

## Chemical Composition and Microbiological Quality of the Central Restaurant Food of Hamedan University of Medical Sciences

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### ABSTRACT

**Background:** The main purpose of this study was to determine the microbial contamination and chemical quality of food prepared in the central restaurant of the Hamedan university of medical sciences.

**Objectives:** The main purpose of this study was to determine the microbial contamination including coliforms and pathogenic bacteria in food cooking and serving center of the Hamedan University of Medical sciences.

**Materials and Methods:** In this cross-sectional study, 150 food samples were randomly obtained from the central restaurant of the Hamedan university of medical sciences and consequently evaluated for bacterial and yeast contamination using the American public health association (APHA) and food and drug administration (FDA) standard methods. In addition, the chemical quality and outward status of food were assessed. Statistical analysis was done using SPSS software (version 16.0) and descriptive and analytical statistics were used.

**Results:** Rice, vegetable pot roast and kebab had the highest total bacteria and coliform count. The total bacteria averages and coliform count for rice were  $1.314 \times 10^5$  CFU (Colony Forming Units)/g and  $1.82 \times 10^4$  CFU/g respectively. Twenty one point four percent, 60% and 20% of rice, vegetable pot roast and kebab tested samples were contaminated with E. coli, respectively. Significant differences were observed among total bacteria, coliforms and yeast counts of different meal samples ( $P = 0.02$ ).

**Conclusions:** The results of the present study demonstrated that none of the tested samples were contaminated with Salmonella and Listeria monocytogenes. Improving methods for cooking and food processing, prevention of the secondary bacterial contaminations, continuous monitoring and surveillance of food processing are of great importance as preventive measures of food contamination.

### ► Implication for health policy/practice/research/medical education:

Results of the current study could be used to show the importance of improved cooking methods and continuous surveillance of food processing in preventing food bacterial contamination at public places such as university restaurants.

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## 1. Background

Food-borne diseases, in particular food poisoning caused by food contaminations are among major health problems in developing countries (1). Concerns about illnesses caused by microorganisms could arise from the growing incidence rates in countries with appropriate recording and reporting systems of food-borne diseases (1, 2). In developing countries, the incidence rate is approximately 916 cases per 100000 populations. Considering the WHO reports, economic loss posed by Salmonellosis could be estimated about one billion dollar with the medical and productivity costs taken into account (2-4).

Several studies have been done in order to address this issue in different countries. Fang *et al.* indicated that Coliforms, *Staphylococcus aureus* as well as *Bacillus cereus* contamination rates were 27.5%, 17.9% and 7.9% respectively (5). In the other study, average contamination rates of *Staphylococcus aureus*, *E. coli* and *Streptococcus* were reported 7.6%, 8.8% and 13.7%, respectively. The authors noticed the inappropriate temperature of fast-food in serving place and long distance between cooking and serving places as important causes for the observed contaminations (6). Results of one study in Tehran University had shown that kebab and fish were the most contaminated food according to the total bacterial and coliforms counts. In addition, 38.9% and 55.6% of samples were contaminated with *E. coli* and *Staphylococcus aureus* (7). Kebab had the highest total average of bacteria in Tehran University restaurants and *Staphylococcus aureus* contamination was only revealed in kebab samples (8).

In the educational centers, central kitchens are used for cooking and serving of food; therefore, unhealthy conditions could lead to the incidence of food-borne illnesses among such population (7). Since students are at relatively high risk of developing serious food-borne illnesses, central university restaurants are of utmost importance in regard to food bacterial contaminations (5).

## 2. Objectives

Investigation of the quality of served food in central university restaurants is of great importance for providing healthy food and supervising the food serving conditions in such areas. The main purpose of this study was to determine the microbial contamination including coliforms and pathogenic bacteria in food cooking and serving center of the Hamedan university of medical sciences.

## 3. Materials and Methods

We conducted this cross-sectional study to investigate the microbial, chemical and outward quality of the

served food at the central restaurant of Hamedan university of medical sciences. Served food included rice, mince stew, eggplant stew, vegetable pot roast, prune as well as celery stew, kebab, roast chicken, vegetable and rice, fish, bean and rice, meat, canned bean, canned fish, soup and pickle. Samples were obtained from the aforementioned food for five times, and then microbial and chemical tests were randomly conducted on two samples of any food in each sampling time. The tests were selected based on standard methods and randomized sampling, standard numbers of institute of standards and industrial research of Iran (ISIRI No. 815, 194, 9263 and 1-8923, ISIRI, 2009). A total of 150 samples were experimented. Samples in each series were taken from main dishes before serving by students. Subsequently, samples were placed in cooling box and transmitted to the food experimental laboratory.

Before performing the experiments, samples were mixed and homogenized. The tests included the total frequency of bacteria and Coliforms, *E. coli*, *Staphylococcus aureus*, *Salmonella* and *Listeria monocytogenes*, mold and yeast count, which were used for assessing food quality according to the American Public Health Association (APHA) standard methods (9). According to the ISIRI and food and drug administration (FDA) recommendations, fat level and moisture content measurements were also applied, in order to investigate the chemical quality. In addition, evaluation of canned food was conducted based on the instruction of ISIRI-2326. Moreover, food outward status was investigated via filling out checklists by the food laboratory technician group. Food outward factors consisted of size, shape, color, lucidity or opacity and being blur or varnish. Statistical analysis was done using SPSS software (version 16.0) and descriptive (mean and SD) and analytical statistics (kruskal-wallis and mann-whitney test to find significant differences among total bacteria, Coliforms and yeast count of different meal samples). The level of significance was set at 5%.

## 4. Results

Details of fat level and moisture content amounts of the investigated food are given in Table 1. As Table 1 shows, prune stew had the highest of fat level with  $8.45 \pm 0.72\%$ , and the lowest fat level ( $0.2 \pm 0.10$ ) was found in chicken soup. The highest and lowest levels for moisture content amounts were observed in celery stew ( $71.2 \pm 1.23\%$ ) and canned fish ( $25.2 \pm 0.00\%$ ). Outward status was appropriate in the total food samples. The information about total bacterial count, yeast, molds and Coliforms are shown in Table 2. Rice, mince stew and kebab had the highest of total bacteria, Coliforms, and pathogenic bacteria including *E. coli* and *Staphylococcus aureus*. The means of total bacteria and coliforms in rice were  $131428.571 \pm 364034.17$

**Table 1.** Details of the Measured Parameters for served Food

Type of Food	Moisture Content (% w.b.) (Mean ± SD)	Fat Level (Grams) (Mean ± SD)	Outward Status	P value
Rice	39.17 ± 1.99	2.22 ± 0.92	Appropriate	0.01
Mince stew	42.36 ± 1.59	3.97 ± 0.24	Appropriate	0.012
Vegetable pot roast	57.62 ± 1.12	5.05 ± 0.1	Appropriate	0.015
Prune stew	46.87 ± 1.61	8.45 ± 0.73	Appropriate	0.3
Celery stew	71.2 ± 1.23	5.08 ± 0.09	Appropriate	0.02
Kebab	32.51 ± 4.27	5.83 ± 1.12	Appropriate	0.01
Hen	47.39 ± 1.38	4.71 ± 0.38	Appropriate	0.02
Fish	36.00 ± 3.65	2.94 ± 0.1	Appropriate	0.02
Roast chicken	38.24 ± 0.16	1.09 ± 0.07	Appropriate	0.02
Vegetable rice	43.99 ± 1.05	2.48 ± 0.15	Appropriate	0.01
Bean rice	40.69 ± 1.08	5.21 ± 0.35	Appropriate	0.04
Meat	63.56 ± 1.04	4.54 ± 0.23	Appropriate	0.015
Fish conserve	25.2 ± 0.00	4.00 ± 0.00	Appropriate	0.02
Bean conserve	64.73 ± 0.00	3.9 ± 0.00	Appropriate	0.03
Hen soup	58.70 ± 0.7	0.29 ± 0.1	Appropriate	0.04

**Table 2.** Details of The Total Bacterial Count, Coliforms, Yeast and Mold in Served Meal (CFU/g)

	Total Bacteria Count (CFU/gr)	Coliforms (CFU/gr)	Yeast (CFU/gr)	Mold (CFU/gr)
Standard ranng	5 × 10 <sup>5</sup>	102	104	103
Rice	131428.57 ± 364034.17 <sup>a</sup>	18258.57 ± 66712.9 <sup>a</sup>	267.26 ± 71.42	0
Mince stew	110200.00 ± 218963.92 <sup>a</sup>	6400.00 ± 8648.69 <sup>a</sup>	2162.17 ± 1600	0
Kebab	0	6.8 ± 13.08	0	0
Pickle	0	0	266.04 ± 434.00	4.2 ± 14.2
Other	0	0	0	0

Abbreviation: CFU; colony forming unit

<sup>a</sup> Population greater than standard amounts

**Table 3.** Details of The Pathogenic Bacterial Counts

	Positive Sample for <i>E. coli</i> , (%)	Positive Sample for <i>Staphylococcus Oreos</i> , (%)	Positive Sample for <i>Salmonella</i> , (%)	Positive Sample for <i>Listeria mono cytogeneses</i> , (%)	Total Samples
Rice	3 (21.428)	-	-	-	14
Mince stew	3 (60)	-	-	-	5
Kebab	1 (20)	-	-	-	5
Other	-	-	-	-	95

and 18258.571 ± 66712.9 CFU (Colony Forming Unit)/grams, respectively. Therefore, rice was regarded as the most contaminated food. Contamination with other bacterial species was not reported on other samples of food. In regard to canned Tuna and canned bean, results indicated full consistency with the recommended standards and inconsistency was not reported.

As Table 2 shows, yeast was detected in rice, mince stew and pickle. In addition, mold was only found in pickle (14.2 ± 4.2). Vegetable pot roast, pickle and rice had the

highest level of yeast, respectively. Details of the pathogenic bacteria counts are summarized in Table 3. As Table 3 shows, rice, mince stew and kebab samples were positive regarding the presence of *E. coli*. Other pathogenic bacteria were not detected in the investigated samples.

A Significant difference was observed in total bacteria, coliforms and molds between food samples. Total bacteria and coliforms numbers in rice as well as mince stew were more than standard figures (100 colonies per each gram for coliforms).

#### 4. Discussion

In this study, the chemical composition and microbiological quality of the central restaurant food of Hamedan University of Medical Sciences were studied. According to our results, rice, vegetable pot roast and kebab were identified as dishes with high amounts of total bacteria and coliforms. Vegetable pot roast had the highest *E. coli* contamination among dishes followed by pot roast and kebab. Laboratory tests showed that the outward status of food samples is appropriate. According to the ISIRI guidelines, acceptable fat level in kebab is 20% (gram/gram) (8) and our finding is coherent with the acceptable standard.

Rice, mince stew and kebab had the most contaminated samples by means of total bacteria, coliforms and pathogenic bacterial counts. This may be attributed to the primary crude material, food manipulation by personnel, serving conditions and inappropriate cooking processes (9). In addition, cook temperature and heat distribution in entire food could be considered as influencing factors of food contamination. One of the five kebab samples was contaminated with coliforms, although it was in agreement with the acceptable standards. Other samples were not contaminated by coliforms. This finding is in accordance with another study conducted in Argentina (6) which showed similar findings regarding the total bacteria and coliforms in the rice and mince stew samples. Findings of the performed study by Nemati *et al.* on kebab have shown that the total bacterial and coliform counts were  $3.22 \times 10^3$  CFU/g and  $1.69 \times 10^3$  CFU/g, respectively which is higher than our results. Insufficient heat and secondary contamination after cooking, inappropriate preparation and contaminated masher could be effective in food contamination (10).

Regardless of mince stew, bacterial contamination was not detected in other stews, which could be related to the long time of cooking and high temperature (6, 8, 10); This finding was also previously observed in another study performed by Tavakoli *et al.*, in 2009 to evaluate the bacterial, chemical and organoleptic quality of cooked food with traditional and modern equipment. They stated that high cooking temperature is effective in reducing the contamination level; however, the quantity of vitamin B1 and B2 in addition to the organoleptic characteristics may decrease as a result of high cooking temperature (11). After all, the food cooking temperature is an important factor; as some studies have shown that bacterial growth may begin only within two hours after cooking (12). Therefore, preventive measures for avoiding secondary contamination should be considered in such stages.

Rice had the highest total bacterial and coliform numbers among collected food samples. A variety of bacteria could exist in rice. In particular, *Bacillus cereus* could stay alive even in high temperatures (13, 14). Rice contamination could be affected by primary sources, agricultural productions, storage steps and preparation condition (15).

Considering the lack of *Staphylococcus aureus* in collected samples, hypothesis of contamination by human practice is not likely (16). Mold and yeast were only detected in rice, mince stew and pickle, which is in contrast to the results of previous studies (17). Molds, yeast and other species of *Enterobacteriaceae* are among the natural flora of some food materials, which may decrease during the preparation of crude material, the heating process (high heating such as pasteurization or use of cold) and adding preservative materials.

Results show that the microbial contaminations in rice, mince stew and kebab require preventive considerations. In addition, crude material should be considered for microbial quality tests before preparation for any cooking stage. Moreover, results of this survey could be used to inform restaurant managers, policy makers and students about the foods' quality and safety regarding to microbiological contamination and chemical composition.

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#### Authors' Contribution

None declared.

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