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Chicken Carcasses Bacterial Concentration at Poultry Slaughtering Facilities

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ABSTRACT

Microbial contamination starts on incubation period among chickens. Poultry and Poultry environments, fodder, water and several animals and humans are significant resources of contaminations on incubation and growing period. Microorganisms or its toxins growth and living on chicken meats can contaminate the human with consumption and cause several infection or poisoning on them. These stiuations can decrease productivity of company or several economical losses. In this study which is to define chicken carcasses bacterial concentration at poultry slaughtering facilities, sampling process was made twice a month during 6 months covering dates between April-September 2010. The chicken carcasses were examined with regarding to Total Aerobic Mesophilic Bacteria, *E. coli*, *S. aureus*, *Pseudomonas* spp., *Salmonella* spp., *L. monocytogenes* sorts. At the end of examinations, Total Aerobic Mesophilic Bacteria, *E. coli*, *S. aureus*, *Pseudomonas* spp., *Salmonella* spp., *L. monocytogenes* are identified under criterions of Turkins Poultry Codex for dew poultry meats.

Key words: Poultry slaughtering facility, chicken carcass, microbial contamination, toxin, bacterial concentration

INTRODUCTION

Aerosols occur those are sprading microorganisms depending on several factors at food processing factories. These are:

- Washing and cooling the food by spraying
- Using high-pressure spraying on cleaning
- Washing the filters and channels by water on the backdrop
- Using mixers and engines
- Running the other equipments

Animal based foods can be source of chemical or biological contamination as well. Microorganisms involve to fodder with animal's skin, feet and hair. Consumption of fodders contaminated microorganisms increase the amount and sort of organisms in the digestive system. The fodders cause disease in animals, If contain potential pathogenes such as *Salmonella*. Microorganisms infects carcass and the other parts during slaughtering. There is no existing

microorganism on tissues of healthy animals. These tissues are sterilized. However, surface of meats prepared for consumption are generally contaminated by numerous bacteria, ferment and fungus. Amount of this contamination is depending on the conditions of environment the food presents, the method of food processing, durance and conditions of storage. Much less contamination is observed at the foods those obtained and prepared by suitable techniques (Ayhan, 2000).

Contamination on Surface of animal carcasses which are stored at cool air storages after slaughtering is lower level. Surfaces that come into the open as the meat is cutted to smaller pieces keep contamining by microorganisms arising from the knifes used and environment. Contamination rises to the higher level by chopping meats to the mince (Unluturk and Turantas, 1999).

There are existing organisms with either normal floras when alive or during slaugtering, plucking and eviscerating processes at new cleaned skin of poultries such chicken, turkey, duck and goose (Ray, 2004). There are microorganisms number between 100-1000 cm^2 on poultries' skin those are slaughtered and processed at conditions the sanitation is well but a poultry's skin processed within bad conditions can contain 100 times or more microorganisms. Bacterias primerily existing on poultry's skin are spieces belonging to *Pseudomonas*, *Acinetobacter*, *Escherichia*, *Flavobacterium* and *Salmonella* (Mead, 2000).

Many foods get through several processes until its arrival to consumer. But the contamination probability increases in each step of these processes. It is necessary to provide hygienical conditions and storage on suitable conditions at processing steps of meat production (Baskaya *et al*., 2004). Therefore, aseptic processing is used on food processing. On this technique, first, the food is sterilized and after put in pots which are sterilized, like that and pots are covered within aseptic conditions. Stuff made of paper, plastic and thin material are used as pot (Erol, 2007).

Researching microbial flora of ambients of these processes steps will allow to define microorganisms existing in these environments and to identify the concentration.

THEORETICAL BASIS

Source of microorganisms on foods: Microorganisms those naturally exist on lives and a part of their life are called normal flora. Microbial flora of a food is formed from either microorganisms exist on material used during production or hands and contaminations during applied processes.

Internal tissues of animals are actually sterilized. Foods are infected by several sort of ferments, molds, bacterias and viruses and their toxins during processing. Natural contamination sources for animal foods are its skin, feather, digestive system, reproductive system, respiratory tract and for milk animals is milk channels on mammas. Foods can be contaminated by microorganisms from environment via air, soil, sewage and water. Amount and sorts of microorganisms on foods are depending on conditions of sanitation during processing.

General source of contamination of microorganisms on foods are soil, water, plants, fodder, fertilizer, animals, humans, canalizations and tools and equipments used during processing, additives, product to product and package materials.

Soil is most natural environment of microorganisms. Types of mold, ferment and bacteria can infect to food from soil. Prevention from transition and contamination is remarkable for decreasing microorganisms coming from these sources (Rheinheimer, 1992).

Water tanks are used in order to wash poultry's carcass and clean facility and tools at slaughtering facilities. Microorganism can infect from these tanks. Temperature of water in order

to boil that can destroy many pathogenes and microorganism the factor of corruption. But this tempreture may not be well enough to destroy thermophiles (Aydin and Atabay, 2001).

Many muscle tissues are substantially sterilized on alive and healthy animals. In case of disease or after slaughtering, microorganisms contaminate to the muscle tissues from surface, intestine, respiratory or the other processes (Swartz, 2002).

Humans hands, breathe, hair and sweat can contaminate the foods. Studies conducted showed that 60% of food businesses' staff do not wash out their hands correctly and 25-40% of diseases occured by foods consist just because of food companies or staff working on service of the food.

Equipments, reusable pots and containers must have proberty of appropriate materials for health, easy and fast cleanable, able to disinfect, smoothless and not be cause of contamination. These must be saved always clean and suitable ones must be disinfect when necessary. Tools and equipments used due to production technology must be indesructable to materials such as heat, steam, acid, alkali and salt.

Floor, according to the workplace, must be made of a material which is waterproof, non-slippery, washable, clean and proper for disinfection and with no cracks, cleanable and disinfectable and must have a slope on to channels for not to accumulate water.

Windows and such places open must be not allowing to contamination, thin porous, easy to clean, often renewable featured coated by wire, plastic or a proper material.

The doors must have surfaces smoothless and waterproof, be self-closing according to case to case, be blocking entrance of detrimental organisms (Pichharidt, 2004).

Packagers have duties as that is limiting the contamination or preventing cover. However, they can not prevent microbial growth. Packaging is used for limiting the microbial content before its packaging or preventing the contaminations. The sustainability of compilation is ensured during package, storage and distribution (Erkmen, 2010).

Disinfectants used in chicken slaughter houses and companies: Cleansing and hygiene are very important issues in food industry. Food corruption caused by microorganisms with prevention of microbial contamination and diffusion, abolishing the food-borne toxicities and infections are actualized with cleaning and disinfection processes.

The important issue while choosing disinfection is sort of microorganism. Amount and type of microorganisms can differ from company to company. Particular microorganism for company must be determined just because microorganism reflect different sensations for disinfectant.

Chicken meat is cheap, healthy and nutritious food which contains high level protein and lower fat. Goods produced with red meat such as sausages, salami, sausages, burgers, doners, meatballs has been manufactured with chicken meat as well.

Infections and poisonings caused by consumption of chicken products still happen commonly in developed countries such as Australia, Canada, UK and Wales. It has on 1st or 2nd place of food-borne diseases in Wales and 3rd place with 8% of diseases in USA. Epidemiological studies in these countries pointed that 95% of food-borne diseases are caused by chicken meats which are given to the p Theazara (Conner *et al*., 2000).

Staphylococcus is a bacteria common in the microbial flora of poultry. It is observed on chicken skin about 10 gG^{1} and it can reach to the amount of 10^{3} gG^{1} after slaughtering. *Staphylococcus aureus* is a toxication which is food-borne. Factor of the disease is enterotoxins that organism excretes. This type of toxication mostly occurs just because consumption of contaminated chickens by infected hands. Enterotoxins that *S. aureus* excretes may not be inactived completely by either cooking or pasteurization (Hargis *et al*., 2000).

Escherichia coli presents in normal intestinal flora of any warm-blooded animals and humans. That is why it is considered to be indicator of fecal contamination. In chickens, verotoxin producing of *E. coli* may be encountered 0157: H7 strains (Mead, 2000).

In Belgium, chickens obtained from samples of some retail stores were examined for the presence of pathogenic bacteria, *Salmonella* spp., *Campylobacter coli*, *C. jejuni* and *L. monocytogenes*. 36.5% of *Salmonella*, 28.5% of the *C. coli*, *C. jejuni* and 38.2% *L. monocytogenes* were found in examples (Uyttendaele *et al*., 1999).

In Spain, chicken meat samples obtained from retail outlets of supermarket were examined again for the presence of *Salmonella* and *Campyloba*cter. It was reported that there were found isolated 49.50% of thermophilic *Campylobacter* and 35.83% of *Salmonella* (Dominguez *et al*., 2002).

Salmonella is a common pathogenic bacteria in the world. Its primarily source is intestine tract of healthy human or other healty vertebrates. Poultries have a remarkable place withing animal origined ones. Factors which make the *Salmonella*'s infections fast are using the fodders contaminated, infected hencoops, insects and mobility of rodents in hencoops. Transorporting the animals with unsuitable conditions; contaminations during boilig, plucking and cooling are important factors on the spread of infections (Karap?nar and ve Gonul, 1998).

Microbial contamination started during incubation, raise and transportation keep growing after entrance to the facility. Processing phases after admission and slaughtering are generally designed to decrease microbial content. However, microorganisms on carcass can not be totally eliminated. Furthermore, at different processing phases further contaminations can occur on carcass. Tools and equipments used, each ground contacted, staff and aerosols and environment are remarkable soruces of contaminations (Pope and Cherry, 2000).

Chickens brought in slaughtering house are firstly hung from their feet then Slaughtering is happened via electric shock., it can increase to high values too. Some studies made point that processing stages for the number of microorganisms significantly reduce but during this process, particularly after cooling, in samples presence of *Salmonella* increase in number is prescribed and the increase of blood flown chickens are boiled for an easy plucking. Boiling process can be immersion, spraying hot water or steaming. After boiling process, plucking is done via a mechanichal plucking machines called rubber-finger and washing process follows it. Then parts like head, food and wen are cut off and splitting giblets is done. After washing, cooling and ozonation following this, chicken is packaged as complete or in pieces. As these processes can decrease the contamination on carcass the point in question in the cross contamination due to reported (Whyte *et al*., 2001). It is reported that primerily phases of processing causes to contaminations are boiling, plucking, siplitting giblets, cooling and package (Sams, 2000).

Boiling processes applied to chicken can eliminate huge part of microorganisms on carcass. However, during boiling. Chickens' feet, feathers, leather on the surface, digestive and respiratory systems found in dirt, dust and fecal material can transist to the water and it can contain very high level of content of microorganisms. In this step, it is observed that using the boliling tank as reverse flow could decline the bacteria content (Mead, 2000).

Plucking phase can be an important contamination source for *Staphylococcus*, *Salmonella* and *E. coli*. These bacterias can settle to feather follicles and are joint to the cross contamination following plucking process.

Enteric pathogens such as *Salmonella* in the intestines of chickens can be found in high numbers. Therefore viscera removing step is an important point in terms of the risk of

contamination. During the process of cutting intestinal, perforation or used instruments to be cleaned and disinfected regularly in a good way is to increase this risk (Roberts *et al*., 1998).

Washings are usually performed by spraying water to the carcass surface. Blanching step is proposed as in the counter-current applications. Washing the carcasses with high pressure water on the interior surface and the organic material out with the potential faecal materials and significantly reduces the burden of microorganisms. Also the addition of chloride in the washing water is stated that more effective. The cooling process is carried out by cold water cooling or air circulation. Air cooling is widely used in the European Union countries, on the other hand in the United States mostly cooling systems in water are used.Carcasses are circulated in the room for certain period of time and air cooled carcass internal temperature is lowered to below 4.4°C (Hargis *et al*., 2000).

After cooling, it is done the step of degradation and processing of the carcass. At this stage, microorganism contamination can occur to the product from several sources.In this phase the most important sources of contamination are cutting and breaking devices and personal. If the product is not treated sanitary may undergo intensive recontaminationin this phase (Conner *et al*., 2000).

Packaging and storage of the product from the slaughter house and are in the final steps of contamination can occur. In these phases, the most important sources of contamination are packaging material, packaging systems and the staff (Conner *et al*., 2000).

Chickens in slaughter houses and businesses Good Manufacturing Practices (GMP) ensure product quality and safety are important sources referenced. GMP program and related topics listed below comprise the programmes:

- Buildings and facilities
- Tools and equipments
- Processing phases
- Cleansing and sanitation
- Materials used in production
- Staff
- Pest control and following of the product
- Returnable product

According to this study, business building and the environment in accordance with the principles of hygiene and sanitation must be designed, built and ensured its continuity. Sufficient and good quality water supply and water should be provided wherever necessary in the business distribution should be done in a proper manner. All types and techniques used in production of the excipient material (raw materials, additives, packaging material, the cleaning and sanitizing items etc.) list should be removed and obtained specific and reliable places. All of the staff should be trained about hygiene and sanitation and especially staff's hygiene issues in company (Sener and Temiz, 2004).

Cleaning, is removing the all dirt from the food contact surfaces and various tools and equipment and preventing from food debris and their conversion into a form of the growth medium for microorganisms. As practical cleaning, it is carried out with water and detergent at 50-70°C (Temiz, 2001).

Disinfection, killing microorganims or reduce to the lowest level after cleaning step which may be a source of contamination to the product in the environment. Disinfection in food industry is in general forms of high temperature, radiation application and use of disinfectants. Some physical and chemical processes are being implemented in the chicken business. It is achieved that as physical processes are temperature applications, radiation, UV, a high-voltage electrical applications, the high pressure, negative air flowing; chemical processes are use of various chemicals, antibiotics, bioactive microbicide and use of pesticides (Yang *et al*., 1998).

Disinfectants used in food industry which must carry the characteristics listed below:

- Should kill microorganisms as possible, should be more kinds of microorganisms and to be effective in a short time
- Should be resistant to organic materials
- Should not be affected too much by hardness of water
- Should not be toxic and irritant properties for humans and animals
- The effect must be durable and able to continue during storage for a long time
- Should dissolve easily and homogeneous in water
- Should be odorless or not be stinky
- Should not be coloring or decolorizing the surfaces applied
- Should be cheap and easy appliable
- Should be easy obtainable

Chlorine is one of the most used chemical materials in chicken businesses. However, it is disscussed that chlorine bring changes about bleaching of color in the carcass, loss of color and flavor.

Affects of H_2O_2 is well known about reducing the number of bacteria. However, these disinfectants can cause group of negativities such as blistering on the skin surface, boiled appearance and accumulation of gas and water under the skin.

In chicken businesses; work areas, floors and equipment periodically from the use of ozone disinfection is a method widespread in recent years. In addition to this, the line of cut at the phase showered carcasses,ozone is used in packaging and storing poultry and poultry products.

Ozone slows the growth of microorganisms and sensory quality of the surface provides protection at carcasses cold storaged. A study cunducted showed that ozone used low concentrations on chicken meat decrease the number of *Pseudomonas* sp. and *C. scotti*, extends the lagphases of *Thamnidium* and *Penicillium* (Kim *et al*., 1999).

- It is possible to use ozone as an effective contra-microbial in meat industries
- No matter the source of ozone disinfects water for drinking, processing and using
- Ozone makes hygienic the animals entering the slaughtering section. Thus it is prevented the transport of pathogens
- Ozone is loaded on the carcass during slaughter and/or internal organs formed during discharge while preventing microbial transport, on the one hand accelerates the blood discharge, on the other hand prevents wastage. Thus, eliminates the bad looking in subcutaneous fat and gelation
- Minimizing the use of chemicals, provide disinfection without leaving residue on the product
- Shelf life increases by keeping the meat fresh for longer (http://permroofing.com/ozone)

MATERIALS AND METHODS

Poultry Slaughtering Facility has been established in 2003-2004. Six forty three people are employed in facility including 416 men, 227 women. Research stations are open places night, weekday and weekend. It has parts such as accepting live animals, shocking and cutting, off al cleaning, dry cooling and ozonation, cutting, packaging and shipping departments are further processed. Facility is wall-paneled. Room temperature is kept constant at 0-1°C dry cooling, crushing and packing room temperature kept constant at 8°C. Accepting live animals is worked as a double shift between 9:00 and 18:00. From 8:00-12:00 (4 h) is the busiest time of the facility. Other sections are active 24 h. The facility has a special cooling systems without human intervention chicken meat is produced in hygienic conditions. Facility has got HACCP 13001 licence of TSE.

Growth media used for bacterial identification and isolation

Total Aerobic Mesophilic Bacterial (TAMB) count: Plate Count Agar (PCA) was used for TAMB count. The 0.1 mL of different dilutions was inoculated on PCA media and drigalski spatula was used to evenly spread the inoculation on the media. TAMB counts were obtained after 24-48 h of incubation at 37°C

***Staphylococcus aureus*:** Baird Parker Agar (BPA) containing 50 mL LG[1] Egg Yolk Tellurite Emulsion was used. The 0.1% peptone water to 1/10 ratio of homogenizer was prepared. One milliliter of diluted liquid, three different standards by sharing evenly into dish 1/10 the hood seeded, were incubated for 48 h at 37°C.

***E. coli*:** Tryptone Bile X-Glucuronide Medium (TBX) was used for identifications of *E. coli*. The 1 mL of the sample homogenized at a ratio of 1/10 with 0.1% peptone water was inoculated to 3 different standard and plates were incubated at 30°C for 4 h followed by incubation at 44°C for 18 h.

***Pseudomonas* spp.:** *Pseudomonas* Agar F (Base), prepared by addition of 10 mL LG[1] Glycerol was used for identifications of *Pseudomonas* species. The 0.1 mL samples were inoculated and media was incubated at 37°C for 5-7 days. Following incubation, ivory-white colonies were counted.

***Salmonella* spp.:** For *Salmonella* isolation, the standart method is "The Oxoid *Salmonella* Rapid Test Oxoid Folio 481" were applied.

***L. monocytogenes*:** The 25 g of samples to be analysed were weighed in sterilized stomacher bags on which 225 mL *Listeria* Selective Enrichment (LEB) Broth Base, Oxoid CM 862 was added. The mixture was homogenized and incubated at 30° for 24 h. The 0.1 mL of the pre enrichment homogenate was transported to enrichment broth (Fraser Broth; Oxoid CM 895) to be incubated at 35°C for 24 h. In the last step, an agar-plating was performed on Oxford (*Listeria* Selective Agar Base, Oxoid CM 856) and Palcam Agar (Oxoid CM 877) and plates were incubated at 35°C for 24-48 h.

RESULTS

Microbial burden according to months: Enumeration values of Total Aerobic Meshophilic Bacteria, *Staphylococcus aureus*, *E. coli*, *Pseudomonas* spp., *Listeria*, *Salmonella* spp. are obtained due to evaluation of general microbiological quality of chicken carcasses (Table 1).

Table 1: Sterilized poultry white meat by-products microbiological analysis results between the dates April 2010-September 2010

Date	Product	TAMB	*Staphy. aureus*	*E. coli*	*Pseudom* spp.	*Listeria monocyt*	*Salmonella* spp.
11 April	Breast	1.2×10^3	<100	50	295	Non-det	Non-det
	Com. Ch	3.4×10^3	<100	20	220	Non-det	Non-det
25 April	Wing	6×10^3	<100	<10	255	Non-det	Non-det
	Com. Ch	9×10^2	<100	<10	10	Non-det	Non-det
16 May	Wing	6×10^3	<100	20	600	Non-det	Non-det
	Com. Ch	5.2×10^3	<100	60	855	Non-det	Non-det
30 May	Thigh	2.3×10^3	<100	90	505	Non-det	Non-det
	Com. Ch	2.1×10^3	<100	<90	200	Non-det	Non-det
13 June	Gizzard	1.2×10^3	<100	80	700	Non-det	Non-det
	Com. Ch	2.3×10^3	<100	30	135	Non-det	Non-det
27 June	Chop	4.2×10^3	<100	60	410	Non-det	Non-det
	Com. Ch	3.6×10^3	<100	70	280	Non-det	Non-det
11July	Grill	2×10^3	<100	40	690	Non-det	Non-det
	Com. Ch	1.7×10^3	<100	60	100	Non-det	Non-det
25 July	Thigh	3.9×10^3	<100	30	480	Non-det	Non-det
	Com. Ch	2.2×10^3	<100	70	180	Non-det	Non-det
15 August	Bagette	3×10^3	<100	90	180	Non-det	Non-det
	Com. Ch	6×10^2	<100	20	495	Non-det	Non-det
29 August	Muz	1.1×10^3	<100	30	450	Non-det	Non-det
	Büt. Piliç	1.8×10^3	<100	10	435	Non-det	Non-det
12 September	Fillet	1.6×10^3	<100	<10	420	Non-det	Non-det
	Com. Ch	2.5×10^3	<100	70	150	Non-det	Non-det
26 September	Grill	7.5×10^3	<100	30	825	Non-det	Non-det
	Com. Ch	1.9×10^3	<100	40	160	Non-det	Non-det

DISCUSSION

Ozone is a strong and effective is used as a sterilanting activating bacteria. Ozone is used in cold storage which prevents the formation of bacteria. There is no harm in human or animal health eco-friendly low doses. It is just because turn into oxygen. It leaves no residue on the product (Naito and Takahara, 2006).

Ozone is applied on conservation of chicken meat in forms of gas and liquid too and positive results has been obtained. It has been tested on chicken different solutions in the atmosphere or in a mixture of gases in liquid form of incubators, in the disinfection of nests, chicken carcasses, the carcass cooling waters and disinfection of contaminated eggs at chicken enterprises. *Staphylococcus*, *Streptococcus* and *Bacillus* sorts and culture collections, *Pseudomonas fluorescens*, *Salmonella typhimurium*, Proteus species and *Aspergillus fumigatus* derived from *E. coli* isolated from nest incubators were exposed in lab trials on petri dishes by smear method inoculation. Ozone used in these experiments was found from 1.5-1.65% (w/w) on the concentration of ozone in the bacterial population on logarithmic unit 4-7 and 4 logarithmic units in the above mold to cause a numerous decrease (Turantas, 2001).

At the dry cooling room of the facility it studied, cooling lines for cooling chicken carcass were 3600 m. Carcasses in this line do not touch each other and the water inside completely drained. It is exposed simultaneously to the ozone gas. Our research of microfungi in the products we get from this room for growth is unpresedented. Ozone may increase the air quality and have hampered the growth of microfungi. During slaughter and carcass processing operations applied affect the level of microorganismsin different ways. Delivered chickens to the facility are hung from their legs and

Table 2: Microbiological criteria for raw poultry meat

Parameters	No. of sample	C	M	M
TAMB	5	2	5.0×10^5	5.0×10^5
E. coli	5	2	5.0×10^2	5.0×10^5
S. aureus	5	2	5.0×10^2	5.0×10^5
Pseudomonas spp.	5	2	5.0×10^4	5.0×10^5
Listeria monocytogenes	5	0	Must not be found	Must not be found
Salmonella spp.	5	0	Must not be found	Must not be found

C: Number of microorganisms containing acceptable maximum number of samples to be analyzed between m and M, M: (n-C) number of samples to be analyzed can be found in 1 g acceptable maximum number of microorganisms, M: C number of samples to be analyzed in 1 g of the acceptable maximum number of microorganisms that may be present (Anonymous, 2009)

applied electro-shock. Chickens blood streamed after cutting are boiled due to remove the feathers easily. Generally, in the form of hot water immersion and steam boiled hot water injection operations methods may be secured. After boiling process in order to remove the feathers a mechanical machine is used called rubber-finger. Washing process follows this. Afterwards; head, feet, shin-shank portions are cut and oil glands and internal organs by manual or mechanical removal process begins. After washing and subsequent cooling process chickens are packed in whole or broken.

As these processes applied can reduce the level of microorganisms on the carcass, increase contrary to the higher levels.

According to Turkish Food Codex Regulations of Notification of Meat Production, it is determined that cutting suitable technique, blood flown, plucked, emptied inside and cut off feet, washing and cooling processes have been done, leaked the water, poultry animal body for but chery (Anonymous, 2000).

In the official newspaper published that is dated 6 February 2009 Turkish Food Codex Community on Microbiological Criteria according to the data of microbiological criteria for raw poultry meat are given in Table 2.

According to this table for the Turkish Food Codex it is allowed to have raw poultry meat more than 5.0×10^6 CFU g^{-1} of total aerobic mesophilic bacteria. In this study, none of the samples analyzed for total aerobic mesophilic bacteria count was not over the limit set by the TFC.

Chicken carcasses were examined for sale in packaged, form 6 different company's own sales outlets and/or from the supermarket, one from the business of the firm purchased a total of 35 pieces of 7 different companies in Adana. In all samples, aerobic bacteria such in all CFU g^{-1} were detected in the range of 65×10^2-32×10^3. In the study, the results we have achieved total aerobic bacteria count is lower than the results Ergeldi achieved (Ergeldi, 2010).

Turkish Food Codex have been let for raw poultry meat more than 5.0×10^3 CFU g^{-1} of *E. coli*. In none of samples analyzed in this study, the number of *E. coli* was found above the limit set by the TFC.

Efe and Gumussoy (2005) found at -180°C in frozen bagged 50 whole chicken meat, thigh, skin and breast portions of microbiological contamination levels investigated in the study viewed chicken drumsticks, skin and breast meat, respectively, in *E. coli* y 12%, in 64 and 4% in Ankara Garrison. Turkish Food Codex allowed to have *Staphylococcus aureus* by maximum of 5.0×10^5 CFU g^{-1} for raw poultry meat. In this study, all of the specimens studied was below 100 CFU g^{-1}.

Staphylococcus is naturally found in human and animal skin and nasal mucosa but also very common bacterium in the microbial flora of poultry (Conner *et al*., 2000). In a study for skin of

chicken, 10 CFU g^{-1} levels were determined and reached on *S. aureus* anchorage 10^3 CFU g^{-1} after cutting. It is known that enterotoxins are not completely inactivated by pasteurization process conventional cooking methods. Therefore raw chicken meat and poultry products should not contain *S. aureus* or can not exceed a certain level (Karap2nar and ve Gonul, 1998).

Pseudomonas can proliferate so easily close to the 0°C arrival at temperatures or lower than 00°C in foods can be stored in the cold. In addition, *Pseudomonas* proliferation of the most suitable for environments are easily processed products pass water supplies, cooling tanks and factory-processing equipment and for these equipment adequately disinfected failure on the remaining oil, meat and blood remnants (Banwart, 1989; Goktan, 1990).

Sundheim *et al*. (1998), has defined, in 601 isolate cold-stored chicken carcasses, 531 of them are *Pseudomonas* spp.

Turkish Food Codex allowed to havemore than 5.0×10^3 CFU g^{-1} *Pseudomonas* for raw poultry meat.

Rate of *salmonella* infections in food-borne infections is very high. Epidemiological records about intestinal diseases show that the most important source of *Salmonella* is chicken meat (Bryan and Doyle, 1995).

Blind intestine and cropare found in abundance of the region of *Salmonella* in chicken.The contents of this area of the body can become an important sources of contamination during cutting process (Hargis *et al*., 2000).

Salmonella was not found in this study. The use of ozone and dry coolingin the facilitymay have hampered the growth of *Salmonella*.

Listeria monocytogenes is a bacteria capable of binding to meat surfaces. Meningitis and septicemia in humans, leading cause of death is high in people with suppressed immune system.

Erol and Sireli (1999) identified that 30% of chicken carcass were contaminated with *Listeria monocytogenes*.

With the studies done in several countries, it was determined that 25-85% of fresh or frozen chicken carcass samples were contaminated with *Listeria monocytogenes* (Wang *et al*., 1992). There is no *Listeria monocytogenes* detected in the study.

In this research facility in accordance with the HACCP program, improving hygienic conditions, especially cross-contamination is under control. Cleaning and disinfection the surface, tool and equipments that will contact with carcasses will be carried out effectively. Staff give importance to the hygiene rules and personal hygiene. Staff working in section called dirty accept live animals, shock-cuts and offal cleaning staff do not pass to the sections of ozonation dry cooling-called clean section, shredding and packaging. Staff working in the clean section get into working areas with thumb prints. Hands and boots are disinfected before entering shredding and packaging sections.

Shredding and packaging is accomplished hand- off. All staff use gloves, caps, gowns and masks.

Complying these rules of hygiene may have been caused the microbiological counts had been found are under the criterion of Turkish Food Codex.

CONCLUSION

Advises to the meat consumers can be such as:

- When shopping chicken should be left to the last. Thus, you would have more time until refrigerator

- The expiry date should be considered
- Products with broken packages should not be purchased
- Packages with ice crystals under or inside, should not be purchased
- Conditions of storage and use must certainly be read
- Unless there are any stains on the skin of chicken, chicken skin from dark yellow to white to show the variety of colors which is normal. If there is a stain with another color, should not be purchased
- Chicken, in appropriate circumstances, will retain freshness until the expiration date. However, in terms of health care must be taken as early as possible should be cooked or frozen
- Before and after touching raw meat, hands should be washed thoroughly with soap and hot water
- Nails should be kept short and clean. Beside when dealing with nail polish, rings, jewelery must not be used
- Hands should be washed after leaving the toilet
- Hands should be washed after talking by phone
- Hands should be washed after emptying the trash or placing the dishes
- Sink must be cleaned before starting food preparation
- When preparing meats raw and cooked, should be used different knives and chopping boards
- After each use all the tools and surfaces should be thoroughly washed and disinfected with detergent and hot water
- If you have cut or wound in hand the injured part while preparing food should be covered with waterproof bandage
- Kitchen utensils have been in contact with the ground or floor unhygienic, should be washed
- Unpacking the product should be washed thoroughly
- Washed and new products should be stored in clean bags or containers
- Tools used for taste, should be washed before re-use
- When putting away uncooked food to the refrigerator, ready to be cooked should be placed at the bottom of the rack
- When placing raw meat in the refrigerator must be placed on one plate to the bottom, so the water must flow into the floor
- To maintain the coldness of the food, it must be kept at fridge 40°C or lower
- The remains must be put away to refrigerator in 2 h after cooking
- In less time to cool, remains stored in small portions
- When removing cooked foods,must be placed in a clean container, not the side of raws
- Cooked before serving, it is very important food to be kept in good condition
- The package should be used if you have previously opened instead of opening the new one
- Surplus nutrients must be placed by dividing it into small pieces. Thus, it would be easy to use for ejecting the dissolution, as well as a regular settlement can be achieved much more in the freezer
- The cooked foods not to consume immediately should be with tempreture between 60°C and 70° for hots, +4°C or lower for colds
- If you I picked a product fresh and do not intend to consume within 1-2 days, immediately freeze it. Fresh chicken, packaged meat, meat products can be put in freezer with pack itself without any processing. An untreated meat should be placed in a special storage bag. Bags must be taken to remain in the air as little as possible and bags should be placed in the freezer wrapped in aluminum foil

- Frozen chicken you have purchased may remain in the freezer at -18°C until the expiry date. The storage conditions specifiedfor that product on package should be read carefully
- Cooked meat and chicken, if they are not sauced or watery can be stored in the same way.Otherwise, it is better to store them in a container that you can close them tightly
- Cooked are must be stored separately from raws
- Fresh meats must be put away to the freezer immediately. Not store them in room tempretures such as in car or house
- Meat must be in freezer until cook
- Frozen foods must be defrosted on proper way. Refrosted foods must not be refreeze
- Food must be taken out from pot after refrosting and tools used during refrost process must be washed
- Water used on refrosting must not be used another process
- Frozen foods must never be refrosted on radiator or stove. The proper ways to refrost the foods are refrigerator tempreture, under flowing water within original package or in microvawe.
- Foods must be cooked immediately after refrost

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