
No	131	98.5

Figure (1): Availability of hand washing facilities at El-Obeid basic schools; (n=133).

The study reveals that only (1.5%) of basic schools had hand washing facilities, while (98.5%) did not have hand washing facilities as shown in Figure (1).

DISCUSSION

This descriptive cross-sectional study was carried out in El-Obeid City, North Kordofan State, to study the availability and infrastructure compliance of food premises in El-Obeid basic schools, North Kordofan State, Sudan, 2022.

The study showed that (75.2%) of schools haven't food premises. This finding is in contradiction with Wulandari and et al, who reported that school cafeteria service is one of the supporting facilities that have a very important role in school activities. Starting from early childhood education to college there is always a cafeteria service in it. The existence of cafeteria services in schools is needed by students. Particularly with long and tight study hours while at school, students interrupted during recess can go to the school cafeteria service to get the type of food and drink they want, the purpose of establishing a school cafeteria to utilize the existing land of the school and provide food and drink for students who contain nutrition and in accordance with an allowance [14].

The study showed that artificial lighting was insufficient in all food premises (100%). This result contrast with Barnes et al, who stated, that the food preparation area must be well lit. Light fixtures should include shatter-resistant bulbs [6], Lighting and ventilation ample natural lighting facilities aided by artificial lighting with good circulation of air are necessary for food premises [12]. The study showed that about (81.8%) of the food was stored under unsuitable conditions. This finding is in contradiction with WHO, which recommended that food for school children and staff is stored and prepared to minimize the risk of disease transmission, and food is kept at safe temperatures, Safe water, and safe raw ingredients are used [9].

The study showed that (72.7%) of food handlers at schools' premises haven't health cards, which may encourage the spread of diseases transmitted by food among pupils, these results are considered high when compared with the results of a similar study conducted in municipal public schools of Natal, Brazil which reflect that about 51.9% of food providers did not undergo annual health examinations and 100% did not practice proper hand hygiene [15]. The requirement for a food handler to have a medical examination before employment and periodically thereafter has been discussed and debated for some time. The

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medical examination and specimen collections are an important part of a food-borne illness investigation [12].

The study showed that about (79.7%) of the schools were surrounded by vendors. This result is inconsistent with WHO, which stated that food sold to children by street vendors or in cafes may be unsafe, and school authorities should seek local solutions to protect school children from the disease from this source [9].

The study also showed that all street venders (100%) were sold foods in poor condition and exposed to insects and dust, our result contradicts with WHO, which stated that, food should be protected from insects, rodents, and other animals, which frequently carry pathogenic organisms and are a potential source of contamination of food. In many situations, schoolchildren bring food with them from home to school. In these cases, the school hygiene committee or equivalent should work with the families of the school children to ensure that food is prepared hygienically and that they avoid foods that carry a high risk if stored at ambient temperature [9].

The present study showed that (98.5%) of basic schools lacked hand washing facilities. These findings are consistent in the line with the result of the study conducted in Dares Salaam Region a Case of Kinondoni Municipality [16], through observation the study revealed that majority (90%) of the schools visited in the study area had no hand washing facilities that are either installed within the toilet unit or outside near the toilet units[17]. These findings contrast with, which reflects that basic hygiene service means schools have a hand washing facility with water and soap available. Schools that have facilities with water but no soap are classified as providing a limited service. Schools with no hand washing facilities or no water are classified as providing no service.

CONCLUSIONS

Most basic schools lacked food premises, and more than three-quarter of schools were sounded by street venders. The absence of food premises and poor hygiene practices among venders indicate high risks of foodborne illness among school children.

STUDY ETHICS

Ethical approval was obtained from the Ministry of Education, North Kordofan State, and the Education Management Office of Shikan Locality. Permission was also obtained from school administrators and headmasters before data collection.

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