

## MICROBIOLOGICAL QUALITY OF HOME COOKED MEAT MEALS AND VEGETABLE SALADS

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### ABSTRACT

**Objective:** To determine the microbiological quality of home meals and salads samples.

**Methodology:** A total of 180 samples were collected between May 2007 and July 2007 in Ankara, Turkey. The samples were analysed for the presence of total aerobic bacteria (TAB), *thermotolerant coliform bacteria* (TCB), *Esherichia coli*, *Salmonella spp.* and *Staphylococcus aureus*.

**Results:** In the present study, *S.aureus*, *coliforms*, *E.coli*, and *Salmonella* were not detected in cooked meat meals samples. TAB was detected in 22 (24.4%) meat dishes ranges  $10^2$ - $10^4$ . The cooked meat dishes samples were analyzed for the presence of TCB, and detected in 2 (2.2%) meat dishes ranges  $10^3$ - $10^4$ . Numbers of the aerobic mesophilic bacteria ranged from  $10^2$  to  $10^5$  cfu/g and *coliforms* from 37 to 1400 MPN/g in 17 (18.9%) of salad samples. *E.coli* was detected at level  $10^2$ - $10^3$  (n=12, 13.3%) and *S. aureus* was detected in 9 (10.0%) at levels of  $10^3$ - $10^4$  cfu/g salad samples tested. In 4 (4.4%) of the salads samples *S.aureus* and *E.coli* were isolated together.

**Conclusion:** The results indicate that the type of vegetable salads analysed may contain pathogenic bacteria and thereby represent a risk to the consumers in regard to foodborne diseases. Thus, it remains essential to include the significance of effective hygiene practices as an important safety measure in programmes of home hygiene, consumer education, and advice

**KEY WORDS:** Microbiological quality, Contamination, Food pathogens, Home hygiene, Salad vegetables.

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### INTRODUCTION

Over the past two centuries our knowledge and understanding of microbial pathogens has

developed. Despite much progress however infectious diseases remain significant concerns the incidence of foodborne diseases has not decreased during the last few years.<sup>1,2</sup> Previous studies suggest that 16% of food poisoning outbreaks in England and Wales may be associated with meals prepared in private houses.<sup>3</sup> It has been suggested that foodborne illness is initiated in private homes three times more frequently than in commercial operations.<sup>4</sup> Data from some countries indicate that more than 50% of reported outbreaks of gastro-intestinal infection arose in the home.<sup>1,5,6</sup> There is a growing awareness of the importance of home

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hygiene.<sup>7-9</sup> The aim of this study was to investigate the bacteriological quality to assess the microbial quality of home meals and vegetable salads in Ankara, Turkey.

## METHODOLOGY

This study was carried out in Ankara in 45 of our students' households selected for this study. A total of 180 samples, 90 cooked meat dishes and 90 vegetable salads served for lunch and dinner were collected twice during the study in the households located in Ankara from 1st May to 30 July 2007. The meat dishes were prepared by Turkish traditional methods with red meat, minced meat, meatballs, poultry or seasonal vegetables. The salads were mixed and prepared by slicing lettuce, tomato, cucumber, carrot, onion, parsley and green-pepper.

All samples (200g) were aseptically collected, placed in sterilized jars ice chests during transport to the laboratory. Analyses of the samples were conducted either immediately after arrival in the laboratory, or following overnight storage in the refrigerator (4°C), being examined on the next day. By using American Public Health Association (APHA) standard guidelines, we performed the following examinations; bacterial total count, coliform count, *E.coli* assay, *Staphylococcus aureus* assay and counting, determination of *Salmonella*.<sup>10-12</sup>

## RESULTS

In the present study, *Staphylococcus aureus*, *E.coli*, and *Salmonella* were not detected in cooked meat meals samples. The cooked meat dishes samples were analyzed for the presence of TAB detected in 22 (24.4%) ranges  $10^3$ - $10^4$ , and TCB detected in 2 (n=15, 13.3%) ranges  $10^3$ - $10^4$  meatball dishes samples. Results obtained from the bacteriological analyses cooked meat dishes are shown in Table-I.

The meatballs were further processed (fried or grilled) after preparing and forming by hand. This cooking step should have inactivated any bacteria, provided that they were thoroughly cooked. Further study of cooking process and handling after cooking will be undertaken to identify conditions that may have contributed to contamination of this product.<sup>13</sup> When vegetable salads were analyzed, some salads samples were detected as contaminated with *S.aureus*, *coliforms*, and *E. coli*, whereas no salmonella were isolated from vegetable salads. In four (4.4%) of the salads samples *S.aureus* and *E.coli* were isolated together. Results obtained from the bacteriological analyses of vegetable salads are presented in Table-II.

## DISCUSSION

In 76 (84.4%) salads samples TAB ranged from  $10^2$  to  $10^5$  cfu/g and *coliforms* ranged from

Table-I: Results of microbiological quality of cooked meat dishes

Kind of meat dishes/ Numbers of samples	TAB n % range	Coliforms n % range	<i>E.coli</i> n % range	<i>S.aureus</i> n % range	<i>Salmonella</i> n % range
Meatballs (n=15)	4 26.6 $10^2$ - $10^4$	2 13.3 $10^3$ - $10^4$	ND*	ND	
Minced meat and seasonal vegetables (n=15)	2 13.3 $10^2$ - $10^4$	ND	ND	ND	ND
Chopped red meat dishes (n=15)	3 20.0 $10^2$ - $10^3$	ND	ND	ND	
Baked poultry (n=15)	4 26.6 $10^2$ - $10^4$	ND	ND	ND	ND
Chopped poultry and seasonal vegetables (n=15)	5 33.3 $10^2$ - $10^4$	ND	ND	ND	ND
Chopped red meat and seasonal vegetables(n=15)	4 26.6 $10^3$ - $10^4$	ND	ND	ND	ND
Total (n=90)	22 24.4 $10^2$ - $10^4$	2 2.2 $10^3$ - $10^4$	ND	ND	ND

ND\*: Not Detected

Table-II: Results of microbiological quality of raw vegetable salad samples

Bacteria	Positive samples		Range (cfu/g)
	n	%	
TAB	76	84.4	10 <sup>3</sup> -10 <sup>4</sup>
Coliforms	17	18.9	37-1400
<i>E.coli</i>	12	13.3	10 <sup>2</sup> -10 <sup>4</sup>
<i>S. aureus</i>	9	10.0	10 <sup>3</sup> -10 <sup>4</sup>
<i>E.coli</i> and <i>S.aureus</i>	4	4.4	10 <sup>3</sup> -10 <sup>4</sup>

37 to 1400 MPN/g (n=17, 18.9%). The *E. coli* was detected at level 10<sup>2</sup>-10<sup>4</sup>, and *S. aureus* was detected at level of 10<sup>3</sup>-10<sup>4</sup> cfu/g in 9 (10.0%) salad samples tested. *S. aureus* was isolated together with *E. coli* in 4 (4.4%) salads samples at level 10<sup>3</sup>-10<sup>4</sup> cfu/g. Sadýk et al<sup>14</sup> reported aerobic plate counts of salads as <10<sup>6</sup> cfu/g. The high *coliform* counts could be due to pollution of vegetables by humans, animals or irrigation water.

In salad samples aerobic mesophilic bacteria ranged from 10<sup>2</sup> to 10<sup>5</sup> cfu/g and *coliforms* ranged from 23 to 1100 MPN/g. The *E. coli* levels ranged from 9 to 210 MPN/g in these samples. *S. aureus* was detected at level of 10<sup>3</sup>-10<sup>4</sup> cfu/g in 8 (11.4%) salad samples tested. In our country, the researchers isolated *S. aureus* together with *coliforms* or *E. coli* in some samples tested.<sup>15</sup> A study conducted by Ayçiçek et al<sup>16</sup> aerobic and *coliform* counts were up to 7.4 and 6.9 cfu/g, and *E. coli* counts up to 3.8 cfu/g of analysed samples contained. Their results correlate well with another study performed by Johannessen et al.<sup>17</sup> *E.coli* and *Salmonella* spp were not detected in any of the samples. TCB were detected small proportion of the samples. The numbers of TCB present varied from 10 cfu/g to approximately 4500 cfu/g. *Staphylococcus* spp were detected 18.5% of the total samples. In a study performed by Viswanathan and Kaur<sup>18</sup> aerobic plate counts for raw salad vegetables 10<sup>5</sup>-10<sup>10</sup> cfu/g their corresponding *coliform* counts ranged between 10<sup>6</sup>-10<sup>9</sup> cfu/g. Vegetables production practices, growth conditions and the location of the edible part during growth will affect their microbial status at

the time consumption.<sup>19-21</sup> As a result, outbreaks of human infections associated with consumption of raw fruits and vegetables have occurred with increased frequency during the past decades.<sup>22</sup> However, recently a wide range of contaminated fresh vegetables have caused large outbreaks of microbial infections.<sup>23</sup> Many pathogenic bacteria, parasites, and viruses have been detected in raw vegetables.<sup>24</sup> Homes further contaminate the salad during slicing, chopping and mixing by handling, processing and distribution.<sup>23</sup> There are reports of high aerobic and *coliform* counts. Several out breaks of human gastro-enteritis have been linked to the consumption of contaminated fresh vegetables.<sup>25,26</sup>

The present study revealed the potential hazard of home prepared salad vegetables. Plate count of aerobic mesophilic microorganisms found in food is one of the microbiological indicators for food quality.<sup>27</sup> In recent years increasing attention has been focused on the microbial safety of vegetables, mainly on intervention methods to kill or remove human pathogens from fresh products.<sup>28</sup> According to the results of this study raw mixed vegetable salads analyzed may contain pathogenic bacteria, food pathogens can survive in vegetable salads, and thereby represent a risk to the consumers in the home regard to food borne disease.

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