International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 23s, 2025
https://theaspd.com/index.php

Development of Helwan University Nutritional Services and Their Impact on Nutritional Status of In- Dorm Students

Zeinab Emam Mohamed Afifi[1], Hanan Ali Sayed[2,3], Sedrak A.S.[1], Reda Mohamed Abdelhafiz Gadelrab[4], Yasmin Mohamed Mohamed Hamed El Sersy[2]
[1]Public Health and Community Medicine Department, Faculty of Medicine, Cairo University
[2]Department of Community, Occupational and Environmental, Medicine, Faculty of Medicine, Helwan University, Cairo, Egypt
[3]Department of Public Health, Theodor Bilharz Research Institute, Giza, Egypt
[4]Hotel Management Department, Faculty of Tourism & Hotels, Helwan University and Hospitality Management Department, Faculty of Tourism, King Abdulaziz University
***Corresponding author:** Yasmin Mohamed Mohamed Hamed El Sersy
Email: dryasminelsersy@gmail.com**,**

Abstract:
Background and purpose: *In dorm students rely mostly if not completely on the food provided by the university food service. Deviation from the required food quantity, quality or sanitation requirements could have a deleterious impact on those students. Over nutrition was reported among dining halls students. University resident students were found tobe 1.58 times significantly more likely to have a higher BMI ≥ 25 than non-residents. This study aimed at the development of nutritional services provided to in dorm students in Helwan University.*
Method: *This Nutrition service intervention study was conducted on 342 students (193 males and 149 females) who were selected from in dorm students participating in Helwan university on-campus nutrition service and all 20 workers in the central kitchen. Initial assessment was carried out for the nutritional status of included students; central kitchen, dining room and sanitation; students' satisfaction with the food, service, and general atmosphere in dining room. Two nutrition education programs were developed and implemented, one for the students and one for the workers; defects were reported to the administration. Following intervention all the items of initial assessment were re-assessed using the same tools.*
Result: *Overweight, obesity, anemia and high risk of cardiometabolic diseases were prevalent in the studied sample. They affected 37.4%, 16.7%,62.0% and 88.6% of the studied sample respectively. Overweight, Obesityand central obesity were more prevalent among males while anemia was more common among females. Students are not or are partially consumingthe provided meals while most of them were eating other foods than that served by the nutrition facility.*
Conclusion: *There was an improvement in total nutritional record, compliance dining room, satisfaction and sanitation after implementation the current study program.*
Keyword: *Nutritional services, Helwan university, in dorm, sanitation, dining room, satisfaction, kitchen, weight, anemia, obesity*

INTRODUCTION:

University students are late adolescents (18-19 years) and young adults (20-23 years) who need good nutrition for health and wellbeing. They are at risk for malnutrition, both over and under nutrition. Recent studies of students in Pharos University in Alexandria (PUA) showed a high prevalence of Overweight and obesity (44%), abdominal obesity (25.2%), anemia (27.3% among females and 4% among males) **(1)** and 3.5% of the students were underweight **(2)**. The average student gains an estimated 1.6–3.0 kg during4 years of study.

Indorm students rely mostly if not completely on the food providedby the university food service. Deviation from the required food quantity, quality or sanitation requirements could have a deleterious impact on those students. Over nutrition was reported among dining halls students. University resident students were found to be 1.58 times significantly more likely to have a higher BMI ≥ 25 than non-residents **(3).** One in four college students in Public University in WesternUnited States were found to gain an average of ten pounds during their first semester. Unsurprisingly, students that gained the most weight ate fewer fruits and vegetables, indulged in fattier foods and slept less than students who showed no change in their weight **(4).**

Events of food poisoning occurring in universities have been reported abroad and in Egypt **(5, 6).** In 12 November 2012, Alyoum 7 newspaper announced 124 cases of food poisoning in Helwan University

girls' accommodations. This outbreak occurred after eating cooked meals from 5 to 6 pm **(7).**

Helwan University, Nutrition Administration (HUNA) offers food services to students in university accommodations (in-dorm), out dorm students, summer camp students and employees. Every year the university provides the Nutrition Administration with lists of students who are going to participate in university feeding programs. They calculate the ingredients required for the meals and issue Requests for proposal. The best offer is decided on. After receiving materials, processing and distribution to university students and employees follow.

In the last two years, 5000 students got the food services. About 3500 students are dorm residents and 1500 are non-dorm residents. The regular nutrition services are provided throughout the academic year, not during the summer vacation. Similar services are provided to Helwan University's summer camp participants.

Three meals (breakfast, lunch and supper) are daily served for in- dorm students (3500). The meals provided are dry for breakfast and supper,hot for lunch. One week menu is prepared and repeated throughout the twosemesters.

University foodservice is one of the largest sectors of foodservice industry, and the college student market is getting larger. Given the projected growth in the college and university food service market, it is important that university foodservice be monitored periodically and improved comprehensively in order to retain students as satisfied customersfor on-campus foodservice **(8).** Customers, studentsand staff will go to an off-campus if the on-campus providers do not meettheir needs and wants **(9).**

A pilot study carried out by the researcher at Helwan dining rooms showed that a large percentage of students were not satisfied with the quantity, cooking, presentation, timing, quality and variety of the provided meals. Also HUNA doesn't consider gender differences in dietary requirements.

Accordingly, assessment of the nutritional service provided at Helwan University was deemed necessary. It will help identifying the gaps and plan interventions to close them.

Methods

This Nutrition service intervention study was conducted on 342 students (193 males and 149 females) who were selected from in dorm students participating in Helwan university on-campus nutrition service and all 20 workers in the central kitchen.

Inclusion criteria:

- First to fourth year Helwan University in-dorm students
- Participant in university nutritional service
- Consent to participate in the study

Exclusion criteria:

- Students of the Fifth grades.

Material & equipment:

The study tools were tailored and adapted from various studies withsimilar objectives based on reviewing related national and international literature:

Tool I: Student assessment composed of two parts **(Appendix I)**

Part 1: General characteristics of the studied students including age, gender, academic year, mobile number, E-mail and period of participating in nutritional services.

Part 2: Nutritional assessment questionnaire: This part was adapted from **(10, 11),** and includes taking the following measurements:

A-Anthropometric measurements:

- Weight by using in body weight measuring device made in Germany,
- Height by using wall mounted height meter,
- Waist circumference by using waist circumference tape, (according to WHO measuring waist circumference in the horizontal plane midway between the lowest ribs and iliac crest).

B-Hemoglobin by using the China made hemoglobin testing system HB- 101 which can accurately detect the hemoglobin index of the blood by using HB-101 test paper.

Tool II: Structured self-administered student satisfaction questionnaire(Appendix II): this tool was adapted form **(12-14).** This questionnaire waswritten in Arabic and administered by the students to assess their satisfaction regarding nutritional services in the central kitchen andincludes three main parts:

Part 1: Food. Includes enquiry about general characteristics of serviced meals (10 items), items of serviced meals (5 items), suitabledegree of cooking temperature (2 items), use of different methods in food

preparation (3 items), and provided meals for 7 days (breakfast, lunch and dinner).
Part 2: Service includes 5 items as team work (7 items), system of meals booking (3 items), cleaning (4 items), utensils and food equipment(2 items) and timing (3 items).
Part 3: General environment in dining rooms as lightening in dining room and furniture in dining room (incudes 14 items).
The different items were rated on five level Likert scale as (veryunsatisfied= 1, unsatisfied=2, don't know= 3, satisfied= 4 and verysatisfied = 5).
Tool III: Checklists for dining room and kitchen sanitation. **(AppendixIII):** This tool was adapted from **Serhan & Serhan (15), Alberta (16) & Berkeley University Health Services (17)** and used to assess sanitation in the dining room and in-dorm kitchen. It includes two parts;
Part I: Dining room sanitation (113 items). Includes enquiry about:

- Infrastructure (23 items).
- Proximities (10 items).
- Serving area (11 items).
- Hot and Cold Serving Tables (7 items).
- Food (16 items).
- Floors, Aisles, Stairs and Landings (6 items).
- Emergency Procedures (12 items).
- First aid (3 items).
- Facility Cleanliness (7 items).
- Dish Room / Dish Machine (10 items).
- Electrical (4 items).
- Lighting (4 items).

Part II: Kitchen sanitation (217 items). Includes enquiry about:

- Kitchen infrastructure (31 items).
- Personal hygiene (59 items).
- Food (127 items).

Sub-items, were rated on two levels likert scale as (No= 0 & yes= 1).
Tool IV: Food diary. **(Appendix IV):** This tool was adapted from **Soriano et al. (18) & Salameh et al., (19)**. It was used to assess food types and portions consumed by students from served university meals, fast food or outdoor foods eaten instead/added to served meals.
Methods
Preparatory phase:
It included reviewing related literature and theoretical knowledge of various aspects of the study using books, articles and internet's periodicalsand journals to develop tools for data collection.
Tool validity and Reliability:
Tool validity:
Face and content validity was ascertained by a panel of four experts (2 professors of community medicine from Helwan University and Kasr Al-Ainy Faculty of Medicine; and 2 assistant professors of community medicine from Kasr Al-Ainy faculty of Medicine and Faculty of Tourism and Hotel, Helwan University). The experts reviewed the tools for comprehensiveness, clarity, relevance, simplicity, and applicability. Minormodifications were done and the final forms were developed.
Reliability:
In the present study, reliability was tested using Cronbach's Alpha coefficients. It was 0.866 for structured self-administered questionnaire, 0.834 for dining room checklists and 0.759for kitchen sanitation tool.
A pilot study:
Pilot testing of the questionnaire was done with 20 in-dorm studentsof different faculties to:

- Check the clarity of questions.
- Estimate the time needed to complete the questionnaire.
- Detect difficulties that may arise and how to deal with it.

Feedback from the pilot study:

- Some questions changed to be more understandable
- The majority of the respondents were cooperative with the researcher.
- The time needed to complete the interview questionnaire by thestudent form ranged 20 to 30 minutes.

NB: the data derived from pilot questionnaires were not included in theanalysis.

Ethical considerations:

The study protocol, data collection tools, and consent form were approved by the Scientific and Ethical committee of the department of Public Health and Community Medicine, Helwan University as well as the main Research Ethical Committee (REC) of the Faculty of Medicine, Cairo University. Informed consents were obtained from all the participants in the study and data confidentially was preserved according to the revised Helsinki decelerations of biomedical ethics (20). The researcher clarified the objectives ofthe study to student and personnel included in the study to gain their confidence and trust. The researcher assured maintaining anonymity and confidentiality of subjects' data.

Preparatory phase:

It included reviewing past and present local and international related literatures as books, articles, internet, periodicals and magazines to develop tools for data collection and the handouts of sessions.

- A brochure was prepared including messages on Myplate food guide and planning healthy diet, faulty habits (excess intake of salt and fast foods and lack of exercise) and the prevalent problem of overweight and obesity. It was prepared in Arabic and distributed to the students during the educational sessions **(Appendix V).**
- Posters were prepared demonstrating important messages regarding food safety and sanitation for workers and two posters about healthy plate model and dangers of fast food for students **(Appendix V).**

Field work:

Data were collected in the following sequence:-

- Once the permission was obtained, the researcher interviewed the students and kitchen personnel and explained the aim of the study and took their approval to participate and cooperate in the study.

Data collection was carried out in 3 phases:

Phase I: Assessment phase:

The student assessment data were collected by the researcher through interviews **(tool I),** student satisfaction data were collected by structured self-administered questionnaire **(tool II),** checklists for dining room and kitchen sanitation (tool III) were completed by the investigator and food dairy (tool IV) was completed by the students. This data constituted baseline data pre health education sessions.

Phase II: Planning and implementation phase (Intervention):

- Students were divided into 2 groups (171 students/session) each groupreceived the same intervention using the same teaching strategies and handout.
- The total number of sessions was 2 for each group of students and one session for working personnel in central kitchen.
- Two health education programs were developed in Arabic; one directed toward nutrition service providers to improve quality of the service (filling gaps); the other was directed to the studied students to increase their compliance (by increasing number of offered/consumed meals and decreasing number of refused or wasted meals) and improve their nutritional status.
- Health education sessions for students included; definition of teenage, nutritional needs for youth, wrong nutritional habits among in-dorm students, examples of fast food and unhealthy food, impact of unhealthy food habits, nutritional needs of university age phase, component of healthy plate model, examples of healthy nutritional components, examples for healthy snacks, meals for prevention and treatment of anemia and importance of exercise.
- Health education sessions for workers in central kitchen was provided with the aid of two posters including instructions for healthy food preparation, keeping good sanitation during food preparation, food safety instructions and healthy plate model.
- During each session the researcher used simple, brief and clear words. At the end of each session, a brief summary was given by the researcher, emphasizing the most important points included in each session.

- The vice dean of Faculty of Medicine, Helwan University (Prof. Mohamed Fath Elbab) was very supportive to the study and facilitated theadministrative affairs required to make the intervension of the study. Also,one of the members of the research team (Assistant professore. Reda AbdElhafeez) was acting as the Supervisor of the university's central kitchenshelped in making the required changes to the furniture, decor, and toolsused in the kitchen, and urged the workers to cooperate with the researcherand encourage them to implement the study to a greater extent.

Phase III: Evaluation phase (Post educational sessions intervention):

Post intervention evaluation was done through Assessment of dining room, sanitation, Students' satisfaction, nutrition including weight,height, waist circumference and hemoglobin following the same procedures and tools as in initial assessment.

Administrative items:

An official permission was obtained by submission of official letters issued from the dean of faculty of Medicine, Helwan University to the directors of central kitchen and university in-dorms at Helwan University. The title and aim of the study was explained as well as the main data items and the expected outcomes.

Statistical design

The collected data were organized, tabulated and statistically analyzed using SPSS software (Statistical Package for the Social Sciences,version 16, SPSS Inc. Chicago, IL, USA). Chi square test, Paired t test, McNemar and Wilcoxon signed-rank test were used . Significance was adopted at $p<0.05$ for interpretation of results of tests of significance.

Results:

Table (1) Observed compliance with all domains of dining room during the3 follow-ups before and after intervention

	Before		After		Paired t p value *
	Mean yes out of 3 Times		Mean yes out of 3 Times		
	No.	%	No.	%	
I-Infrastructure	1.26	42.0	2.61	87.0	0.000**
II-Proximities	1.40	46.7	2.68	89.3	0.181
III-Serving area	1.82	60.7	2.45	81.7	0.089
IV-Hot and Cold Serving Tables	1.71	57.0	2.71	90.3	0.086
V-Food	1.46	48.7	2.65	88.3	0.001*
VI-Floors, Aisles, Stairs andLandings	2.83	94.3	3.00	100.0	0.363
VII-Emergency Procedures	1.25	41.7	2.67	89.0	0.003*
VIII-First Aid	0.00	0.0	2.67	89.0	0.015*
IX-Facility Cleanliness	0.57	19.0	2.57	85.7	0.001*
X-Dish Room/ Dish Machine	2.40	80.0	2.80	93.3	0.168
XI-Electrical	2.00	66.7	3.00	100.0	0.252
XII-Lighting	0.75	25.0	2.75	91.7	0.066

*Paired t p-value>0.05 non-significant; *p-value <0.05 significant; **p-value <0.001highly significant

In the current study before intervention the lowest observed 3-followup mean compliance was in first aid (0%), cleanliness (19%), and lighting (25%). The highest was in Floors, Aisles, Stairs and Landings (94%), and Dish Room/ Dish Machine (80%). improved compliance in all dining room domains. After intervention, the observed 3- followup mean compliance increased in all domains especially in Infrastructure, Food, Emergency Procedures, First Aid and Facility Cleanliness ($p<0.05$ in all 5 domains) **(Table 1).**

Table (2): Compliance with sanitary requirements of kitchen infrastructure (items 1-9) during the three follow-ups before and afterintervention

I. Kitchen Infrastructure	Before intervention		After intervention		Paired t p value *
	Yes out of3 Times		Yes out of3 Times		
	No.	%	No.	%	
1- Ceilings:					
– Smooth and easily to clean.	3	100.0%	3	100.0%	-
– No sharp angle.	3	100.0%	3	100.0%	-
2- Floors:					
– Smooth and easily to clean.	3	100.0%	3	100.0%	-
– No sharp angle.	3	100.0%	3	100.0%	-
3- Walls:					
– Smooth and easily to clean.	3	100.0%	3	100.0%	-
– Wall side with no sharp angle.	3	100.0%	3	100.0%	-
4- Hand washing facilities:					
– In or adjacent to bathrooms.	3	100.0%	3	100.0%	-
– Placed in suitable places for workers	0	0.0%	3	100.0%	<0.001**
5- Ventilation:					
a) Natural:					
• proper and sufficient	0	0.0%	3	100.0%	<0.001**
b)Artificial:					
• proper and sufficient	0	0.0%	3	100.0%	<0.001**
• Ventilation filters are kept clean and free of dust, grease, etc.	0	0.0%	3	100.0%	<0.001**
6- Lighting:					
– Distribution of light intensity suitable for different procedures.	0	0.0%	3	100.0%	<0.001**
– Stairs are lighted.	0	0.0%	2	66.7%	0.184
– Storerooms are properly lighted.	0	0.0%	3	100.0%	<0.001**
7- Water Drainage system:					
– Well designed to facilitate daily cleaning and prevent reverse flow.	3	100.0%	3	100.0%	-
8- Sewage disposal.	3	100.0%	3	100.0%	-
9- Presence of separate rooms forchanging cloths of food handlers.	0	0.0%	3	100.0%	<0.001**

***Paired t** p-value>0.05 non-significant; *p-value <0.05 significant; **p-value <0.001highly significant

Before intervention there was complete compliance with sanitary requirements of ceilings, floors, walls, water drainage, sewage drainage and hand washing facilities in or adjacent to bathrooms in all 3 follow-ups. Sanitary requirements of all other items (ventilation, lighting and the presence of separate rooms for changing cloths of food handlers) were not observed in any of the 3 pre intervention follow-ups. Interventions improved compliance in the latter items significantly **(Table 2).**

Table (3): Compliance with sanitary requirements of kitchen infrastructure(items 10-11) during the three follow-ups before and after intervention.

I. Kitchen Infrastructure	Before intervention	After intervention	Paired t p
	Yes out of 3Times	Yes out of 3Times	

	No.	%	No.	%	value *
10- Bathrooms:					
— Bathrooms attached to the kitchen are fullyisolated from places of food preparation and processing.	3	100.0%	3	100.0%	-
— Equipped with self-closing doors	3	100.0%	3	100.0%	-
— Basins for washing hands with taps controlled by elbow or foot.	0	0.0%	2	66.7%	0.184
— Basins are provided with:					
• liquid soap	3	100.0%	3	100.0%	-
• paper towels	1	33.3%	3	100.0%	0.184
11- Pest control:-					
— Absence of:					
• insects	3	100.0%	3	100.0%	-
• rodents	3	100.0%	3	100.0%	-
• animals as cats	2	66.7%	3	100.0%	0.423
— Screens are available on open windows and doors	0	0.0%	3	100.0%	<0.001**
— Outside doors are well- sealed	1	33.3%	3	100.0%	0.184
— Presence of insect killer apparatus.	0	0.0%	3	100.0%	<0.001**
— Use of pesticides.	3	100.0%	3	100.0%	-
— Only pesticides approved and registered by governmental authorities are used.	3	100.0%	3	100.0%	-

*Paired t p-value>0.05 non-significant; *p-value <0.05 significant; **p-value <0.001highly significant

Before intervention hand washing taps controlled by elbow or foot, screens on open windows and doors and insect killer apparatus were not observed in any of the 3 follow-ups. Bathroom paper towels and well-sealed outside doors was observed in only one of the 3 follow-ups. Following intervention, compliance with sanitary requirements of defective items improved especially the presenceof screens and insect killing apparatus (p<0.001) **(Table 3).**

Table (4): Compliance with sanitary requirements of Personal hygiene during the three follow-ups before and after intervention

II- Personal hygiene	**Before intervention**		**After intervention**		**Paired t p value ***
	Yes out of 3Times		**Yes out of 3Times**		
	No.	%	**No.**	%	
- Employees appear in good health	3	100.0%	3	100.0%	-
- Employees wear proper uniform.	2	66.7%	3	100.0%	0.423
- Employees wear clean uniform.	2	66.7%	3	100.0%	0.423
- Employees wear shoes.	0	0.0%	3	100.0%	<0.001**
- Effective hair restraints are properlyworn.	0	0.0%	3	100.0%	<0.001**
- Fingernails are short.	3	100.0%	3	100.0%	-
- Fingernails are unpolished.	1	33.3%	3	100.0%	0.184
- Fingernails are clean (no artificial nails).	3	100.0%	3	100.0%	-
- Jewelry is limited to a plain ring, such aswedding band	0	0.0%	3	100.0%	<0.001**
- No bracelets are worn	2	66.7%	3	100.0%	0.423
- Burns, wounds, sores or scabs, or splintson hands are bandaged	3	100.0%	3	100.0%	-

- Burns, wounds, sores or scabs, or splints on hands are completely covered with afoodservice	3	100.0%	3	100.0%	-
- Validity of license of the employee	3	100.0%	3	100.0%	-

***Paired t** p-value>0.05 non-significant; *p-value <0.05 significant; **p-value <0.001highly significant

Many of the items of personal hygiene were not initially complied with in any of the 3 follow-ups (wearing shoes, effective hair restraints and jewelry). Other items were observed only in one or 2 of the 3 pre intervention follow-ups. After intervention, complete compliance was observed in all 3 follow-ups **(Table 4).**

Table (5): Compliance with sanitary requirements of Personal hygiene (handwashing) during the three follow-ups before and after intervention

II- Personal hygiene:	**Before intervention**		**After intervention**		**Paired t p value ***
	Yes out of 3Times		**Yes out of 3Times**		
	No.	%	**No.**	%	
- Hands are washed properly					
a. Use the hand washing sink with warm running water.	0	0.0%	3	100.0%	<0.001**
b. Rinse hands and exposed parts of arms under running water and apply soap	0	0.0%	3	100.0%	<0.001**
c. Lather hands +together for at least 10-15 seconds paying close attention to fingernails, between the fingers/fingertips, and surfaces of the hands and arms.	0	0.0%	3	100.0%	<0.001**
d. Rinse thoroughly with clean, warm running water.	0	0.0%	3	100.0%	<0.001**
e. Thoroughly dry the hands and exposed portions of arms with single-use paper towels, a heated- air hand-drying device, or a clean, unused towelfrom a continuous towel system that supplies each user with a clean towel.	0	0.0%	3	100.0%	<0.001**
f. Avoid recontamination of hands and arms by using a paper towel to turn off hand sink faucets or to open the restroom door.	0	0.0%	3	100.0%	<0.001**

Table (6): Compliance with sanitary requirements of Personal hygiene (handwashing) during the three follow-ups before and after intervention (Cont.)

II- Personal hygiene:	**Before intervention**		**After intervention**		**Paired t p value ***
	Yes out of 3Times		**Yes out of 3Times**		
	No.	%	**No.**	%	
- Hands are washed frequently	1	33.3%	3	100.0%	0.184
- Hands are washed at appropriate times.					
a. When entering a food preparation area.	0	0.0%	3	100.0%	<0.001**

b. Before putting on clean, single-use glovesfor working with food and between glove changes	0	0.0%	3	100.0%	<0.001**
c. Before starting food preparation.	0	0.0%	3	100.0%	<0.001**
d. Before handling clean equipment and serving utensils.	0	0.0%	3	100.0%	<0.001**
e. When changing tasks and switching between handling raw foods and working with ready-to-eat foods.	0	0.0%	3	100.0%	<0.001**
f. After handling soiled dishes, equipment, or utensils.	0	0.0%	3	100.0%	<0.001**
g. After touching bare human body parts, forexample, parts other than clean hands and clean, exposed portions of arms.	0	0.0%	3	100.0%	<0.001**
- Employees immediately wash hands after theseacts.	0	0.0%	3	100.0%	<0.001**
h. After the following acts:					
• Using the toilet.	3	100.0%	3	100.0%	-
• coughing,	0	0.0%	3	100.0%	<0.001**
• sneezing,	0	0.0%	3	100.0%	<0.001**
• blowing the nose,	0	0.0%	3	100.0%	<0.001**
• using tobacco,	0	0.0%	3	100.0%	<0.001**
• eating, or	2	66.7%	3	100.0%	0.423
• after drinking.	0	0.0%	3	100.0%	<0.001**

*Paired t p-value>0.05 non-significant; *p-value <0.05 significant; **p-value <0.001highly significant

All hand washing practices were defectivebefore the intervention. frequent hand washing, immediate hand washing after eating and after using toilet were observed in 1,2 and 3 times of the 3pre intervention follow-ups respectively. The sanitary requirements were observed in all 3 follow-ups after intervention (p<0.001) except hands washing frequently and after eating were not significant (p>0.05) **(Table 5,6).**

Table (7): Compliance with sanitary requirements of Personal hygiene (gloves and disposable tissue) during the three follow-ups before and after intervention

II- Personal hygiene	**Before intervention**		**After intervention**		**Paired t P value***
	Yes out of 3Times		**Yes out of 3Times**		
	No.	**%**	**No.**	**%**	
- Glove while handling food.	0	0.0%	3	100.0%	<0.001**
- Disposable gloves are used properly					
a. Washing hands before and after use of disposable gloves.	0	0.0%	3	100.0%	<0.001**
b. Wearing gloves when preparing or serving ready to eat food as fresh fruits,vegetables and salads.	0	0.0%	3	100.0%	<0.001**
c. Changing gloves frequently and between tasks.	0	0.0%	3	100.0%	<0.001**
d. No handling of money and food while wearing the same gloves.	3	100.0%	3	100.0%	-
e. Changing gloves after					
• Sneezing	0	0.0%	3	100.0%	<0.001**

• Wiping nose	0	0.0%	3	100.0%	<0.001**
• Touching hair	0	0.0%	3	100.0%	<0.001**
f. Disposal of soiled gloves after use	0	0.0%	3	100.0%	<0.001**
- Employees use disposable tissues when					
a. Coughing	1	33.3%	3	100.0%	0.184
b. Sneezing	2	66.7%	3	100.0%	0.423

*Paired t p-value>0.05 non-significant; *p-value <0.05 significant; **p-value <0.001highly significant

No handling of money and food while wearing the same gloves was the only item observed in all pre intervention follow-ups. Use of disposable tissues when coughing and sneezing was observed in 1 and 2 of the 3 pre intervention follow-ups. Compliance in defective items increased significantly in all but except the last item **(Table 7).**

Table (8): Compliance with sanitary requirements of Personal hygiene(facilities) during the three follow-ups before and after intervention

II- Personal hygiene:	**Before intervention**		**After intervention**		**Paired t p value***
	Yes out of3 Times		**Yes out of3 Times**		
	No.	%	**No.**	%	
Facilities					
- Hand sinks are unobstructed	3	100.0%	3	100.0%	-
- Hand sinks are clean.	1	33.3%	3	100.0%	0.184
- Hand sinks are stocked with:					
a. Soap	0	0.0%	3	100.0%	<0.001**
b. Disposable towels	0	0.0%	3	100.0%	<0.001**
c. Warm water.	0	0.0%	3	100.0%	<0.001**
- A hand washing reminder sign is posted.	3	100.0%	3	100.0%	-
- Employee toilets are operational	0	0.0%	3	100.0%	<0.001**
- Employee toilets clean.	0	0.0%	3	100.0%	<0.001**
- The following behaviors are allowed onlyin designated areas away from preparation, service, storage, and warewashing areas:					
a. Eating	3	100.0%	3	100.0%	-
b. Drinking	3	100.0%	3	100.0%	-
c. Chewing gum	0	0.0%	3	100.0%	<0.001**
d. Smoking and using tobacco	0	0.0%	3	100.0%	<0.001**

*Paired t p-value>0.05 non-significant; *p-value <0.05 significant; **p-value <0.001 highly significant p-value>0.05 non-significant; *p-value <0.05 significant; **p-value <0.001 highly significant

Unobstructed hand sinks, hand washing sign posted and eating/drinking allowed in designated areas were complied with in all 3 preintervention follow-ups while cleanliness of hand sinks was observed onlyonce. Compliance with all other items increased significantly after the intervention (p<0.001) **(Table 8).**

Table (9): Compliance with sanitary requirements of Food during the three follow-ups before and after intervention

III- Food	Average before intervention		Average after intervention		Paired t P-value*
	Yes out of 3 Times		Yes out of 3 Times		
	No.	%	No.	%	
A) Receiving	2.4	66.7%	3	100.0%	>0.05
B) Food preparation	1.0	33.3%	2.9	100.0%	<0.001**
C) Cooking	1.5	33.3%	3	100.0%	>0.05
D) Hot holding	1.7	33.3%	3	100.0%	<0.05*
E) Cold holding	.25	0.0%	3	100.0%	<0.05*
F) Refrigerator, freezer and milk cooler	2	66.7%	3	100.0%	<0.05*
G) Food storage and dry storage	1.9	66.7%	3	100.0%	<0.05*
H) There is a regular cleaning schedule forall food surfaces					
First: Daily cleaning	1.5	33.3%	3	100.0%	>0.05
Second: cleaning every week	1.5	33.3%	3	100.0%	>0.05
Third: cleaning every month	1.7	66.7%	3	100.0%	>0.05
Environment	1.3		3		<0.05*
I) Cleaning and sanitizing	1.7	66.7%	3	100.0%	<0.05*
J) Utensils and equipment	1	33.3%	3	100.0%	<0.05*
K) Large equipment	0	0.0%	3	100.0%	>0.05* a
L) Garbage storage and disposal	1	33.3%	3	100.0%	<0.05*
M) Surveillance system for food and utensil safety(through recorded data)	0	0.0%	3	100.0%	>0.05 a
N)Audit system (through recorded data)	3	100.0%	3	100.0%	-

*Paired t p-value>0.05 non-significant; *p-value <0.05 significant; **p-value <0.001highly significant
a. Related samples McNemar test. The Paired Samples Test table is not produced.Because the SE of the difference is 0

Average compliance with sanitary requirements in all defective parameters increased after intervention. The most marked change was in food preparation (p<0.001) **(Table 9).**

Table (10): Compliance with sanitary requirements in the 3 domains during the three follow-ups before and after intervention

Domain of sanitation	Yes in 3 follow-ups Before intervention		Yes in 3 follow-ups After intervention		p-value
	No.	%	No.	%	
I. Kitchen Infrastructure	2	66.7%	3	100.0%	<0.001**
II- Personal hygiene	1	33.3%	3	100.0%	<0.001**
III- Food	1	33.3%	2	66.7%	<0.001**
Overall of sanitation	1	33.3%	3	100.0%	<0.001**

p-value>0.05 non-significant; *p-value <0.05 significant; **p-value <0.001 highlysignificant

Before intervention positive kitchen infrastructure was observed in 2 out of three follow-ups (66.7%) while personal hygiene and food sanitation were observed in one of the 3follow-ups (33.3%). Following intervention there was significant improvement in all sanitation domains (p <0.001), however food sanitation was still not observed in one of the 3 follow-ups **(Table 10).**

Table (11): Distribution of all students according to their satisfaction with the 3studied domains pre and post intervention (N=312)

The 3 Domains ofSatisfaction	Before Intervention(n=342)				After Intervention(n=312)					
	Satisfied		Unsatisfied		Satisfied		Unsatisfied			
	No.	%	No.	%	No.	%	No.	%	x2	p-value
I-Food	86	27.6%	226	72.4%	118	37.8%	194	62.2%	6.999	0.008*
A- General specifications of the meal served in the central restaurant:	97	31.1%	215	68.9%	122	39.1%	190	60.9%	4.052	0.044*
B- The elements of the meal provided to you:	101	32.4%	211	67.6%	126	40.4%	186	59.6%	3.988	0.046*
C- The degree of cooking is appropriate	16	5.1%	296	94.9%	53	17.0%	259	83.0%	21.118	<0.001**
D- Using multiple methods of preparing food	118	37.8%	194	62.2%	137	43.9%	175	56.1%	5.142	0.023*
E-Meals provided:	97	31.1%	215	68.9%	122	39.1%	190	60.9%	4.052	0.044*
II- Service	125	40.1%	187	59.9%	158	50.6%	154	49.4%	6.621	0.010*
A-Staff (Caterers)	96	30.8%	216	69.2%	126	40.4%	186	59.6%	5.88	0.015*
B- Meal reservationsystem	132	42.3%	180	57.7%	167	53.5%	145	46.5%	7.423	0.006*
C- cleanliness	135	43.3%	177	56.7%	171	54.8%	141	45.2%	7.855	0.005*
D- utensils andcutlery	121	38.8%	191	61.2%	150	48.1%	162	51.9%	5.114	0.024*
E- Timing:	140	44.9%	172	55.1%	169	54.2%	143	45.8%	5.026	0.025*
III- The general atmosphere in the dining halls	135	43.3%	177	56.7%	178	57.1%	134	42.9%	11.308	<0.001**
Overall satisfaction	108	34.6%	204	65.4%	143	45.8%	169	54.2%	7.705	0.006*

*p-value <0.05 significant; **p-value <0.001 highly significant

There was a statistically significant improvement in students satisfaction with the 3 domains food, service and general atmosphere in dining room following intervention (p <0.001). It is also noticed that the 5.1% of studied students who were satisfied with the degree of cooking pre-intervention increased to 17% post intervention **(Table 11).**

DISCUSSION:

University students undergo a life transition that often results in unhealthy dietary behaviors and unfavorable increase in body weight. Students who leave their families should self-organize the purchase and preparation of food and this might affect their dietary habits negatively. College students living away from home were highly vulnerable to imbalanced diet and malnutrition due to attraction to a new lifestyle, makingtheir own food choices and irregular daily routines **(21).**

University food/nutrition service is expected to provide balanced adequate diet to indorm students participating in it. However, these serviceswere repeatedly criticized by unsatisfied students including those at HelwanUniversity. So, the main objective of the current study was reaching betternutrition and health of indorm students in Helwan University.

The study included 342 students 149 females and 193 males. Since the sample was selected by proportionate stratified systematic random sample of first to fourth year students, this reflects a male preponderance in the underlying indorm student population as well as Helwan university student population. The preponderance of males over females among university students was reported by **Hartmann et al., (22)** and **Yun et al., (23)**.

Before intervention, the present study showed that, the lowest observed 3-followup mean compliance was in first aid which was zero times, facility cleanliness and lighting (<1 time). **First aid kits** were not located in an easy to see unobstructed location, neither were they adequately stocked with the approved items only. With respect to cleanliness of the facility, clean floors and drains were observed only in 2 of the 3 pre- intervention checkups; all other items were not observed in any of the initial 3 follow-ups (properly lined not overflowing garbage cans, clean ceiling, well stocked hand soap and paper towel and clean fans).

As for **lighting**, 3 of the checked 4 items were not observed in any of the initial3 follow-ups namely the presence of adequate steady lighting, and the provision of emergency lights. Many of the items of **food service** were not complied with in any of the 3 initial follow-ups (the use of standardized recipes, consistency in serving foods at suitable temperature,recording temperature throughout the serving period, attractive display of cold foods, removal of food that has been sitting out too long and becomedry, discolored, or otherwise unappealing from the serving table). So isthe case with **emergency procedures**. The highest compliance was in Floors, Aisles, Stairs and Landings (almost 3 times), Dish Room/ Dish Machine (2.4 times) and electrical fittings (2 times).

After intervention, the observed 3-followup mean compliance increased in all domains especially in Infrastructure, Food, Emergency Procedures, First Aid and Facility Cleanliness ($p<0.05$ in all 5 domains). However, complete compliance was only observed in the case of **Floors, Aisles, Stairs and Landings and electrical fittings.** In addition to the intervention, the observed improvement is also attributed to the great contribution of the vice dean of faculty of medicine Helwan University (Prof. Mohamed Fath Elbab) and Supervisor of the university's central kitchens (Assistant professore. Reda Abd Elhafeez) in making noticeable changes in the furniture, tools, decoration, types and quantities of food provided to students in the central kitchens, and also urging workers to cooperate.

The observed defects in compliance with the domains of dining room negatively affect the environment in which the students dine andare mostly responsible for the large proportion of students eating none or only portion of served meals. Upgrading the process of food preparation, storage, serving it properly in a safe attractive setting and disposing its remains suitably can improve student share of provided food and reduce the wastage and cost on part of the university and students as well. Continuous supervision and the application of Quality control measures are highly recommended.

Dining facilities have long played a principal role in colleges and universities as a place of communion. Today, campus dining strategies are also utilized to enhance and encourage student face-to-face interactions and informal learning. Many colleges and universities often use dining to help fulfill their mission, reflect their culture and values,and influence the way students interact. Campus dining allows institutions to influence how students meet and learn, while creatingexperiences that shape campus society and strengthen campus communities. Although it is understood that campus dining supports learning environments for students, little research has been done to explore how these spaces engage students in learning **(24).**

Compliance with sanitary requirements was assessed in 3 domains (I- kitchen Infrastructure, II-Personal hygiene and III-Food sanitation). The present study proved complete initial compliance with many of the tested infrastructure items (ceilings, floors, walls, and water drainage system and sewage disposal). Other items as the suitability of hand washing places for workers, ventilation, lighting and the presence of separate roomfor food handlers to change clothes in and the presence of Basins for washing hands with taps controlled by elbow or foot were not observed inthe initial 3 follow-ups. As for compliance with pest and animal control, no screens were available on windows and doors, also no pesticides nor were insect killer apparatus present. Cats were observed in 2 of the 3 follow-ups. Lack of compliance with these items undermines sanitation and predisposes to foodborne diseases.

As for personal hygiene, employees did not apply hair restraints or hand washing practices properly; they did not use gloves while handling food nor used disposable gloves properly. Employee toilets were neither operational nor clean. Many of the items of food sanitation were eithernot observed at all or only in some of the 3 initial follow-ups.

The most common contributing factors for outbreaks in restaurants are related to food workers and food preparation practices. Not cooking food to a hot enough temperature and other improper food preparation practices can lead to pathogens growing **CDC, (25) and (26)** and predispose to foodborne infections. Most regulatory retail food inspectionprograms throughout the United States monitor these risk factors in their routine inspections, and each necessitates specific food safety behaviors and practices to control the risks. Ensuring proper continuous control of sanitary conditions in the kitchen and dining room through inspection, training and applying corrective measures is recommended and can improve the situation at Helwan University nutrition facility. A recent FDA study showed that restaurants were able to have the best control over ensuring no bare-hand contact with RTE foods and cooking rawanimal foods to their required temperatures.

There remains a need to gain better control over the following food safetybehaviors and practices: employee Handwashing (includes both when to wash and how towash properly), cold holding of foods requiring refrigeration and foods are cooled properly

Following intervention there was significant improvement in almost all items of the 3 sanitation domains. **Uzoama et al., (27)** concluded that supervision and training were helpful to enhance food safety practice. Overall knowledge of the food handlers translates to good food safety practices. Relevant regulatory bodies are needed to institute measures to ensure the enforcement of food handling laws to limit therisk of food contamination by food handlers.

Before intervention, around two thirds of the studied female and male students were unsatisfied with almost all the General specifications of the meal served in the central restaurant. They were only highly satisfied with the amount and diversity of served carbohydrates (99.5%). They were least satisfied with the amount of served protein and to a lesserextent with fruits, milk and dairy products and vegetables. They wereleast satisfied with the diversity of served dairy products, vegetables, fruits and protein. Less than half the students were satisfied with the degree of cooking and with the use of frying and baking in preparing food.

Before intervention, the lowest overall satisfaction was observed with food while the highest was with the general atmosphere in the diningroom domains. Overall satisfaction was observed in a quarter of students in the case of food domain, forty percent of students in the case of serviceand about forty three percent in the case of the general atmosphere in dining room domains. The lowest satisfaction (5.1%) was reported with appropriateness of the degree of cooking. The sex difference in satisfaction was insignificant in most cases. Female students were less satisfied with the appropriateness of the degree of cooking than males; however the percentage of satisfied male and female students was closeto each other with the 3 domains of satisfaction. The absence of sex difference in satisfaction regarding sanitation in dining room was also reported by **Wooten et al., (28)**. Contrariwise, this result disagreeswith **Abdelaty & Abdel-Aal, (29)** who stated that there was highly statistically significant difference between studied students before providing intervention program.

The satisfaction rate observed in this study is much lower than that reported in other similar studies. **Wooten et al., (28)** found that one third of studied students were satisfied with food as overall while **Serhan & Serhan, (15)** reported that three quarter of studied students had satisfactory level regarding food quality.

CONCLUSION:

There was an improvement in total nutritional record, compliance dining room, satisfaction and sanitation after implementation the current study program.

REFERENCES:

1. Salama A, Esmail N and Helaly N. (2021). Double Burden of Malnutrition among Freshman University Students: Determinants and Correlates. The Egyptian Journal of Community Medicine. 39. 10.21608/EJCM.2021.144080.
2. Genena D.M. and Salama, A.A. (2017): –Obesity and Eating Habits among University Students in Alexandria, Egypt: A CrossSectional Study.‖ World Journal of Nutrition and Health, vol. 5,no. 3: 62-68.
3. Hafez S, Ghazawy E, Mahfouz E, Abd-El Rahman T, Emam S. (2022):Obesity/Overweight among University students. Minia, Egypt. Minia Journal of Medical Research; 33(3): 30-36. doi: 10.21608/mjmr.2022.129100.1068.
4. Kabir A, Miah S, Islam A. (2018): Factors influencing eating behavior and dietary intake among resident students in a public university in Bangladesh: A qualitative study. PloS one.; 13(6):e0198801.
5. Ahram Online. (2015). 150 'food poisoning' cases at Al-Azhar dorms in Egypt's Assiut. Available at: https://english.ahram.org.eg/ News Content/ 1/64/119286/Egypt/Politics-/-food-poisoning cases at-AlAzhar-dorms-in-Egypts-A.aspx. (Accessed on 1/9/2024)
6. Ajulo, Olusola Adetunji, Olugbenga Ajulo. (2020): Review of Gastroenteritis Caused by Food Poisoning in University College Hospital, Ibadan, Nigeria, Current Developments in Nutrition; 4(2):734. https://www.sciencedirect.com/ science/ article/pii/ S2475299123082525
7. Alyoum 7. (2012, November 12). 124 cases of food poisoning in Helwan University girls' accommodations. Alyoum 7 Online. Retrieved from https://www.youm7.com/
8. Joung HW, Lee DS, Kim HS, Huffman L. (2014): Evaluation of the on-campus dining services using importance-performance analysis. Journal of Foodservice Business Research.; 17(2):136-46.
9. Cuy Castellanos D, Holcomb J. (2020): Food insecurity, financial priority, and nutrition literacy of university students at a mid- size private university. Journal of American college health.; 68(1):16-20.
10. Gazibara T, Tepavcevic D.B, Popovic A. & Pekmezovic T. (2013): Eating habits and body-weights of students of the Universityof Belgrade, Serbia: A cross-sectional study. Journal of Health, Population and Nutrition, 31(3).
11. Bede F, Cumber S.N, Nkfusai C.N, Venyuy M.A, Ijang Y.P, Wepngong E.N. & Nguti Kien A.T. (2020): Dietary habits and nutritional status of medical school students: The case of three state universities in Cameroon. Pan African MedicalJournal, 35. doi:10.11604/pamj.2020.35.15.18818.
12. Nelson M.C. & Story M. (2009): Food environments in University dorms. American Journal of Preventive Medicine, 36(6), 523- 526. doi:10.1016/j.amepre.2009.01.030.

13. Weinroth M.D, Belk A.D. & Belk K.E. (2018): History, development, and current status of food safety systems worldwide. Animal Frontiers, 8(4), 9-15.
14. Aljohani N.E. (2019): Comparison of nutritional status between university students living at dormitory and students living at home. International Journal of Advanced Research, 7(9), 905-911. doi:10.21474/ijar01/9736.
15. Serhan M. & Serhan C. (2019): The impact of food service attributes oncustomer satisfaction in a rural University campus environment. International Journal of Food Science, 2019, 1- 12. doi:10.1155/2019/2154548.
16. Alberta (2019): Design guidelines for continuing care facilities in Alberta. Available at: https://open.alberta.ca/publications/ design guidelines-continuing-care-facilities-alberta. (Accessedon 1/9/2024).
17. Berkeley University Health Services. (2018): Design guidelines.Available at: https://uhs.berkeley.edu/facstaff/ ergonomics/ design-guidelines. (Accessed on 1/9/2024).
18. Soriano J, Moltó J. & Mañes J. (2000): Dietary intake and food pattern among university students. Nutrition Research, 20(9), 1249- 1258.
19. Salameh P, Jomaa L, Issa C, Farhat G, Salam ÃJ. & Zeidan N. (2014): Assessment of dietary intake patterns and their correlates among University students in Lebanon. Frontiers in Public Health, 2.
20. World Medical Association (2013): Declaration of Helsinki - Ethical principles for medical research involving human subjects. WMA General Assembly, Fortaleza, Brazil; October 2013.World Med J.; 59(5):199-202".
21. Alghamdi E.S, Farrash M.S, Bakarman M.A. & Mukhtar A.M. (2018): Dietary habits of University students living at home orat University dorm: A cross-sectional study in Saudi Arabia. Global Journal of Health Science, 10(10), 50. doi:10.5539/ gjhs.v10n10p50.
22. Hartmann Y, De Cássia C. de A. Akutsu R, Zandonadi R.P, Raposo A. & B.A. Botelho R. (2021): Characterization, nutrient intake, and nutritional status of low-income students attending a Brazilian University restaurant. International Journal of Environmental Research and Public Health, 18(1), 315.
23. Yun C.T, Ahmad S.R, Soo Quee, D.K. (2018): Dietary habits andlifestyle practices among University students in Universiti Brunei Darussalam. Malaysian Journal of Medical Sciences, 25(3), 56-66.
24. Boswell J. (2023): The Relationship between Campus Dining, Student Learning, and Student Success. Graduate Research Theses & Dissertations, 7128.
25. CDC, (2024). Food safety, About food safety. Available at: https:// www.cdc.gov/food-safety/about/? CDC_AAref Val=https://www. cdc. gov/foodsafety/foodborne-germs.html. (accessed on1/9/2024).
26. CDC. (2017). Foodborn disease outbreak surveillance system. Highlights from the 2017 Surveillance Report. https://www. cdc. gov/fdoss/annual-reports-report-highlights.html#print
27. Uzoama JO, Kimm H, Konlan KD. (2023): Factors associated with foodsafety practices among food handlers in Abuja municipal area council, Nigeria. J Glob Health Sci. 2023 Jun;5(1):e9.https://doi.org/10.35500/jghs.2023.5.e9
28. Wooten R, Lambert LG, Joung H. (2018): Evaluation of students‘ satisfaction with three all-you-can-eat university dining facilities. Journal of Foodservice Business Research, 21(5), 539-552.
29. Abdelaty Y. and Abdel-Aal E. (2017): Assessment of University residence food service using importance-performance analysis (IPA): Student perspective (A case study of sadat city University). International Journal of Heritage, Tourism and Hospitality, 11(1), 123-141. doi:10. 21608/ijhth.2017.30186.