FOOD HYGIENE WITH REFERENCE TO PUBLIC HEALTH VIABLE BACTERIAL COUNTS OF READY TO EAT FOODS SERVED IN RAWALPINDI ISLAMABAD

Pages with reference to book, From 304 To 308

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Abstract

Bacterial loads of Street served foods and cut fruits sold in open market was assessed. The mean viable plate count was 2.4x107/gm, highest being 7x10 /gm found in meat group foods. Eighteen percent food samples, mostly, either processed foods, carbonated drinks or foods served boiling hot were found sterile. All other foods examined yielded very high standard aerobic plate count per gram, indicating inadequate hygienic conditions of the retail shops, (JPMA 36 : 304, 1986).

INTRODUCTION

Technological advances have made avail-able throughout the world a great variety of prepared or "convenience' food items. All such foods are characterized by simplicity of preparation for eating. Although they are not sterilized during production, they usually receive a heat treatment of some type, the purpose of which may be to cook the food, to inactivate enzymes or to kill undesirable micro-organisms. However, such heat treatment does not eliminate spores or other relatively resist ant micro-organisms[1]

It is believed that food borne disease is at least ten times as prevalent as reported. Reasons for this include short duration of symptoms for which patients do not seek medical attention, misdiagnosis by physicians and failure to report outbreaks to state Health Departments.[2] Armstrong et al[3] reported that most of the foodborne disease outbreaks were associated with food service operations. Of 1615 outbreaks studied in regard to places where foods were mishandled only 104 (6%) were attributed to foods mishandled in food processing plants.

Microbial problems in food stem from situations like: Incoming raw foods may be contaminated. Processes devised to kill pathogens may fail. Foods may become contaminated during operations after heat processing. Environmental conditions may permit bacteria to multiply to such an extent that they attain numbers (or if toxigenic, produce enough toxin) sufficient to exceed a consumer's resistance threshold and cause disease.[4]

Food habits vary from country to country and even within countries. In those countries where environmental sanitary conditions are poor, gastroenteric diseases are one of the most important causes of morbidity and mortality. Food and water are important channels for transmission of these diseases. However, food habits adopted by populations may mitigate or increase the hazards.[5]

The raw products with a high initial bacterial number if not stored properly and given proper treatment are likely to carry microbial contaminants to the prepared foods.

Despite the existing rules to check the consumption of contaminated foods in Pakistan, the prevailing situation is not very encouraging. It is noted with great concern that in Pakistan alone 25% of the deaths occur below 5 years of age and the main cause of death is gastroenteritis[8].

The present study was conducted to determine bacterial loads in ready to eat foods and cut fruits and to see the hygienic conditions of foods with reference to public health.

MATERIAL AND METHODS

Sample Collection

A total of 200 food samples randomly collected from Rawalpindi/Islamabad were included in the study. Two hundred grams of each sample was directly placed in a sterilized wide mouth glass stoppered flask and immediately transported to the laboratory for examination.

CULTURE MEDIA

Phosphate buffered saline, pH 7.2 (Oxoid) for serial ten-fold dilution and plate count agar (Difco) for viable bacterial count was used.

Sterilization and adjustment of pH of the culture media were carried out according to the manufacturers specifications.

STANDARD PLATE COUNT

Ten gram of food sample was blended with 90 ml of phosphate buffered saline (PS) pH 7.2. One ml aliquots of serial ten fold dilutions of the food suspension with the same buffer were prepared. One ml aliquots from each dilution were dispensed in duplicate petridishes and was added with 15 20 ml of melted plate count agar, already kept at 45°C in a water bath. The inoculated plates were rotated to mix the suspension evenly before it solidified.

The plates were then incubated at 37°C for 48 hours in an inverted position. The colonies, thus received were enumerated using a colony counter. Plates having 30 300 colonies were selected for enumeration. The microbial concentration in the original sample was estimated from the arithmetic mean of counts.[9]

RESULTS AND DISCUSSION

The different types of foods included in the study were catts (food dish usually made of well cooked grams or other cereals, hot spices, boiled potatoes, raw tomatoes and onion with some lemon juice and yogurt added to it), fried foods, cut fruits, milk products, mid-day meals (sold publicly) and certain processed foods. The samples were studied under the following food groups, viz; cereals, fruits, vegetables, dairy, poultry, meat and carbonated drinks. Besides these, some of the studied food samples were mixtures of the aforementioned food groups.

The isolates were classified as 129 strains (58.6%) of gram negative bacilli and 91(41.4%) strains of gram positive cocci or rods. On the basis of morphological, biochemical and sugar fermentation reactions, the isolates were identified belonging to following genera.

Escherichia coil (16.8%), Proteus sp. (8.2%), Klebsiella sp. (3.7%), Citrobacter sp. (4.1%), Bacillus sp. (24.5%), S&ratia sp. (5%), Pseudomonas sp. (1.8%), Enterobacter sp. (16%), Salmonella sp. (0.5%), Staphylococcus sp. (6%), Vibrio sp. (0.5%), Yersinia sp. (1 .4%), Clostridium sp. (0.9%), Corynebacterium sp. (0.9%), Lactobacillus sp. (4.1%), Unidentified organisms (0.9%).

Incidence rate of pathogenic bacterial types among the aforementioned genera was:

Escherichia coil (16.8%), Proteus mirabiis (8.2%), Bacillus cereus (2.3%), Pseudomonas aeruginosa (1.8%), Salmonella typhi (0.5%), Staphylococcus aureus (2.7%), Streptococcus feacalis (3.7%), Vibrio cholera (0.5%), Yersinia enterocolitica (1.4%), Clostridium perfringens (0.9%).

TABLE - I
Standard Plate Count from different Food Groups.

Standard plate Count range/gram	Cereals	Fruits	Vegetables	Dairy	Poultry	Meats	Carbonated drinks	Total	Percentage
	No of samples from:								
< 10	10	10	4	10	0	4	5	43	17.84
$10 - < 10^2$	0	0	0	0	0	0	0	0	–
$10^2 < 10^3$	4	1	2	0	1	0	0	8	3.31
$10^3 < 10^4$	12	3	5	10	1	4	0	35	14.52
$10^4 < 10^5$	11	8	5	7	1	13	0	45	18.67
$10^5 < 10^6$	20	10	6	14	3	8	0	61	25.31
$10^6 < 10^7$	7	4	0	5	0	9	0	25	10.37
$10^7 < 10^8$	4	2	0	2	1	2	0	11	4.56
$10^8 < 10^9$	4	1	2	3	0	3	0	13	5.39

Table I shows the summary of viable aerobic bacterial counts per gram of the foods falling under various groups. Eighteen percent food samples were found to be sterile. These were mostly either processed foods, carbonated drinks or foods served boiling hot.

The total viable bacterial count ranged from $6x10^2$ to $7x10^8$ per gram of the food when incubated at 37°C Mean viable bacterial count was $2.4x10^7$/gm. (Table II).

TABLE - II
Standard Plate Count from Different Food Groups.

	Cereals	Fruits	Vegetables	Dairy	Poultry	Meat	Total
†††							
Permissible range	10^4/gm(m)†	10^5/gm(m)	10^5/gm(m)	10^4/gm(m)	$5x10^4$/gm(m)	10^3/gm(m)	–
	10^6/gm(m)††	10^6/gm(M)	10^6/gm(M)	$2.5x10^5$/gm(M)	10^6/gm(M)	10^4/gm(M)	
Mean viable count	$2.2x10^7$	$1.4x10^6$	$3.9x10^7$	$4.2x10^7$	$3.6x10^5$	$3.7x10^7$	$2.4x10^7$
Lowest viable count	$6x10^2$	$7x10^3$	$6x10^2$	$1.8x10^3$	$3.6x10^3$	$1x10^4$	$6x10^2$
Highest viable count	$4.4x10^8$	$1.5x10^7$	$4.4x10^8$	$6.5x10^8$	$1.5x10^7$	$7x10^8$	$7x10^8$

†(m)= Level of test organism which is acceptable & attainable in the food (ICMSF, 1978).

††(M)= Hazardous level of contamination caused by bad sanitary practice, including improper storage (ICMSF, 1978).

††† = The International Commission of Microbiological specifications for Foods (ICMSF, 1978).

Only five samples of the carbonated drinks were subjected to this study and less than ten organisms per ml could be recovered indicating that these beverages were almost sterile (Table I). Possible cause of sterility in carbonated drinks may be the low pH (i.e. 2.5 to 3) of the product which does not permit microbial multiplication. These findings are consistent with a study by Begum.[10]

The highest incidence of viable bacterial count was yielded by the meat group which was $7x10^8$]gm, being $3.7x10^7$/gm (Table II), which is again very high. Similar results have been reported by Begum[10] High bacterial counts are often due to mishandling in distribution and improper storage of meat. In a study on frozen and non frozen meat and gravy, it was observed that the bacterial counts increased significantly in cooked meat while it was being sliced and handled under unhygienic conditioons[11-13] The dairy products also yielded high bacterial counts. In this case the highest viable bacterial count was 6.SxlO^8/gm(mean $4.2x10^7$/gm.) Akhtar[7], showed high initial contamination of the milk. Rashid[14] recovered enterotoxigenic Escherichia coil from raw milk indicating poor hygiene of the raw milk. Armstrong et al[3] reported that most of the outbreaks of foodborne disease where associated with food service operations. In a study on gastroenteritis due to contaminated ice creams, of 1615 outbreaks studied, only attributed to foods mishandled in food processing plants, whereas most of them were associated with food service operations. In the present study too food handlers and food service systems were found to be most unhygienic possibly contributing high microbial loads to ready to eat foods.

Raw evgetables and fruits with subjected to this study also yielded high viable bacterial counts. The mean viable bacterial count in case of vegetables was $3.9x10^7$/gm and in cut fruits $1.4x10^6$ (Table II). High incidence of microorganisms in raw vegetables and fruit salads had been reported by Bryan[15] and Begum.[10]

Cereals and poultry were mostly served in the mid-day meals. These foods also yielded high viable bacterial counts. The cereal group showed a mean count of $2.2x10^7$/gm and the poultry products $3.6x10^5$/gm Jiwa et al.[16] and Begum[10] also reported high incidence of coliforms in these food types. The International Commission on Microbiological specifications for foods[17] (ICMSF, 1978) has recommended criteria for different foods (Table II). For most of the foods, their recommended standard plate count was m = 104/gm, M = 10^6/gm, wherein the bacterial count which separates marginal from defective quality. Values above M are completely unacceptable.[18] For the cooked, ready to serve meats the recommended criteria is much less i.e. m1^3/gm and M10^4/gm. When these bacterial count criteria were applied to the bacterial numbers recorded in the present study our numbers were found to be enormously high and reject almost all the food groups to be served to humans. The highest viable aerobic bacterial count yielded by the foods examined was $7x10^8$/gm and with a mean of $2.4x10^7$/gm in case of all the food groups combined together (Table II). Hobbs[19] stated that foods suspected of causing food poisoning give higher counts ranging from one million to 10 million per gram of the food. Thus all the studied foods could be a potent source of food-borne infection which might not be recognised due to short duration of the symptoms misdiagnosis; alternatively the consumers might have developed a relatively high resistance to sustain such infections being regular consumer of the contaminated foods.

Such a high viable bacterial count suggests practice of inadequate hygienic measures, mal handling and unhygienic condition of the retail shops.[20]

In case of ready to eat foods WHO' had advised that as these foods are not cooked before consumption, thus meeting of microbio logical standards should be more important for them, than for other foods. In many of these products, the presence of large numbers of bacteria suggests, that they had been mishandled or improperly stored or cooked inadequately.

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