Prevalance of Salmonella in Meat of Kathmandu

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Abstract

Introduction Food borne pathogenic bacteria in meat and meat products are the cause of illness and death for many people each year in Nepal. There are two major sources of bacteria in meat causing diseases in human beings. Firstly the living animal carries pathogenic bacteria while the processing environment harbours them. Secondly, the human being is also an important source of pathogenic bacteria which frequently cross contaminate the carcass. Animals Act as humane slaughtering and subsequently be distributed via cut meat or carcass carrier which may contaminate raw meat and material for further processing into meat products as the living animals carry bacteria in the intestinal tract. Cross contamination routes involve faeces of animals to carcass then carcass to carcass and environment to carcass.

Objectives The specific objectives of this study were to perform a survey of meat shops regarding sanitary condition, slaughtering and marketing facilities of meat in ward no. 13 of KMC; to isolate and identify pathogenic *Salmonella sp.* in different raw meat on the basis of biochemical tests; to compare contamination of *Salmonella* pathogen in chicken, buff and chevon kept for sale; to determine seasonal variation of *Salmonella* contamination in different raw meat samples of market.

Methods A cross sectional study of raw meat samples in Kathmandu Metropolitan City with special emphasis on isolation and identification of *Salmonella* was carried out during September 2002 to May 2003 to study about sanitary condition of meat shop and prevalence of Salmonella in different meat samples. Total 123 samples of which 55 chicken, 37 buff and 31 chevon samples were collected, and analysed.

Results *Salmonella* was found to be positive in 11.3 percent samples i.e. in 14 samples out of 123 samples. 8 samples of chicken i.e. 14.5 percent, 5 samples of buff i.e. 13.5 percent and one sample of chevon i.e. 3.2 percent were found to be positive for *Salmonella.* Different *Salmonella species* were isolated from different types of meat samples. *S. pullourm* in 3.2 percent samples, *S. gallinarum* in 0.81 percent, S. *typhi* in 1.62 percent and *S. choleraesuis* in 0.81 percent and *Salmonella* of subgenus I or II type in 4.8 percent samples. Besides this around 80 percent samples were positive for coliform especially *E. coli.* Prevalence of *Salmonella* seasonally was found to be highest in months of April/May i.e. 18 percent. In Nov/Dec prevalence was 13.15 percent and in September/Oct it was only 3.2 percent positive for *Salmonella* presence. Sanitary survey results revealed unsatisfactory conditions of sanitation and other essential facilities in meat shops of Kathmandu.

Conclusion Slaughtering places must be provided with clean and regular water supply, washable concrete base for slaughtering and proper effluent disposal; training course should be developed and held for butchers and meat sellers for proper slaughtering and better meat marketing techniques; meat in retail shops should be protected from insects, flies, dust and dirt. Cleanliness of surrounding has greater effected on food hygiene so, it should be given high importance; carcass kept for sale must be hanged and properly covered. Gut or intestinal part must be kept separate and introduction and implementation of effective meat inspection procedures.

Key words Raw meat, Chicken, Buffalo, Chevon, Prevalence.

Introduction

Food borne pathogenic bacteria in meat and meat products are the cause of illness and death for many people each year in Nepal. There are two major sources of bacteria in meat causing diseases in human beings.

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Firstly the living animal carries pathogenic bacteria while the processing environment harbors them. Secondly, the human being is also in important source of pathogenic bacteria which frequently cross contaminate the carcass[1,2,3,4]. Animals Act as human slaughtering and subsequently be distributed via cut meat or carcass carrier which may contaminate raw meat and material for further processing into meat products as the living animals carry bacteria in the intestinal tract. Cross contamination routes involve faeces of animals to carcass then carcass to carcass and environment to carcass. It has been shown in HACCP on controlling the sources of contamination during slaughtering, processing and meat inspection by improving the hygiene and sanitation level. It has been well documented and established that many pathogenic bacteria like *Listeria sp., Staphylococcus aureus, Yersinia entericolitica, Salmonella* and *Aeromonas sp.* may be detected in the slaughterhouse environment, for example on floor and walls, cold room floor, hand basins, splitting saws, chopping blocks[5,6,7].

Salmonellosis is the medical infestation caused by *Salmonella*; a gram negative, short rod shaped bacteria. It is a zoonotic disease i.e. the disease which can be spread from animal to humans. Other zoonoses are related to occupational practices, contact with animals but Salmonellosis is an exception being a food borne pathogen involved in transmission of this disease[8,9,10,11].

The genus *Salmonella* is including about 2000 serotypes variously named. *S.typhi* and paratyphoid serotypes of *S.enteritides; paratyphi* A & C are specific for man, *S.choleraesuis* and various serotypes of *S.enteritidis* such as *S.gallinarum, S. pullorum, S.abortusequi* and *S.dublin* are adapted to animal but they are transmissible to a greater or lesser degree to man[12].

The specific objectives of this study were to perform a survey of meat shops regarding sanitary condition, slaughtering and marketing facilities of meat in ward no. 13 of KMC; to isolate and identify pathogenic *Salmonella sp.* in different raw meat on the basis of biochemical tests; to compare contamination of *Salmonella* pathogen in chicken, buff and chevon kept for sale; to determine seasonal variation of *Salmonella* contamination in different raw meat samples of market.

The objective rationale is that, in Nepal, official reports of the bacteriological study of postmortem cases of chicken and birds, and animal are found in the reports published by NARC, National Zoonoses and Food Hygiene Research Centre and Central Veterinary Lab annually. Some studies with similar objective are also proceeded by Central Food Research Lab, Babarmahal. But the studies about consumable fresh meat in relation to public health and veterinary aspect are limited. This study may be useful for further advancement in the field.

Methods

A survey was carried out in 50 meat shops of which 14 chevon, 24 chicken and 14 buffalo meat shop in ward number 13 of Kathmandu Metropolitan City (KMC) during September 2002 to May 2003 and total 123 meat samples of which 55 chickens, 37 buffalo and 31 chevon (Goat meat) were collected and cultured with the objective to see the prevalence of bacteriological food-borne pathogens in meat. These all samples were processed in primary culture in EMB agar and MacConkey media had then sub-culture in BGA and XLD agar media.

Results

Bacteriological analysis of meat samples from study area

Out of 123 samples 14 samples were positive for *Salmonella* presence i.e. 11.38 percent. In total 14.5 percent chicken sample,13.15 percent and 3.2 percent chevon sample were found to be positive for *Salmonella* presence. Eighty percent of chicken samples 89 percent of buff samples and 70 percent of chevon samples were found to be positive for presence of *Coliforms* especially *E. coli*. All the samples were found to have positive growth in MacConkey Agar as lactose fermenter colonies while 20 percent of poultry, 29 percent of buff and 22 percent of chevon samples showed presence of non lactose fermenter colonies in MacConkey Agar See (Table 1).

Table 1: Primary and subculture results

Type of Sample	Total no. Of sample processed	Primary Culture						Sub-Culture				
		Growth in EMB Agar		Growth in Mac. Conkey Agar				Growth in BSA +ve	Growth in BGA +ve	Growth in XLD +ve	Total +Ve	Total (%)
				Lac. Fer.		Non Lac Fer.						
		+ve	%	+ve	%	+ve	%	+ve				
Chicken	55	44	80	55	100	16	29	9	8	7	8	14.5
Buff.	37	33	89	37	100	11	29	6	3	5	5	13.5
Chevon	31	22	70	31	100	7	22	2	1	1	1	3.2
Total	123	99	80	123	100	34	27	17			14	11.3

Prevalence of different Salmonella species in different types of meat samples

Out of 123 samples tested 14 samples were found to be positive for various type species of *Salmonella*. *S. pullorum* was found in 3.2 percent samples *S. gallinarum* in 0.81 percent, *S. typhi* in 1.62 percent *S. choleraesuis* in 0.81 percent and *Salmonella* of subgenus I or II in 4.8 percent samples (See Table 2).

Table 2: Prevalence of *Salmonella* species in meat samples of ward 13 (n=123)

Isolate	No.of Bacterial species(%)
S.pullorum	4(3.2)
S.gallinarum	1(0.81)
S.typhi	2(1.62)
S.choleraesuis	1(0.81)
Salmonella of subgenus I or II gp.	6(4.8)

Different *Salmonella* species were isolated from different types of samples. Out of 55 chicken samples 8 were found to be positive for *Salmonella* among these 8 isolates 4 were *S. pullorum* 1 was *S. gallinarum* and 3 isolates were of *Salmonella* of subgenus I and II type. Most of the *Salmonella* isolates from poultry samples were found to be of intrinsic contaminant type since *S. pullorum* and *S. gallinarum* are *Salmonella* types adapted to poultry. Similarly among 5 buff sample isolates, 2 were *Salmonella typhi*, 1 was *S. choleraesuis* and 2 were *Salmonella* of subgenus I and II group. *S. typhi* and *S. choleraesuis* are *Salmonella* types not adapted to cattle, *S. typhi* is human adapted type and *S. choleraesuis* is swine adapted type .Thus their presence in buff samples may be the case of extrinsic contamination. Only one *Salmonella* isolate was isolated from 31 sample chevon samples and it was *Salmonella* of subgroups I or II group (See Table 3).

Table 3: *Salmonella* isolated from different types of samples

Types of sample	Total no. of sample processed	Total +ve	Isolate	+ve cases(%)
Chicken	55	8	*S.pullorum*	4(7.2)
			S.gallinarum	1(1.8)
			Salmonella subgenus I or II	3(5.4)
Buff	37	5	*Salmonella typhi*	2(5.4)
			S.choleraesuis	1(2.7)
			Salmonella subgenus I or II	2(5.4)
Chevon	31	1	*Salmonella* subgenus I or II	1(3.2)

Salmonella of subgenus I and II group was isolated in all the types of samples which can not be differentiated, but subgenus I include type species like *S. entiritidis* which is a very prevalent species. Thus its probability in these meat samples is high in case of incompletely identified *Salmonella* isolates.

Discussion and Conclusion

Microorganism including many pathogens favours the meat and meat products due to its high nutritive value. With the intensification of animal husbandry in developing countries and increase in production of different types of foods of animal origin, new problems of food borne zoonotic disease raised. Parasitic and zoonotic food borne diseases are particularly prevalent in tropical and sub-tropical countries. There are a number of factors responsible for the spread of zoonotic disease like Salmonellosis. The important role is being played by water and other source of contamination. The numbers of organisms in the meat and meat products at any given time depends on its handling, storage temperature and length of time at which food has been kept.

Microbiological standards of safe food are determined by total count of indicator organism like *E. coli,* and by presence of certain pathogens in the food. There are two extreme kinds of pathogens found to be present in food. At one extreme are those that are so dangerous (e.g. septicaemic *Salmonella typhi* and *S. paratyphi, types* A and B and *(Clostridiumbotulinum)* that their presence is clearly intolerable under any circumstances. At opposite extreme are potential pathogen that occur relatively frequent in some foods and can hardly be avoided e.g. *E. coli, B. cereus, Staphylococcus aureus* and gastroenteric type of *Salmonella*[14]. Therefore microbiological standards of safe food are determined by total count of indicator organism like *E. coli,* and by presence of certain pathogens in the food. The application of microbiological criteria is becoming increasingly important for analysis of food hygiene and its primary objective is protection of the consumer.

In 1990 a survey was carried out to find out the prevalence of Salmonella in dairy product sold in street of Kathmandu valley. A total of 200 samples of various dairy products were collected. *Salmonella, E. coli and East & Molds* were isolated from 3 percent samples. Variety wise 12.5 percent in ice cream and 2.1 percent in sweet item.

Another survey study was carried out to assess the occurrence of microorganism in cheese collected from retail shop in Kathmandu City market. Among other bacteria *Salmonella typhi* was found to be present in 11 percent of total samples[13].

According to the 1996/97, 1997/98, 1999/2000 and 2000/2001 microbiological analysis of various food and meat products were carried out and *Salmonella* was detected in 3 samples of sausage out of 23 samples, in 1

sample of dry meat out of 20 samples, in 1 sample of Kachila out of 14 samples and 1 in Chhewela sample out of 10 samples. In the same report Salmonella was also reported from 3 samples of raw momo out of 29 samples.

There are several measures to be taken into consideration when dealing with current safety issues in meat and meat products. Measures must be applied along the whole meat production chain, from the stable, via processing, to the consumers table and applied as early as possible in the production chain.

Sanitation and clean water use during the slaughtering and processing of meat can protect the meat from undesired contamination of micro-organism. The slaughtering places and meat shops must fulfill some basic requirements for proper sanitation, like clean and regular water supply, slaughtering places away from sewage disposal sites, shops clean, free from humidity and dampness, with proper facilities for offal removal etc.

The basic principle approach of food safety is to monitor the entire meat production chain i.e. "The Farm-to Table Approach" or in Nepal "Ghoth to Ounth Approach" which is very much similar with the well-established HACCP concept as applied in all food processing factories. To minimize the public health risk factors the following activities must be carried out by the concerned authorities in the country[14].

In conclusion slaughtering places must be provided with clean and regular water supply, washable concrete base for slaughtering and proper effluent disposal; training course should be developed and held for butchers and meat sellers for proper slaughtering and better meat marketing techniques; meat in retail shops should be protected from insects, flies, dust and dirt. Cleanliness of surrounding has great effected on food hygiene so, it should be given high importance; carcass kept for sale must be hanged and properly covered. Gut or intestinal part must be kept separate and introduction and implementation of effective meat inspection procedures.

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