EVALUATION OF HYGIENIC QUALITY OF FOOD SERVED IN UNIVERSITIES CANTEENS OF NORTHERN PORTUGAL

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INTRODUCTION

Mass catering services have increased in the last years since people need eat outside mainly by work or study reasons. The present work assessed the microbial quality of meals served in 20 food establishment (cafes and canteens) of two universities in northern Portugal.

MATERIAL AND METHODS

A total of 156 ready-to-eat food samples from university canteens were analysed for *Salmonella* spp., *L. monocytogenes*, *S. aureus*, *B. cereus*, *E. coli*, total plate count, yeast, mould, LAB and Enterobacteriaceae, by routine microbiological procedures. For study purpose, foodstuffs were classified as cold meals (i. e. salads, cakes and sandwiches) and hot meals (cooked dishes mainly composed by rice, chicken, fish, meat, pasta or soup). Differences regarding the microbiological counts among of foodstuffs were analysed by one-way ANOVA. Also, quality of foodstuffs was classified in a 3-level quality scale (satisfactory, acceptable or non satisfactory).

Table 1. Microbiological counts (expressed as Log CFU/g ± standard deviation) of foodstuffs under study

	Cold meals				Hot meals								p (CM x HT)
	Cakes	Salads	Sandwich	p	Rice	Chicken	Fish	Meat	Pasta	Soup	p	
N	28	17	43		8	3	12	24	5	16		
ENT	0.52±1.17[b]	2.05±2.08[a]	1.06±1.24[b]	<0.01	0.41±1.17	0.68±1.19	1.26±1.70	0.35±0.73	1.18±1.62	0.18±1.64	ns	<0.01
TPC	1.23±1.60[a]	3.35±1.48[a]	2.50±1.35[b]	<0.001	1.55±1.76	1.55±1.00	1.63±1.34	1.11±1.35	3.01±0.79	1.23±1.74	ns	<0.001
MY	0.57±1.04[a]	2.11±1.36[b]	1.08±1.26[b]	<0.001	0.52±1.08	0.88±1.53	0.18±0.36	0.09±0.27	0.78±0.90	0.20±0.62	ns	<0.001
LAB	1.04±1.34[a]	2.53±1.69[b]	1.46±1.47[b]	<0.01	0.62±1.18	0.88±1.53	1.46±1.86	0.98±1.33	2.47±2.67	1.00±1.68	ns	ns
BC	0.02±0.10	0.16±0.58	0.02±0.13	ns	nd	nd	nd	0.03±0.14	nd	0.11±0.29	ns	ns
EC	nd	0.06±0.28	nd	-	nd	nd	nd	nd	nd	nd	-	-
SA	0.17±0.56	0.22±0.51	0.25±0.8	-	0.09±0.14	nd	0.36±0.84	0.09±0.32	0.28±0.64	ns	ns	ns
CLOS	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	-	-
SAL	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	-	-
LIS	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	-	-

N: total number of samples; ENT: Enterobacteriaceae; TPC: Total plate count; MY: mould and yeast; LAB: Lactic acid bacteria; BC: *Bacillus cereus*; EC: *Escherichia coli*; SA: *Staphylococcus aureus*; CLOS: *Clostridium* spp.; SAL: *Salmonella* spp.; LIS: *Listeria monocytogenes*; ns: not significant (p>0.05); nd: not detected; CM: cold meals; HM: hot meals; Different superscript letters indicate statistical differences.

Table 2. Microbiological quality of different food types

MO	Microbiological quality	Rice	Cakes	Chicken	Fish	Meat	Pasta	Salads	Sandwich	Soup
SA	Satisfactory	8	26	3	10	24	4	16	40	16
	Acceptable	0	2	0	2	0	1	1	2	0
	Non satisfactory	0	0	0	0	0	0	0	1	0
LAB	Satisfactory	8	28	3	12	24	5	17	43	16
	Acceptable	0	0	0	0	0	0	0	0	0
	Non satisfactory	0	0	0	0	0	0	0	0	0
BC	Satisfactory	8	28	3	12	24	5	16	41	15
	Acceptable	0	0	0	0	0	0	1	2	1
	Non satisfactory	0	0	0	0	0	0	0	0	0
CLOS	Satisfactory	8	28	3	12	24	5	17	43	16
	Acceptable	0	0	0	0	0	0	0	0	0
	Non satisfactory	0	0	0	0	0	0	0	0	0
EC	Satisfactory	8	28	3	12	24	5	16	43	16
	Acceptable	0	0	0	0	0	0	1	0	0
	Non satisfactory	0	0	0	0	0	0	0	0	0
ENT	Satisfactory	7	25	3	9	23	3	6	30	15
	Acceptable	0	2	0	1	1	1	4	12	1
	Non satisfactory	1	1	0	2	0	1	7	1	0
LIS	Satisfactory	8	28	3	12	24	5	17	43	16
	Acceptable	0	0	0	0	0	0	0	0	0
	Non satisfactory	0	0	0	0	0	0	0	0	0
MY	Satisfactory	7	24	2	12	24	4	6	30	15
	Acceptable	1	4	1	0	0	1	10	12	1
	Non satisfactory	0	0	0	0	0	0	1	1	0
SAL	Satisfactory	8	28	3	12	24	5	17	43	16
	Acceptable	0	0	0	0	0	0	0	0	0
	Non satisfactory	0	0	0	0	0	0	0	0	0
TPC	Satisfatory	7	26	3	12	23	5	12	36	14
	Acceptable	1	1	0	0	1	0	4	6	2
	Non satisfatory	0	1	0	0	0	0	1	1	0

MO: microorganisms; ENT: Enterobacteriaceae; TPC: Total plate count; MY: mould and yeast; LAB: Lactic acid bacteria; BC: *Bacillus cereus*; EC: *Escherichia coli*; SA: *Staphylococcus aureus*; CLOS: *Clostridium* spp.; SAL: *Salmonella* spp.; LIS: *Listeria monocytogenes*; ns: not significant (p>0.05); nd: not detected. Different superscript letters indicate statistical differences.

RESULTS

Results revealed foods served at canteens displayed a high level of microbiological quality. In overall (Table 1), hot meals displayed lower microbiological counts than cold meals. Also, microbiological results revealed no safety risks for the consumers due to the absence of foodborne pathogens. Regarding cold meals, salads displayed the highest microbiological counts. Regarding hot meals, no differences were observed among different types. According to the classification of foodstuffs (Table 2), 91 were considered as satisfactory, 48 acceptable and 17 not satisfactory. Statistical differences were observed among the quality of foodstuffs considered "cold" and "hot" (p<0.05).

DISCUSSION

The present study showed that foodstuffs served at university canteens presented a high level of microbiological quality. Regarding cold meals, the highest counts for hygiene indicators and foodborne in salads could be explained by poor washing and sanitization procedures, cross-contamination and absence of thermal processing. Regarding hot meals, thermal processing (i.e. cooking) guarantees its safety, but counts of total plate counts and Enterobacteriaceae indicate that special attention should be taken regarding cross-contamination.