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Original Research Article

Microbiological Quality of Retail Meats

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ABSTRACT

A total of 220 random meat samples of different animal species were collected from 50 carcasses consisting 10 carcasses from each of beef, buffalo, camel, sheep and goat, as well20 frozen beef samples. Each carcass represented by four cut samples from neck, shoulder, abdomen and thigh. All samples were collected from random retail and butchers' shops ofBeni-Suef governorate to assess their microbiological status and compare the levels of contamination among animal species and carcass cuts. This study showed and compared the means of counts (CFU/g) of total aerobicbacteria (mesophilic count and psychrophilic count), coliforms,fecal coliforms,Escherichia coli,Staphylococcusaureus in each of beef, buffalo, camel, sheep and goat carcasses and imported frozen beef as well. Beside the incidence of E.coli, Salmonellaspp, and coagulase positive Staphylococcus aureus. The obtained results clarified that the examined beef, buffalo and mutton samples were more contaminated than those of other kinds of meat. The results were discussed from the hygienic point of view and compared with the national and international standards to assess their reliability for consumption.

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1. Introduction:

Raw meat is an ideal medium for bacterial growth; this is due to its high moisture contents. It is rich in protein, fermentable carbohydrate (glycogen), favorable pH and other growth factors (Magnus, 1981). May*retal.* (2003) showed that meat provides an ideal condition for the growth of different spoilage bacteria thus making meat very perishable.

In Egypt, all kinds of meat are desirable but beef and buffalo meats are the most consumed meat among population. Consumer awareness for food that is microbiologically safe is increasing tremendously in developed countries, which is not the case observed in most developing countries. Therefore, there is the need to produce meats that are of better quality and disease free especially in most developing countries. Food safety depends on their adequate manipulation, transportation and storage. Children, elderly and immunosuppressed individuals are particularly susceptible to foodborne infections than others.

Animals are slaughtered in Egypt abattoirs which are under standard and operated without adequate quality control systems and sometimes in backyards without observing strict hygienic practices. It is also a common practice to see people carrying carcasses just after dressing on their bare shoulders. Meats are normally transported to the butcher's shops either in meat vans, taxi's, motorcycle and bicycles. Meats are sold in the open butcher's shops sometimes in sieves or without sieves, and deboned on tables that are not well maintained or cleaned after work. Butchers and meat sellers pay little attention to their personal hygiene and serve meats with dirty hands and clothing's (Reference).

Meat is not only highly susceptible to spoilage, but also frequently implicated to the spread of food borne illness, various biochemical changes and microorganisms are associated with meat, during the process of slaughter, processing and preservation (Olaoye and Nilude, 2010). Approximately 69% of gram negative bacteria are known to cause bacterial food borne disease (Okonko*etal.*, 2008a). Several researchers have reported that the meats samples were contaminated with high level of *Klebsiella pneumoniae, Enterobactersp, Pseudomonas aeruginosa, E.coli, Salmonella sp, Serratia marcescens and Proteus vulgaris, Staphylococcus aureus and Bacillus sp* (Okonko*etal.*,2010), (Collins and Thato,2011). On the other hand, food borne pathogens are able to disseminate from contaminated meat to the surfaces (Gorman*etal.*, 2002) and can spread infections in the community.

Meat foods are sometimes contaminated with germs after leaving the manufacture plant. Usually, hygienic conditions are poor when foods are produced in non-industrial establishments, mainly due to the fact that the necessary infrastructure for technologically adequate processes is not available. The wide range of contamination sources leads to the presence of a variety of microorganisms in food, among others, bacteria belonging to the genera *Escherichia, Salmonella* and *Staphylococcus,* in addition to various molds.

High contamination level of coliforms in examined meat products may indicates unsanitary conditions of raw meat production from which produced. They are indicators of fecal pollution at slaughter house which begin from skinning and direct contact with knives and workers' hands. Also, during evisceration and washing, contamination may come from intestinal contents as well as from water during rinsing and washing of carcasses. Under cooked meat products have caused many food poisoning incidents associated with *Escherichia coli* which is present in the feces, intestines and hide of healthy animals from where it can potentially contaminate meat during the slaughtering process (Duffy *et al.*, 2003).

International food management agencies, especially the World Health Organization (WHO), the Food and Agriculture Organization and the International Hazard Analysis Critical Control Point (HACCP). Alliance have already provided guidelines to member countries about safe handling procedures such as HACCP and Good Manufacturing Practices (GMPs).

This study was therefore undertaken to study

the microbiological aspects and to assess the levels of microbial contamination in different kinds of meat retailed in butchers' shops of Beni-Suef governorate, Egypt.

2. Materialand methods

2.1. Collection of samples:

A total of 220 random samples (25 g weight of each) of retailed fresh meats represented by 10 carcasses from each of beef, buffalo, camel, sheep and goat (4 samples were collected from each carcass from neck, shoulder, abdomen and thigh sites) in addition to 20 samples of frozen beef, all were collected aseptically from different butcher's shops at Beni-Suef governorate. The samples were placed separately in clean sterile plastic bags and transferred in an insulted ice box to the laboratory without delay under complete aseptic conditions. All collected samples were subjected to microbiological examination.

2.2.Methods:

2.2.1. Preparation of samples for microbiological examinations (ICMSF, 1978):

Ten fold serial dilutions were used for counting of microorganisms under complete aseptic conditions, 25 g of each sample were transferred in to a sterile homogenizer flask containing 225 ml of 0.1% sterile peptone water, the contents were homogenized for 2-4 minutes at 1400 r.p.m and then allowed to stand for about 5 min at room temperature to make the first serial dilution (10^{-1}), the contents of the flask were thoroughly mixed by shaking and one ml was transferred into a separate sterile test tube containing 9 ml of 0.1% sterile peptone water to make the 2^{nd} serial dilution (10^{-2}), and soon to the dilution of 10^{-10}.

2.2.2. Bacteriological examinations:

2.2.2.1. Determination of total mesophilic count:

The technique recommended by **ISO 4833 (2003)** was conducted. Briefly, one ml from each of the previously prepared serial dilutions was aseptically transferred to duplicated plates of sterile Petri dishes, and then about 15 ml of sterile standard plate count agar previously meltedand cooled at 45˚C were poured and thoroughly mixed in a horizontal position. After solidification inoculated plates as well as control one were incubated in an inverted position at 37˚C for 24- 48hrs. Then the counted colonies were calculated as cfu/g and recorded.

2.2.2.2. Determination of total psychrophilic count:

The same technique of mesophilic count **(ISO 4833, 2003)** was appliedexcept the plates were incubated at 4-7˚C for 5 days. The average total psychrophilic count per gram was then calculated and recorded.

2.2.2.3. Determination of most probable numbers (MPN) of coliforms, faecal coliforms and E. coli: the three- tubes MPN method reported by **AOAC (1990)** was carried out. Then the MPN was calculated from the three-tubes MPN table.

2.2.2.4. Isolation and identification of E. coli biotype I (true faecal type): the technique of morphological and biochemical identification of E. coli biotype I recommended by **AOAC (1990)** was done.

2.2.2.5. IsolationandidentificationofStaphylococcu saureus:

From each of the previously prepared serial dilutions 0.1 ml was inoculated to the surface of duplicate Baird Parker agar plates and was spread with a sterile bended glass rod until the surface of the medium was dried. The plates were incubated in an inverted position at 37˚C for 48 hrs. All black shiny colonies with narrow white margins and surrounded by clear zones extended into the opaque medium were counted. Suspected colonies were stabbed in semi-solid agar for further identification. Then the technique recommended by ISO (1999) for morphological and biochemical identification of coagulase positive Staph. aureus was used.

3. Results

Table 1: Statistical analytical results of microbiological counts (cfu/g) of examined neck, shoulder, abdomen and thigh samples (10 of each)from 10 beef carcasses(of total 40 beef samples).

	Neck X± SEM	Shoulder X± SEM	Abdomen X± SEM	Thigh X± SEM
T. Mesophilic bacteria	$2\times10^7\pm 8\times10^6$	$3\times10^7\pm 6\times10^6$	$2\times10^7\pm 6\times10^6$	$4\times10^7\pm 9\times10^6$
T. Psychrophilicbacteria	$4\times10^6\pm 2\times10^6$	$2\times10^6\pm 6\times10^5$	$2\times10^6\pm 8\times10^5$	$5\times10^6\pm 3\times10^6$
Coliforms (MPN)	$7\times10^2\pm 2\times10^2$	$6\times10^2\pm 2\times10^2$	$4\times10^2\pm 2\times10^2$	$5\times10^2\pm 2\times10^2$
Fecal Coliforms (MPN)	$2\times10^2\pm 10^2$	$10^2\pm 10^2$	12.9 ± 9.59	2.8 ± 1.6
Escherichia coli (MPN)	16.1 ± 14.9	21 ± 21	8.6 ± 7.46	0
Staphylococcusaureus	$3\times10^4\pm 10^4$	$10^4\pm 6\times10^3$	$2\times10^4\pm 7\times10^3$	$10^4 + 4\times10^3$

Egyptian standard (E.S) of fresh meat no 4334/2004 stated that total aerobic bacterial count must not exceed 10^6.

T. = total X= mean SEM= standard error of mean

Table 2: Statistical analytical results of microbiological counts (cfu/g) of examined neck, shoulder, abdomen and thigh samples (10 of each) from 10 buffalo carcasses (of total 40 buffalo samples).

	Neck X± SEM	Shoulder X± SEM	Abdomen X± SEM	Thigh X± SEM
T. Mesophilic bacteria	$2\times10^7\pm 8\times10^6$	$3\times10^7\pm 1\times10^7$	$3\times10^7\pm 1\times10^7$	$3\times10^7\pm 8\times10^6$
T. Psychrophilicbacteria	$9\times10^5\pm 4\times10^5$	$8\times10^6\pm 4\times10^6$	$1\times10^6\pm 5\times10^5$	$4\times10^6\pm 3\times10^6$
Coliforms (MPN)	$6\times10^2\pm 2\times10^2$	$6\times10^2\pm 2\times10^2$	$5\times10^2\pm 2\times10^2$	$6\times10^2\pm 2\times10^2$
Fecal Coliforms (MPN)	17.1 ± 10.5	10.4 ± 9.2	7.5 ± 4.1	$10^2\pm 10^2$
Escherichia coli (MPN)	9.3 ± 9.3	0	3.6 ± 3.6	12 ± 12
Staphylococcusaureus	$10^4\pm 6\times10^3$	$10^4\pm 5\times10^3$	$10^4\pm 6\times10^3$	$5\times10^3\pm 4\times10^3$

Egyptian standard (E.S) of fresh meat no 4334/2004 stated that total aerobic bacterial count must not exceed 10^6.

T. = total X= mean SEM= standard error of mean

Table 3: Statistical analytical results of microbiological counts (cfu/g) of examined neck, shoulder, abdomen and thigh samples (10 of each) from 10 camel carcasses (of total 40 camel samples).

	Neck X± SEM	Shoulder X± SEM	Abdomen X± SEM	Thigh X± SEM
T. Mesophilic bacteria	$3\times10^6\pm 1\times10^6$	$1\times10^6\pm 5\times10^5$	$1\times10^6\pm 5\times10^5$	$1\times10^6\pm 8\times10^5$
T. Psychrophilicbacteria	$4\times10^5\pm 8\times10^4$	$4\times10^5\pm 8\times10^4$	$6\times10^5\pm 3\times10^5$	$5\times10^5\pm 2\times10^5$
Coliforms (MPN)	$2\times10^2\pm 1\times10^2$	$2\times10^2\pm 1\times10^2$	$5\times10^2\pm 2\times10^2$	$2\times10^2\pm 1\times10^2$
Fecal Coliforms (MPN)	0.72 ± 0.72	110 ± 110	0.3 ± 0.3	0
Escherichia coli (MPN)	0	21 ± 21	0	0
Staphylococcusaureus	$6\times10^3\pm 3\times10^3$	$1\times10^3\pm 5\times10^2$	$6\times10^2\pm 4\times10^2$	$5\times10^2\pm 3\times10^2$

Egyptian standard (E.S) of fresh meat no 4334/2004 stated that total aerobic bacterial count must not exceed 10^6.

T. = total X= mean SEM= standard error of mean

Table 4: Statistical analytical results of microbiological counts (cfu/g) of examined neck, shoulder, abdomen and thighsamples (10 of each) from 10 sheep carcasses (of total 40 sheep samples).

	Neck X± SEM	Shoulder X± SEM	Abdomen X± SEM	Thigh X± SEM
T. Mesophilic bacteria	$1\times10^7\pm 5\times10^6$	$1\times10^7\pm 5\times10^6$	$3\times10^7\pm 1\times10^7$	$1\times10^7\pm 4\times10^6$
T. Psychrophilicbacteria	$1\times10^6\pm 3\times10^5$	$2\times10^6\pm 6\times10^5$	$1\times10^6\pm 8\times10^5$	$1\times10^7\pm 4\times10^6$
Coliforms (MPN)	$6\times10^2\pm 2\times10^2$	$6\times10^2\pm 2\times10^2$	$2\times10^2\pm 1\times10^2$	$2\times10^2\pm 1\times10^2$
Fecal Coliforms (MPN)	110 ± 110	1.1 ± 1.1	1.9 ± 1.6	0
Escherichia coli (MPN)	1.5 ± 1.5	0	1.6 ± 1.6	0
Staphylococcusaureus	$5\times10^3\pm 3\times10^3$	$7\times10^3\pm 4\times10^3$	$5\times103\pm 3\times10^3$	$8\times10^2\pm 4\times10^2$

Egyptian standard (E.S) of fresh meat no 4334/2004 stated that total aerobic bacterial count must not exceed 10^6.

T. = total X= mean SEM= standard error of mean

Table 5: Statistical analytical results of microbiological counts (cfu/g) of examined neck, shoulder, abdomen and thigh samples (10 of each) from 10 goat carcasses (of total 40 goat samples).

	Neck X± SEM	Shoulder X± SEM	Abdomen X± SEM	Thigh X± SEM
T. Mesophilic bacteria	$2\times10^7 \pm 7\times10^6$	$2\times10^7 \pm 8\times10^6$	$1\times10^7 \pm 6\times10^6$	$2\times10^7 \pm 1\times10^7$
T. Psychrophilicbacteria	$5\times10^6 \pm 4\times10^6$	$5\times10^6 \pm 3\times10^6$	$4\times10^6 \pm 2\times10^6$	$6\times10^6 \pm 4\times10^6$
Coliforms (MPN)	0	$7\times10^2 \pm 2\times10^2$	$2\times10^2 \pm 1\times10^2$	$5\times10^2 \pm 5\times10^2$
Fecal Coliforms (MPN)	0	6.4 ± 4.2	0.66 ± 0.5	24 ± 14.4
Escherichia coli (MPN)	0	0	0	1.5 ± 1.5
Staphylococcusaureus	$10^3 \pm 5\times10^2$	$5\times10^3 \pm 3\times10^3$	$2\times10^3 \pm 7\times10^2$	$10^3 + 9\times10^2$

Egyptian standard (E.S) of fresh meat no 4334/2004 stated that total aerobic bacterial count must not exceed 10^6.

T. = total X= mean SEM= standard error of mean

Table (6): Incidence of isolated pathogens from examined retail meat samples

Type of samples	Site of samples	No. of samples	Types of isolates					
			Staph. aureus		E.coli		Salmonella	
			No.	%	No.	%	No.	%
Beef	Neck	10	4	40	2	20	1	10
	Shoulder	10	4	40	1	10	0	0
	Abdomen	10	2	20	2	20	2	20
	Thigh	10	4	40	0	0	1	10
	Total	40	14	35	5	12.5	4	10
Buffalo	Neck	10	0	0	1	10	0	0
	Shoulder	10	4	40	0	0	1	10
	Abdomen	10	3	30	1	10	1	10
	Thigh	10	3	30	1	10	0	0
	Total	40	10	25	3	7.5	2	5
Camel	Neck	10	3	30	0	0	0	0
	Shoulder	10	2	20	1	10	0	0
	Abdomen	10	1	10	0	0	0	0
	Thigh	10	1	10	0	0	0	0
	Total	40	6	15	1	2.5	0	0

Sheep	Neck	10	6	60	1	10	1	10
	Shoulder	10	2	20	0	0	0	0
	Abdomen	10	3	30	1	10	0	0
	Thigh	10	5	50	0	0	0	0
	Total	40	16	40	2	5	1	2.5
Goat	Neck	10	4	40	0	0	0	0
	Shoulder	10	5	50	0	0	1	10
	Abdomen	10	3	30	0	0	1	10
	Thigh	10	2	20	1	10	0	0
	Total	40	14	35	1	2.5	2	5
Frozen beef		20	0	0	0	0	0	0

4. Discussion

Conditions of the animals prior slaughtering have an impact on the microbial load of meats. Sources of microbial contaminations of carcasses include: the animal (hides and gastro-intestinal tract), workers, utensils, equipment, air and water. Hence the level of microbial contaminations of a carcass at this stage depends up on the degree of sanitation practiced during the slaughtering-dressing procedures. Because of location and handling practices certain areas of a carcass are more likely to be contaminated or to remain contaminated than are others. For these reasons, microorganisms are not uniformly distributed over the carcass (NAS, 1985).

It is evident from results Tables (1, 2, 3, 4 and 5) that most of the means of total aerobic mesophilic and Psychrophilic bacterial counts (cfu/g) of examined samples of neck, shoulder, abdomen and thigh of all animals were higher than acceptable limits in Egyptian Standards (E.S.) No. 4334/2004 and that set by theInternationalCommission on Microbiological Specification (ICMS, 1982) (<1.0 ×106cfu/g). With exception of camel samples which were more acceptable than other animal species.It's revealed that the thigh was the most contaminated site with microorganisms followed by shoulder and abdomen.

Nearly similar total bacterial counts were reported by Al- Aboudi and Hamed (1988) who revealed that themean aerobic bacterial count of sheep carcasses slaughtered at Mosul-abattoir-Iraq was 4.7×107, where 35% of the examined carcasses had counts more than 107.while 54% had counts ranged from 106to107/g.

Lower total bacterial count was reported by Bhagirthi et al. (1983) who reported that the market fresh mutton samples had bacterial counts between104 to 105cfu/g.

The high counts of total aerobic bacteria may be due to the manual dressing of carcass hides with the hands of the abattoir workers (Elliott and Michener, 1961).

Usually, hygiene conditions are poor when foods are produced in non-industrial establishments, mainly due to the fact that the necessary infrastructure for technologically adequate processes is not available. Spoilage or reduce keeping life of fresh meat can be generally attributed to the presence of very large number of bacteria, these were mainly identified as members of Psychrophilicbacteria and certain other microorganisms capable of growing at 0˚C (Mousa etal.,1988).

High contamination level of coliforms in examined meat products may indicates unsanitary conditions of raw meat production from which produced. They are indicators of fecal pollution at slaughter house which begin from skinning and direct contact with knives and workers hands.

Also, during evisceration and washing, contamination may come from intestinal contents as well as from water during rinsing and washing of carcasses. Undercooked meat products have caused many food poisoning incidents associated with Escherichia coli which is present in the feces, intestines and hide of healthy cattle from where it can potentially contaminate meat during the slaughtering process (Duffy et al., 2003). Coliforms count is are liable indicator of inadequate processing and post processing contamination of such products (ICMSF, 1996). In addition, Coliforms in processed meat may be responsible for inferior quality resulting in economic losses beside their presence in high count may give rise to public health hazard (Morenoetal., 1997).

However, (Fliss et al. (1991) found that variation in the microbial population has associated with many factors, such as the skin of animal, fecal material, soil, water, air, personal and equipment during slaughtering. Fecal coliforms can be present in great numbers on fresh slaughtered carcasses. Its presence in meat generally indicates direct and indirect contamination of fecal origin. The presence of coliforms in great numbers also indicates improper handling and storage. The total plate count, Enterobacteriaceae count and fecal coliforms count have an indicator function for processing hygiene and storage quality.

It is evident from result tables that the means of Staph. aureus counts of could not pass the test of a 102 cfu/g which the Egyptian Standards Board as 30% to 70% of the examined raw meat samples from all sites in all animals species exceeded the acceptable limit (<1.0 x102cfu/g) recommended by ICMS (1980) for Staph. aureus count. Neck and shoulder were the most contaminated sites in animals' carcasses. And there was no significant difference among the animal species which is revealing that the counts found in meat in this study were attributed to the unhygienic measurements and procedures in slaughtering, handling and transportation as that meats are normally transported to the butchers' shop either in vans, minibus, taxi, three wheel motor cycle and horse-cart. This exposes the meat to a number of pathogens some of which may be pathogenic. The high load of microorganisms could also be the result of unhygienic handling and processing using (in butchers' shop) unclean knives, cutting boards, and storage ladder added to the poor hygienic status of food handlers. The high number of staphylococci, which is usually related to human skin and clothing, is indicative of this situation as reported by (Gebeyehu et al. 2013).

Studies indicated that large numbers (usually>106cfu/g) of coagulase positive Staph. aureus must contaminate the food for producing sufficient enterotoxin to cause food poisoning (Listonetal.,1971; Gilbertetal.,1972).

Niamy et al. (1997) suggested that meat safety could be improved by better hygienic conditions during slaughter and transport of the meat.

Lower results were registered by El-Taher (2009) {9.7x103 cfu/g with an incidence of 36.6% from raw meat} and Elwi (1994) {500cfu/g}.

It is often used as hygiene indicators of foods of animal origin. This is a highly recognized food pathogen that causes gastro-intestinal diseases in humans; its presence on processed food may give a better indication than Coliforms of inadequate treatment or post-process contamination from the environment, and may help to indicate the extent of fecal contamination (Neletal., 2004; Crowley et al., 2005). Neletal. (2004) has stated that the maximum limit of E. coli in meat and meat products should not be more than 10 cfu/g (Mathenjwa, 2010). El-Taher (2009) isolated E. coli from 20% of the examined raw meats.

The presence of E. coli in the meat samples is as a result of contamination with fecal matter which could be from the environment, air, materials used including water. The hands of the handlers or even the contents of portions of the meat like the intestines which appear to be the very immediate sources could also be implicated. From preliminary investigation conducted, the environments in which the meat was processed and sold were not hygienically maintained, thus the presence of the E. coli. The standard recommended by ICMS (1980) is < 1.0x102 cfu/g normally, pathogens in general should have a 102 cfu/g or no count in already to eat foods. Reference to the

ICMS criteria may suggest that the pathogen levels in the beef are acceptable since they would have been destroyed after processing at high temperatures. This not withstanding there is a risk of infection if virulent forms of this bacterium are present and the beef which is not well processed before consumption.

Table (6)was showed the comparison between the incidences of isolated M.O (E. coli, Staph. aureus and Salomnella) in beef, buffalo, camel, sheep, goat and frozen beef in each of neck, shoulder, abdomen and thigh of each species. It was showed that the neck, shoulder and thigh were the most contaminated sites by staph. aureus while abdomen and neck were the most contaminated sites with E. coli. Also it was revealed that beef & buffalo samples had the highest incidences followed by sheep and goat samples. On the other hand camel samples may not be a significant source of the food-borne pathogens seen in other meat industries but monitoring programs and inspection are necessary for preventing outbreaks of food-borne diseases which agreed with Rahimi et al. (2010).

Sheep samples contamination could be due to contamination of the sheep carcasses during the slaughtering process. It was subjected to poor sanitary conditions prevailing at both abattoir and butcher`s shops may be the main cause of high incidence of E. coli (El-Mosalami and Wassef, 1973). Also the sheep slaughtering steps contain more handling to the carcasses than those of cattle by intervention of the workers through hanging, pushing and trimming of the carcasses which increase Staphylococci. Also presence of the fleece which act as shedding source of microorganisms. Selvanetal. (2007) found that the mean of total aerobic bacterial counts was significantly greater in mutton products than all other products (beef) studied.

E.coli could be isolated from beef, buffalo, camel, sheep and goat with incidence 12.5%, 7.5%, 2.5%, 5% and 2.5%, respectively. Serotype O: 114 K: 90 was isolated from beef and buffalo meat, while the untypable E. coli was isolated from beef, camel, sheep and goat samples.

Salmonella spp. could be isolated from examined beef, buffalo, sheep and goat samples with incidences with 10%, 5%, 2.5% and 5%, respectively and could not be isolated from camel and frozen beef samples.

Salmonellaspp. which isolated was Kotte from beef and Buffalo, Kentucky from beef, buffalo and sheep and Salmonella Istanbul from goat samples.

E. coli, Staph. aureus and Salomnella are often present on fresh tissues because the slaughtering process does not include a bactericidal step. Levels of these bacteriaon freshly slaughtered animal carcasses will be varied depending upon climatic, farm, livestock transport, stock yard and processing conditions. In general all of them except Salmonella may be present at levels of about 10 to 102 (Johnston and Tompkin, 1992).

Salmonella, Staphylococcus spp. and E. coli infections can be contracted through consumption of contaminated meat. Salmonellae are important causes of gastroenteritis. Symptoms of Salmonella infection in healthy human-beings include fever, diarrhea, abdominal pain, and sometimes vomiting. Staphylococcus spp. can be part of normal flora on the skin of humans and animals which can be transmitted from person to product through unhygienic practices (Postgate, 2000). Staphylococcus spp. cause infections such as arthritis, black pox, boil, bronchitis, bumble foot, carbuncle, cystitis, endocarditis, meningitis, osteomyelitis, pneumonia, and scalded skin (Stuart, 2005). Others cause food poisoning resulting in severe vomiting and diarrhea. Escherichia coli causes illness ranging from gastrointestinal tract-related complications such as diarrhea, dysentery, urinary tract infection, pneumonia and even meningitis (Johnsonetal., 2006), although majority of the Escherichia coli strains are non-pathogenic and exists in the intestinal tract of humans and animals.

5. Conclusion:

Highest contamination was found in beef, buffalo and sheep samples.Generally, highcontaminationlevelswithmesophilicaero beshavebeenreportedforraw retailed meat inthisstudy have been exceeded the106cfu/g acceptable limit and some samples exceeded 107 where spoilage of meat occur (Warriss, 2001). The main factors might be the inadequate hygiene during slaughtering, processing and handling, moreover the heaps of garbage that were scattered from place to place beside our abattoirs. The isolation of Staphylococcus aureus, E. coli and Salmonella spp. Can be worrying because certain strains of these bacteria cause food-borne infections and has public health significance. To reduce microbiological load on and in animals' carcasses, standard operating methods should be practiced. Such methods include screening of butchers, meat sellers and all who handle meat on regular basis on their health status. In addition well maintained meat vane, selling tables covered with nets ,thoroughly cleaned and regularly sterilized knives, aprons and all equipments come into contact with meats should be used. Apart from these, meat cooked to an internal temperature of 70˚C for 15 minutes will help in killing all bacteria before consumption.

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