

## **HYGIENIC QUALITY OF DIFFERENT READY MADE MEAT BALLS CONSUMED IN BURSA**

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Proceedings of the "6th International Conference on Sheep and Goat  
Production and 4th Symposium on the Reproduction of Domestic Animals"  
September 9-11, 1998 Ohrid, Macedonia

This study was made in order to determine hygienic quality of five different ready made meat ball groups (hamburger patties, Ynegöl, butcher, Adana and cheesy meat balls ) which were sold in markets and butchery's and also made to compare the properties of meat balls to each other.

Meat ball samples were examined bacteriologically for total mesophyll aerobic bacteria, psychrophilic bacteria, coliform bacteria, *E. coli*, total staphylococci and micrococci, *S.aureus*, fecal streptococci, salmonella, yeast and mold.

According to our results; psychrophilic bacteria and yeast and mold were at the high values between  $10^7$ - $10^8$  / g in meat balls. There were pathogenic bacteria in most of the samples between  $10^4$ - $10^5$  / g and fecal streptococci also were at the high values. But in none of the samples salmonella sp. were observed.

When the high bacterial counts and high pH values of the ready made meat balls are bear in mind, it is obvious that these meat balls may cause risk from the hygienic point of view. In this situation ready made meatballs should be stored at temperatures below or at 4°C and consumed in 2 days time.

### **INTRODUCTION**

Nowadays, different types of ready-made meat balls are sold commonly in the markets and butchers. Meat balls are made of minced meat which is a very suitable environment for microorganisms to grow in masses. In addition, other substances and spices which are added to the minced meat and its mixing process contributes to contamination (1,2,3,4,5,6,7,8). For this reason, keeping a product which is a natural environment for microorganisms on the shelves of markets may be risky for the public health.

The present study has been carried out by means of measuring the hygienic quality of the meat balls which contain different ingredients and additives for the purposes of investigating whether these meat balls up to the standards of ready made Ynegöl meat ball and ready made hamburger patties or not.

### **MATERIAL AND METHOD**

Ready made meat ball types (~negöl meat balls, hamburger patties, butcher meat balls, Adana meat balls and cheesy meat balls) which are available in the markets and butchers in the city of Bursa were used as materials. 60 samples of meat balls, 12 from each group were

used in the analyses. The samples were brought to the laboratory in their original packaging and analysed on the same day.

### The Preparation of Samples For Bacteriologic Analyses

10 grams of samples from each type were weighed and homogenised 2-3 minutes in the stomacher where they were sterilised in plastic bags each of which contained 90 ml peptone water. This mixture was diluted up to  $10^{-8}$ .

Total mesophyll aerobic bacteria and psychrophilic bacteria counts were analysed by using Plate Count Agar (9), coliform bacteria were analysed by using Violet Red Bile Agar (10). E.coli count was done by following Harrigan and McCance's (9) and Anonymous's (11) methods. Total staphylococci and micrococci count was done by using Baird-Parker Agar and S.aureus count was found by applying Baird-Parker Agar's test of coagulation of colonies which create a transparent zone (12). Fecal streptococci was analysed by following Azide Blood Agar Base, the numbers of yeast and mold were counted by applying Potato Dextrose Agar (13). The analysis of Salmonella were carried out by using the findings of Harrigan and McCance (1976), Beckers *et al* (1986), Anonymous (1982) and Koneman *et al* (1976) (9,10,14,15).

### RESULTS AND DISCUSSION

The results of microbiologic analysis of different types of meat balls are shown in tables 1, 2, 3, 4, and 5. Table 6 presents pH values of 5 different types of meat balls.

Ready made meat balls showed similar counts of total mesophyll aerobic bacteria and remained at the level of  $10^6$  cfu / g which is accepted as the maximum level in terms of hamburger and -negöl meat ball standards.

**Table 1-** The results of the microbiologic analysis of ready made hamburger patties (cfu / g)

Sample No	Total mesophyll aerobic bacteria	Psychrophilic bacteria	Coliform bacteria	E.coli	Total staphylococci and micrococci	S.aureus	Fecal streptococci	Yeast and mold
1	$1.5 \times 10^5$	$1 \times 10^6$	$1 \times 10^4$	-----	$5 \times 10^4$	$2 \times 10^4$	$4.6 \times 10^4$	$4 \times 10^6$
2	$1 \times 10^5$	$5 \times 10^6$	$2 \times 10^5$	-----	$2 \times 10^5$	$3 \times 10^5$	$1 \times 10^5$	$4.9 \times 10^6$
3	$9 \times 10^4$	$4.7 \times 10^6$	$1.15 \times 10^6$	$1.08 \times 10^6$	$2.5 \times 10^5$	$2 \times 10^5$	$2.4 \times 10^4$	$5.5 \times 10^6$
4	$5.1 \times 10^5$	$3.8 \times 10^7$	$7.8 \times 10^5$	$4.02 \times 10^5$	$2.6 \times 10^5$	$1 \times 10^5$	$2 \times 10^5$	$1 \times 10^6$
5	$6.8 \times 10^5$	$1.5 \times 10^6$	$7.6 \times 10^5$	$6.78 \times 10^5$	$4.2 \times 10^5$	$6 \times 10^4$	$7.4 \times 10^4$	$1.6 \times 10^6$
6	$5.8 \times 10^5$	$3.24 \times 10^6$	$2 \times 10^5$	-----	$9.1 \times 10^5$	$1 \times 10^5$	$6 \times 10^4$	$3 \times 10^6$
7	$4 \times 10^5$	$3.6 \times 10^6$	$3.39 \times 10^5$	-----	$1.4 \times 10^5$	-----	$1.11 \times 10^6$	$1.26 \times 10^7$
8	$5.1 \times 10^6$	$4 \times 10^7$	$4.5 \times 10^4$	-----	$1 \times 10^5$	-----	$1.43 \times 10^6$	$1.59 \times 10^7$
9	$1.77 \times 10^7$	$2 \times 10^8$	$6.7 \times 10^5$	-----	$2 \times 10^5$	-----	$7 \times 10^5$	$2.1 \times 10^7$
10	$8.8 \times 10^6$	$1.2 \times 10^7$	$7.5 \times 10^4$	-----	$2 \times 10^5$	$1 \times 10^4$	$3.39 \times 10^6$	$1.46 \times 10^7$
11	$1 \times 10^6$	$4.8 \times 10^7$	$3.08 \times 10^5$	-----	$8 \times 10^4$	-----	$4.6 \times 10^6$	$6 \times 10^6$
12	$1.85 \times 10^6$	$5.6 \times 10^7$	$1.13 \times 10^6$	$1 \times 10^6$	$3 \times 10^5$	$1 \times 10^4$	$3.2 \times 10^6$	$1 \times 10^6$
Means (x)	$6.82 \times 10^6$	$9.2 \times 10^7$	$4.56 \times 10^5$	$7.9 \times 10^5$ 4 samples	$2.59 \times 10^5$	$4.42 \times 10^4$ 8 samples	$1.24 \times 10^6$	$1.85 \times 10^7$
Std.Dev (Sx)	$3.37 \times 10^6$	$3.71 \times 10^7$	$1.23 \times 10^5$	$1.56 \times 10^5$	$6.61 \times 10^4$	$2.31 \times 10^4$	$4.62 \times 10^6$	$1.17 \times 10^7$



Table 2- The results of the microbiologic analysis of ready made *çineğöl* meat balls (cfu / g)

Sample No	Total mesophyll aerobic bacteria	Psychrophilic bacteria	Coliform bacteria	E.coli	Total staphylococci and micrococci	S.aureus	Fecal streptococci	Yeast and mold
1	1,35x10 <sup>7</sup>	4,94x10 <sup>7</sup>	3x10 <sup>4</sup>	4,8x10 <sup>7</sup>	9x10 <sup>5</sup>	2,5x10 <sup>5</sup>	6,7x10 <sup>5</sup>	1,91x10 <sup>7</sup>
2	1,4x10 <sup>6</sup>	5,3x10 <sup>6</sup>	2,4x10 <sup>4</sup>	8x10 <sup>4</sup>	8,1x10 <sup>5</sup>	-----	3,6x10 <sup>5</sup>	2,1x10 <sup>7</sup>
3	1,28x10 <sup>6</sup>	7,65x10 <sup>8</sup>	5,4x10 <sup>5</sup>	-----	4,1x10 <sup>5</sup>	1,5x10 <sup>5</sup>	2,4x10 <sup>5</sup>	3,6x10 <sup>6</sup>
4	1,1x10 <sup>6</sup>	4,7x10 <sup>6</sup>	2x10 <sup>4</sup>	-----	6,1x10 <sup>5</sup>	1x10 <sup>5</sup>	3,4x10 <sup>5</sup>	2,26x10 <sup>7</sup>
5	1,83x10 <sup>6</sup>	6,8x10 <sup>5</sup>	8,1x10 <sup>4</sup>	-----	1,3x10 <sup>5</sup>	-----	3,7x10 <sup>5</sup>	2x10 <sup>6</sup>
6	5,7x10 <sup>5</sup>	4,5x10 <sup>7</sup>	1x10 <sup>4</sup>	-----	3,6x10 <sup>5</sup>	1,5x10 <sup>5</sup>	5x10 <sup>5</sup>	9x10 <sup>6</sup>
7	2,1x10 <sup>6</sup>	2,7x10 <sup>8</sup>	8,7x10 <sup>5</sup>	-----	1,4x10 <sup>6</sup>	8x10 <sup>4</sup>	7,7x10 <sup>5</sup>	6x10 <sup>6</sup>
8	1,37x10 <sup>6</sup>	6,7x10 <sup>7</sup>	1,6x10 <sup>5</sup>	-----	7,9x10 <sup>5</sup>	2,6x10 <sup>5</sup>	8x10 <sup>5</sup>	3,3x10 <sup>6</sup>
9	1,5x10 <sup>6</sup>	3,3x10 <sup>7</sup>	1,94x10 <sup>5</sup>	-----	2x10 <sup>5</sup>	1x10 <sup>5</sup>	4,5x10 <sup>5</sup>	5,8x10 <sup>6</sup>
10	5,6x10 <sup>6</sup>	4x10 <sup>7</sup>	5x10 <sup>5</sup>	1,74x10 <sup>5</sup>	5x10 <sup>5</sup>	2x10 <sup>5</sup>	3,49x10 <sup>6</sup>	2,72x10 <sup>8</sup>
11	8,6x10 <sup>6</sup>	7,2x10 <sup>6</sup>	1,3x10 <sup>5</sup>	2,6x10 <sup>5</sup>	9x10 <sup>4</sup>	-----	2,68x10 <sup>5</sup>	1,1x10 <sup>7</sup>
12	3,3x10 <sup>6</sup>	6x10 <sup>8</sup>	2,5x10 <sup>5</sup>	-----	1x10 <sup>5</sup>	-----	5,3x10 <sup>5</sup>	3,8x10 <sup>7</sup>
Means (x)	3,51x10 <sup>6</sup>	2,73x10 <sup>8</sup>	3,32x10 <sup>5</sup>	1,12x10 <sup>4</sup> 4 samples	6,23x10 <sup>5</sup>	1,61x10 <sup>5</sup> 8 samples	9,3x10 <sup>5</sup>	3,44x10 <sup>7</sup>
Std.Dev. (Sx)	1,13x10 <sup>6</sup>	9,19x10 <sup>7</sup>	1,17x10 <sup>5</sup>	6,33x10 <sup>4</sup>	1,25x10 <sup>5</sup>	2,45x10 <sup>4</sup>	2,99x10 <sup>5</sup>	2,18x10 <sup>7</sup>

Table 3- The results of the microbiologic analysis of the butcher meat balls (cfu / g)

Sample No	Total mesophyll aerobic bacteria	Psychrophilic bacteria	Coliform bacteria	E.coli	Total staphylococci and micrococci	S.aureus	Fecal streptococci	Yeast and mold
1	1x10 <sup>7</sup>	4,59x10 <sup>4</sup>	6,3x10 <sup>4</sup>	6x10 <sup>4</sup>	6,1x10 <sup>5</sup>	5x10 <sup>4</sup>	6x10 <sup>5</sup>	2,67x10 <sup>8</sup>
2	5,2x10 <sup>6</sup>	2,43x10 <sup>8</sup>	7x10 <sup>4</sup>	3,78x10 <sup>4</sup>	5,8x10 <sup>5</sup>	2x10 <sup>5</sup>	1,9x10 <sup>5</sup>	7,3x10 <sup>7</sup>
3	2x10 <sup>6</sup>	2,04x10 <sup>8</sup>	4,7x10 <sup>4</sup>	-----	7,9x10 <sup>5</sup>	1,4x10 <sup>5</sup>	1,11x10 <sup>6</sup>	2,06x10 <sup>7</sup>
4	1,52x10 <sup>6</sup>	4,42x10 <sup>8</sup>	1x10 <sup>5</sup>	-----	3,1x10 <sup>5</sup>	-----	5,2x10 <sup>5</sup>	2,3x10 <sup>7</sup>
5	1x10 <sup>6</sup>	3x10 <sup>8</sup>	3,8x10 <sup>4</sup>	-----	2,3x10 <sup>5</sup>	-----	1,9x10 <sup>5</sup>	2,66x10 <sup>7</sup>
6	1,12x10 <sup>6</sup>	5,1x10 <sup>7</sup>	6,4x10 <sup>4</sup>	7,6x10 <sup>3</sup>	2,2x10 <sup>5</sup>	-----	1,86x10 <sup>5</sup>	2,6x10 <sup>7</sup>
7	1x10 <sup>8</sup>	3,3x10 <sup>8</sup>	1,42x10 <sup>5</sup>	1,28x10 <sup>4</sup>	2,1x10 <sup>6</sup>	-----	3,26x10 <sup>6</sup>	3,12x10 <sup>8</sup>
8	1,1x10 <sup>6</sup>	2,42x10 <sup>8</sup>	4,15x10 <sup>5</sup>	8,52x10 <sup>4</sup>	7,4x10 <sup>5</sup>	-----	2,7x10 <sup>5</sup>	2,33x10 <sup>8</sup>
9	3x10 <sup>6</sup>	4,4x10 <sup>7</sup>	1,01x10 <sup>5</sup>	2,49x10 <sup>5</sup>	1,7x10 <sup>5</sup>	1,5x10 <sup>5</sup>	4,06x10 <sup>5</sup>	2,3x10 <sup>8</sup>
10	5,25x10 <sup>6</sup>	4,5x10 <sup>8</sup>	6,69x10 <sup>5</sup>	2,02x10 <sup>5</sup>	3,4x10 <sup>5</sup>	-----	5,2x10 <sup>5</sup>	3,05x10 <sup>8</sup>
11	7,6x10 <sup>6</sup>	2,52x10 <sup>8</sup>	2x10 <sup>5</sup>	1,33x10 <sup>5</sup>	5,5x10 <sup>5</sup>	4x10 <sup>4</sup>	2,91x10 <sup>5</sup>	5,2x10 <sup>7</sup>
12	4,3x10 <sup>6</sup>	2x10 <sup>8</sup>	4x10 <sup>4</sup>	-----	1x10 <sup>5</sup>	-----	3x10 <sup>5</sup>	2,5x10 <sup>8</sup>
Means (x)	1,18x10 <sup>7</sup>	2,33x10 <sup>8</sup>	2,38x10 <sup>4</sup>	9,84x10 <sup>4</sup> 8 samples	6,89x10 <sup>5</sup>	9,68x10 <sup>4</sup> 6 samples	8,72x10 <sup>5</sup>	1,52x10 <sup>8</sup>
Std.Dev (Sx)	8,06x10 <sup>6</sup>	4x10 <sup>7</sup>	8,91x10 <sup>4</sup>	3,15x10 <sup>4</sup>	1,76x10 <sup>4</sup>	3,16x10 <sup>4</sup>	3,08x10 <sup>5</sup>	3,55x10 <sup>7</sup>

Table 4- The results of the microbiologic analysis of the ready made cheesy meat balls (cfu/g)

Sample No	Total mesophyll aerobic bacteria	Psychrophilic bacteria	Coliform bacteria	E.coli	Total staphylococci and micrococci	S.aureus	Fecal streptococci	Yeast and mold
1	2x10 <sup>7</sup>	1,4x10 <sup>7</sup>	3x10 <sup>5</sup>	-----	5x10 <sup>5</sup>	-----	4,8x10 <sup>5</sup>	1,25x10 <sup>8</sup>
2	1x10 <sup>6</sup>	1,24x10 <sup>8</sup>	2x10 <sup>5</sup>	-----	5,5x10 <sup>5</sup>	3x10 <sup>5</sup>	6x10 <sup>5</sup>	9,3x10 <sup>7</sup>
3	6x10 <sup>5</sup>	1,57x10 <sup>7</sup>	1,1x10 <sup>5</sup>	-----	1x10 <sup>5</sup>	1x10 <sup>5</sup>	4,1x10 <sup>5</sup>	6,7x10 <sup>7</sup>
4	6,5x10 <sup>5</sup>	1,42x10 <sup>8</sup>	2,3x10 <sup>4</sup>	-----	1,2x10 <sup>5</sup>	-----	3,3x10 <sup>5</sup>	1,56x10 <sup>8</sup>
5	5x10 <sup>5</sup>	1x10 <sup>7</sup>	9,4x10 <sup>4</sup>	-----	2x10 <sup>5</sup>	1,2x10 <sup>5</sup>	2x10 <sup>5</sup>	1,82x10 <sup>8</sup>
6	1,8x10 <sup>5</sup>	1,55x10 <sup>7</sup>	3x10 <sup>4</sup>	-----	1x10 <sup>5</sup>	-----	1,7x10 <sup>5</sup>	8x10 <sup>6</sup>
7	3x10 <sup>7</sup>	2x10 <sup>6</sup>	4x10 <sup>7</sup>	5,64x10 <sup>4</sup>	1x10 <sup>6</sup>	-----	2,52x10 <sup>5</sup>	8,6x10 <sup>6</sup>
8	1,24x10 <sup>6</sup>	5x10 <sup>7</sup>	3x10 <sup>4</sup>	2,24x10 <sup>4</sup>	5,4x10 <sup>5</sup>	5x10 <sup>5</sup>	2,2x10 <sup>5</sup>	6x10 <sup>6</sup>
9	4,6x10 <sup>6</sup>	6,2x10 <sup>7</sup>	7,4x10 <sup>4</sup>	5,92x10 <sup>4</sup>	5x10 <sup>5</sup>	2x10 <sup>5</sup>	5,5x10 <sup>5</sup>	7x10 <sup>6</sup>
10	4,2x10 <sup>6</sup>	1,3x10 <sup>8</sup>	4,5x10 <sup>4</sup>	-----	4,8x10 <sup>5</sup>	1,6x10 <sup>5</sup>	4,9x10 <sup>5</sup>	1,2x10 <sup>8</sup>
11	5x10 <sup>5</sup>	2x10 <sup>8</sup>	4x10 <sup>5</sup>	-----	2,2x10 <sup>5</sup>	-----	2,97x10 <sup>5</sup>	1x10 <sup>7</sup>
12	7,3x10 <sup>5</sup>	6x10 <sup>7</sup>	3x10 <sup>4</sup>	5x10 <sup>4</sup>	3,6x10 <sup>5</sup>	2x10 <sup>4</sup>	7,1x10 <sup>5</sup>	1x10 <sup>7</sup>
Means (x)	3,1x10 <sup>6</sup>	6,88x10 <sup>7</sup>	8,47x10 <sup>4</sup>	4,7x10 <sup>4</sup> 4 samples	3,89x10 <sup>5</sup>	1,87x10 <sup>5</sup> 7 samples	3,92x10 <sup>5</sup>	6,52x10 <sup>7</sup>
Std.Dev (Sx)	1,6x10 <sup>6</sup>	1,87x10 <sup>7</sup>	2,44x10 <sup>4</sup>	8,42x10 <sup>4</sup>	7,59x10 <sup>4</sup>	6,46x10 <sup>4</sup>	5,04x10 <sup>4</sup>	1,94x10 <sup>7</sup>

Table 5- The results of the microbiologic analysis of ready made Adana meat balls (cfu/g)

Sample No	Total mesophyll aerobic bacteria	Psychrophilic bacteria	Coliform bacteria	E.coli	Total staphylococci and micrococci	S.aureus	Fecal streptococci	Yeast and mold
1	$1 \times 10^6$	$1.8 \times 10^7$	$1.3 \times 10^5$	$2.6 \times 10^4$	$5.8 \times 10^2$	$6 \times 10^1$	$7 \times 10^3$	$5.07 \times 10^7$
2	$3 \times 10^6$	$1 \times 10^7$	$4 \times 10^5$	$1.4 \times 10^5$	$3 \times 10^2$	$5 \times 10^1$	$4.2 \times 10^3$	$6.2 \times 10^7$
3	$7.3 \times 10^6$	$3.5 \times 10^7$	$7 \times 10^5$	-----	$4 \times 10^2$	$5.2 \times 10^4$	$1 \times 10^5$	$1.04 \times 10^8$
4	$1 \times 10^7$	$1.8 \times 10^7$	$7 \times 10^5$	-----	$7.2 \times 10^2$	-----	$2 \times 10^5$	$9.1 \times 10^7$
5	$9.5 \times 10^5$	$7.8 \times 10^6$	$1.5 \times 10^5$	$5.6 \times 10^1$	$2 \times 10^5$	-----	$2.8 \times 10^5$	$2.29 \times 10^7$
6	$1.4 \times 10^6$	$1.27 \times 10^7$	$2 \times 10^5$	$8.8 \times 10^1$	$1 \times 10^6$	-----	$1.2 \times 10^5$	$3.5 \times 10^7$
7	$5 \times 10^6$	$4.9 \times 10^6$	$3 \times 10^4$	$2 \times 10^4$	$2.2 \times 10^5$	-----	$1 \times 10^5$	$1.3 \times 10^7$
8	$2.2 \times 10^6$	$1.55 \times 10^7$	$1.1 \times 10^4$	$9 \times 10^1$	$1 \times 10^7$	$4.8 \times 10^4$	$1.68 \times 10^7$	$1.58 \times 10^7$
9	$1.2 \times 10^6$	$2.8 \times 10^7$	$2 \times 10^4$	-----	$1.7 \times 10^5$	-----	$9.1 \times 10^7$	$5.1 \times 10^7$
10	$4 \times 10^6$	$3.3 \times 10^7$	$3.32 \times 10^5$	$1.22 \times 10^3$	$2 \times 10^5$	-----	$2.15 \times 10^7$	$3.7 \times 10^5$
11	$2.4 \times 10^6$	$1.9 \times 10^7$	$6.1 \times 10^5$	$3.06 \times 10^4$	$1.4 \times 10^6$	-----	$1.1 \times 10^6$	$2 \times 10^6$
12	$1.31 \times 10^6$	$1.38 \times 10^7$	$1.53 \times 10^5$	$1.2 \times 10^5$	$4 \times 10^5$	-----	$5 \times 10^7$	$4.6 \times 10^7$
Means (x)	$3.31 \times 10^6$	$1.8 \times 10^7$	$2.29 \times 10^5$	$5.36 \times 10^{1.9}$ samples	$4.74 \times 10^5$	$5.25 \times 10^{4.4}$ samples	$2.17 \times 10^5$	$3.72 \times 10^7$
Std Dev (Sx)	$8.22 \times 10^5$	$2.76 \times 10^6$	$6.8 \times 10^4$	$1.87 \times 10^4$	$1.13 \times 10^5$	$2.63 \times 10^3$	$1.76 \times 10^6$	$1 \times 10^7$

Table 6 -pH values of ready made meat balls

Sample No	Hamburger patties	İnegöl meat ball	Butcher meat ball	Adana meat ball	Cheesy meat ball
1	6.25	8.4	7.61	6.33	5.70
2	6.00	6.5	6.90	7.47	5.52
3	6.33	6.49	7.83	5.63	8.49
4	5.15	7.44	7.40	7.69	5.64
5	5.95	6.33	6.94	7.32	8.11
6	5.98	6.37	7.00	7.90	7.98
7	4.92	7.27	7.47	7.99	5.80
8	6.35	8.40	7.40	6.44	5.56
9	5.64	7.40	7.00	5.60	8.50
10	6.29	6.42	6.99	5.85	5.72
11	5.76	6.38	7.50	7.35	8.15
12	5.54	7.20	7.78	6.30	7.80
Means (x)	5.84	7.05	7.32	6.82	6.91

Adana meat ball, cheesy meat ball and İnegöl meat ball have been found to comply with the standards set by the World Health Organization which states the maximum allowed number of bacteria in hamburger patties as  $5 \times 10^6$  cfu / g (16). On the other hand, butcher meat balls were found to have the highest total mesophyll aerobic bacteria number  $1.18 \times 10^7$  cfu/g. This finding is higher than Çetin and Yücel's (17) results and lower than Bayhan and *et al's* (18) though it shows similarities to Soyutemiz and Anar's (19) results.

The number of psychrophilic bacteria in some ready made meat balls was found to be between  $10^7 - 10^8$  cfu / g. The highest average number of psychrophilic bacteria was found in İnegöl and butcher meat balls. All ready made meat balls are above the standards for maximum level which is  $10^5$  cfu / g. While our findings show similarities to Kaymaz (20), they are lower than Elmoşsalami *et al's* (6) findings and lower than Rossi Junior *et al's* (21) results.

The average number of coliform bacteria are between  $10^4 - 10^5$  cfu /g. With  $8.47 \times 10^4$  cfu /g coliform bacteria, the cheesy meat balls have the lowest level. Our findings are above the standards set by the World Health Organization ( $10^3$  cfu /g) (16).

E.coli has been found in 75 % of Adana meat balls, 66.6 % of the butcher meat balls, 33.3 % of the cheesy meat balls, İnegöl meat balls and hamburger patties.



The total staphylococci and micrococci counts of ready made meat balls show similarities and average number was determined as  $10^5$  cfu/g. Our findings are quite lower than the results of Soyutemiz (22), Bayhan *et al* (18), Soyutemiz and Anar (19) and Kaymaz (20).

*S.aureus* has been found 66.6 % of Ynegöl meat balls and hamburger patties, 58.3 % of the cheesy meat balls, 50 % of the butcher meat balls, 33.3 % of Adana meat balls. While the average of meat balls with *S.aureus* varies  $10^4$ - $10^5$  cfu / g, the cheesy meat balls and Ynegöl meat balls have the highest counts. The findings of *S.aureus* in the butcher meat balls are similar to Çetin and Yücel's (17) findings. Those *S.aureus* counts are higher than the Tammiga *et al's* (23), Karım's (24), Rossi Junior *et al's* (21). Nevertheless they are lower than those which were found by Dutschever *et al* (25).

Average fecal streptococci counts in ready made meat balls are between  $10^5$  -  $10^6$  cfu /g. Adana meat ball and hamburger patties have the highest numbers. Our fecal streptococci findings are higher than Kaymaz's (20) and Pambianco's (26) and similar to Bayhan *et al's* (18).

Yeast and mold have been found in high numbers in ready made meat balls. While they were found around  $10^7$  cfu /g on average in Ynegöl, Adana and the cheesy meat balls, in the butcher meat balls were found having the highest amounts of yeast and mold ( $1.52 \times 10^8$  cfu /g). In all samples of ready made meat balls, the amount of yeast and mold is above the standard which is  $10^2$  cfu /g maximum. Soyutemiz and Anar's (19) findings are similar to ours while they are lower than that of Bayhan *et al's* (18).

*Salmonella* has not been traced in any of the meat ball types. This is similar to Bayhan *et al's* (18), Soyutemiz's (22), Karım's (24), Maggi *et al's* (27), Pambianco (26), Albelda Puig *et al's* (28) findings.

As can be seen in the results of the analysis, ready made meat balls contain high amounts of psychrophilic bacteria, yeast and mold, fecal streptococci and pathogenic bacteria. Those factors which play an important role on the hygienic quality of meat balls are the low hygien of the minced meat and spices and absence of hygienic guidelines for the preparation process of the meat ball and unsatisfactory hygienic storage conditions of the meat balls which are high in pH. The average pH value of ready made meat balls are between 5.84-7.32.

In addition, the studies have shown that process of cooking decreases the amount of bacteria by  $10^2$ -  $10^3$  cfu / g (19,23). However, it has been found that the hygienic quality of grilled meat balls from restaurants and cooked hamburgers from cafes are low (18,19,20).

It has been shown that cooking heat reaching 80 °C in the center of a meat ball can destroy the pathogen, but if the heat reaches the center quickly it will not effective on bacteria (4, 22).

Finally, it is necessary to keep the temperature below 4 °C in the market and butcher fridges where the ready made meat balls are stored and to consume them in two days. In addition, meat balls should be cooked 4-5 minutes, during which the temperature reaches up to 80 °C in the center of meat balls.

## REFERENCES

- 1.YOUSSEF, H., HEFNEAWY, Y., AHMED S.H., et.al. (1984). Bacteriological evaluation of raw minced meat in Assuit city, *Fleischwirtsch.* 64 (5) 590-592.
- 2.YILDIRIM, Y. Et Teknolojisi, *Yıldırım Basım ve Yayıncılık*, Ankara, 1988.
- 3.TAMMINGA, S.K., BEUMER, R.R., KAMPELMACHER, E.H. (1982). Bacteriologisch onderzoek van hamburgers I Onderzoek van rauwe, gewelde, of voorgebraden hamburgers. *Voedingsmiddelentechn.* 13 (4) 29-34.
- 4.YOUSSEF, H., ELTIMAWY, A.A.M. (1982). Effect of thermal processing of minced meat

"kofte" on salmonellae , Assuit Veterinary Medical journal , 9 (17-18 ) 111-113 .

5.RAO,D.N., RAMESH, B.S.(1988). Microbial profiles of minced meat Meat Science, 23 (4) 279-291.

6.ELMOSSALAMI, E., ROUSHDY, S., YASSIEN, N. (1990). Improving the hygiene of locally manufactured meat products, Fleischwirtsch. 70 (3) 299-300 .

7.TEKİN NİŞEN, C. O., YURTYERÇİ, A., MUTLUER, B. (1980), Ankara'da satılan hazır kıymaların bakteriyolojik kalitesi , A.U. Veteriner Fak. Derg., 27 ( 1-2 ) 45-63

8.TEKİN NİŞEN, C. O., SARIGOL, C. (1982). Elazığ yöresinde tüketime sunulan bazı öfütülmüş baharatların mikrobiyel florası , F.U. Veteriner Fak. Derg., 7(1-2) 151-162.

9.HARRIGAN, W.F., MC CANCE , M.E. Laboratory Methods in Food and Dairy Microbiology, Whitstable Litho Ltd. Whitstable, Kent, 1976.

10.ANONYMOUS, ICMSE, Microorganisms in Foods 1, Their Significance and Methods of Enumeration, Univ. Of Toronto Press, London, 1982.

11.ANONYMOUS. American Public Health Association, Standart Methods for the Examination of Water and Wastewater , 15<sup>th</sup>. Ed., American Public Health Ass. Inc., Washington D. C, 1980.

12.ANONYMOUS. Gıda Maddeleri Muayene ve Analiz Yöntemleri, Tarım-Orman ve Köyişleri Bakanlığı. Yayın No: 65 (62-105), Ankara, 1983.

13.ANONYMOUS. The Oxoid Manuel of Culture Media, 15 Oxoid Ltd., Hampshire, 1982.

14.BECKERS H. J., VAN LEUSDEN, F. M., PETERS, R.(1986). Comparison of muller - kauffmann's tetrathionate broth and modified Rappoport's medium for isolation of salmonella, J. Food Safety 8 (1) 1-9.

15.KONEMAN ,E.W., ALLEN, S.D, DOWELL, V.R., SOMMERS, H.M. Color Atlas and Textbook of Diagnostic Mikrobiology J.B., Lippincott company, Philadelphia, Toronto, 83-110, 1979.

16.ANONYMOUS. (1975). Health Laws and Regulations, Israel, International Digest of Health Legislation, 26 (5) 562-564.

17.ÇETİN, K., YUCEL, A. (1992). Bursa'da kasap dükkanlarında üretimi, mikrobiyolojik ve kimyasal nitelikleri üzerine araştırma, Gıda Derg., 17 (4), 247-253.

18.BAYHAN, A., ABBASOĞLU, U., YENTUR, G. (1990). Ankara'da Tüketilen Izgara Köftelerin Bakteriyolojik Kalitesinin Halk Sağlığı Yönünden Araştırılması, Gıda Tek. Der. Derg., 15(4) 235-243.

19.SOYUTEMİZ, G.E., ANAR, M. (1993). Bursa'da tüketilen çiğ ve pişmiş izgara köftelerin mikrobiyolojik kalitesi ve bileşimi üzerine araştırmalar, 12(1) 21-28.

20.KAYMAZ, M. (1987). Ankara'da tüketime sunulan hamburgerlerde halk sağlığı yönünden önemli bazı bakterilerin saptanması A.U. Veteriner Fak. Derg., 34 (3) 577-593 .

21.ROSS, JUNIOR, O.D., SCHOCKEN ITURRINO, R. P., NADER FALHO, A. (1985). Bacteriological evaluation of industrially and manually prepared hamburger meat on sale in Jabotiçabal, Brazil. Arquivo Brasileiro de Medicina Veterinariae Zootecnica, 37 (3) 265-279.

22.SOYUTEMİZ, G.E., (1990). Çeşitli köftelerin hazırlanış ve Yaratım Tekniği, Bileşiminin Saptanması Üzerine Araştırmalar, Doktora Tezi.

23.TAMMINGA, S.K. BEUMER R.R., KAMPELMACHER, E.H. (1980). Bacteriologisch onderzoek van hamburgers , J. Hygiene , 88 (1) 125-142.

24.KARIM, G. (1977). Bacteriological quality of raw and cooked hamburger at the retail level in Tehran, J. Food Protection. 40 ( 8 ) 560-561 .

25.DUISCHAEVER, C.L., BULLOCK, D.H., ARNOTT, D.R. (1977). Bacteriological evaluation of retail ground beef, frozen beef patties and cooked hamburger, J. Food Protection, 40 (6) 378-381.



## **ХИГИЕНСКОИТ КВАЛИТЕТ НА РАЗЛИЧНИТЕ ТИПОВИ НА ГОТОВО МЕЛЕНО МЕСО КОИ СЕ ЈАДАТ ВО БУРСА**

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Ова истражување беше спроведено со цел да се утврди хигиенскиот квалитет на пет различни групи на готово мелено месо (плескавици за хамбургер, инеѓол, касапско, Адана и мелено месо со кашкавал) кои се продаваат на пазарите и во касапниците и за да се споредат својствата на групите мелени меса.

Примероци од мелените меса беа бактериолошки испитани за сите мезофилни аеробни бактерии, психрофилни бактерии, колиформни бактерии, *E. coli*, сите видови на стафилококи и микрококи, *S. aureus*, фекални стрептококи, салмонела, квасец и мувла.

Според нашите резултати: психрофилната бактерија, квасецот и мувлата имаа високи вредности, помеѓу 107-108/г во меленото месо. Во повеќето од примероците имаше и патогени бактерии помеѓу 104-105/г, а истотака и фекалните стрептококи беа со високи вредности. Но, во ниеден од примероците не беше забележана салмонела сп.

Кога големото количество на бактерии и високите рН вредности на готовите мелени меса ќе се земат во предвид, станува очигледно дека овие мелени меса можат да претставуваат ризик од хигиенска гледна точка. Во оваа ситуација, готовото мелено месо треба да се чува на температура од 40°C и пониско и да се изедат во рок од два дена.