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Safety of meat served at a university hostel

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ABSTRACT

This study aimed to evaluate the hygienic status of served chicken meat and beef in a university hostel. About one hundred random of chicken and beef meat samples before and after cooking (about 120g) were collected from a university student hostel, Egypt. Samples were examined bacteriologically. The average values (cfu/g) of Aerobic plate count (APC), Enterobacteriacae & Coliform counts were $4.10\times10^7\pm 0.01\times10^7$, $4\times10^2\pm0.03\times10^2$& Less than 10 in raw chicken thigh , $2.47\times10^7 \pm0.02\times10^6$, $6\times10^2\pm0.02\times10^2$& $4.3\times10^2\pm0.01\times10^2$ in raw chicken breast , $2.4\times10^3\pm0.03\times10^3$, Less than 10& Less than 10 in cooked chicken thigh, $5.3\times10^4\pm0.02\times10^3$, Less than 10&Less than 10 in cooked chicken breast , $4\times10^7 \pm0.02\times10^7$, $1\times10^3\pm0.03\times10^3$&$1.3\times10^4\pm0.01\times10^3$ in raw beef and $4\times10^3\pm0.03\times10^2$, $2.2\times10\pm0.02\times10$& Less than 10 in cooked beef, respectively. Moreover, the incidence of *E.coli* was 73.33%, 33.33% and 35% in raw chicken thigh, cooked chicken breast and raw beef., while the mean valued of *Staph. aureus* were $5.3\times10^3\pm0.02\times10^3$, $2.3\times10^3\pm0.01\times10^2$, $6.2\times10\pm0.02\times10$, $6.9\times10\pm0.02\times10$, $3.9\times10^4\pm.01\times10^3$and less than 10 in raw chicken thigh, raw chicken breast, cooked chicken thigh, chicken breast, raw beef and cooked beef, respectively. All samples were accepted based on their APC, Enterobacteriacae, Coliform & *Staph. aureus* counts.

1. INTRODUCTION

The risk of bacterial food borne diseases increases when meat meals were prepared in kitchens, as in hospitals, students' accommodation, youth hotels and shared homes. This increase the risk due to the high number of individuals using the kitchen, the lack of responsibility and the difference in the hygienic standard for the users of these kitchens (Sharp and Walker, 2003).

Meat constitutes the most important item of human food, because of its palatability and nutritional value. It is also a highly desired food and the center of the meal (Hui, 2001). For this high nutritional value, it offers a highly favorable environment for the growth of pathogenic microorganisms.

Cross- contamination from raw to cooked food, inadequate cooking food handlers may also be asymptomatic carrier of food poisoning organisms (Ravishankar et al., 2010).

Meanwhile, insufficient cooking may result in survival of *E.coli* and subsequently causes food poisoning to consumers (Cruz et al., 2005).

The bacterial contamination and hygienic measures during meat production can be measured using the aerobic plate count and three Gram - negative indicator groups viz: Enterobacteriaceae, Coliforms and *Escherichia coli* which is the most important indicator for faecal contamination (Paulsen et al., 2006).

Staph. aureus, *E. coli* and Salmonellae are ones of important bacteria causing food poisoning those leading to gastroenteritis and other health complications (CDC, 2015).

The frequency of several types of food poisoning infections climbed, but that the increases could be the result of new diagnostic tools that help identify more cases. Overall, the agency believes food poisoning rates have remained largely unchanged. It highlights the difficulty in understanding food poisoning when so many cases go un-reported, diagnostic methods are inconsistent, and production practices and eating habits are constantly changing (CDC, 2019). Therefore, this study was conducted to evaluate safety of meat meals served in a university student hostel.

2. MATERIAL AND METHODS

2.1. Sampling:

A total of 100 random samples (120g of each) of raw and cooked chicken meat (60) of breast& thigh (15 of each) and beef (20 of each) were collected from meals served in a university student hostel in Egypt. Each sample was examined before and after cooking. Chicken samples were fried at 190^0 C for 1 hr. till golden brown color appearance and meat samples were boiled in water at 100^0C till full cooking then fried at 190^0 C for 15 min. Both raw and cooked samples were kept in separate plastic bags and transferred directly to the laboratory in an ice box under complete aseptic conditions without undue delay to be examined bacteriologically.

2.2. Preparation of samples:

The samples were prepared according to the technique by APHA (2001) as follow:

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Twenty-five grams of examined samples were aseptically transferred to a sterile stomacher bag and homogenized with 225 ml of 0.1% sterile peptone water for1-2 min to give an initial dilution of 1/10. Tenfold serial dilution was prepared from original dilution.

2.2.1. Aerobic Plate Count (APHA, 2001).
It has been done By using standard plate count agar, The APC per gram was calculated on plates containing 30-300 colonies and each count was recorded separately.

2.2.2. Enterobacteriaceae Count (ISO, 2004).
It has been done By Violet Red Bile Glucose agar medium (VRBG). All large purple suspected colonies surrounded by a purple halo were counted, The Enterobacteriaceae count / g was calculated.

2.2.3. Coliform count (ISO, 2004).
By using plate of tempered melted violet red bile agar (cooled to 44-46 ºC). Suspected colonies, which showed purplish – red colonies surrounded by a red zone of precipitated bile acid, were enumerated to obtain coliforms count /g.

2.2.4. Isolation and Identification of Staphylococcus aureus (ICMSF, 1996).
By using Baired parker agar medium, shiny black colonies were positive. The suspected colonies of *Staph. aureus* were stabbed into semi solid nutrient agar tubes for further biochemical identification.

2.2.5. Isolation and identification of E. coli (ISO 2001).
By TBX media (Trypyone bile x-glucornic), suspected colonies showed bluish green with halo zone.

2.3. Statistical Analysis:
The obtained results were statistically analyzed by application of Analysis of Varian ce (ANOVA) test according to Feldman et al. (2003).

3. RESULTS

It is evident from the result recorded in table (1) that the mean values of APC, Enterobacteriacae, Coliform and *Staph. aureus (*cfu/g) were $4.10\times10^{7}\pm0.01\times10^{7}$, $4\times10^{2}\pm0.03\times10^{2}$, Less than 10 and $5.3\times10^{3}\pm0.02\times10^{3}$ in raw chicken thigh, $2.47\times10^{7}\pm0.02\times10^{6}$, $6\times10^{2}\pm0.02\times10^{2}$, $4.3\times10^{2}\pm0.01\times10^{2}$ and $2.3\times10^{3}\pm0.01\times10^{2}$ in raw chicken breast, $2.4\times10^{3}\pm0.03\times10^{2}$, Less than 10, Less than 10 and $6.2\times10\pm0.02\times10$ in cooked chicken thigh , $5.3\times10^{4}\pm0.02\times10^{3}$, Less than 10, Less than 10 and $6.9\times10\pm0.02\times10$ in cooked chicken breast, $4.0\times10^{7}\pm0.02\times10^{7}$, $1\times10^{3}\pm0.03\times10^{3}$, $1.3\times10^{4}\pm0.01\times10^{3}$and $3.9\times10^{4}\pm0.01\times10^{3}$ in raw beef, $4.0\times10^{3}\pm0.03\times10^{2}$, $2.2\times10\pm0.02\times10$, Less than 10 and Less than 10 in cooked beef.
The present data in table (2) showed the incidence of Enterobacteriacae, Coliform, *Staph. aureus* and *E.coli* were 80%, failed to be detected , 60% and 73.33% in raw chicken thigh, 86.7%, 80%, 60% and failed to be detected in raw chicken breast, failed to be detected, failed to be detected, 33.33% and failed to be detected in cooked chicken thigh, failed to be detected, failed to be detected , 33.33%and 33.33% in cooked chicken breast, 75%, 75%, 20% and 35% in raw beef, 35%, failed to be detected, 20% and failed to be detected in cooked beef.
The present data in table (3) showed the acceptance of examined samples according to EOS/ 2005 (raw chicken and beef samples) and CFS/ 2014 (cooked chicken and beef samples) which showed that the acceptability of meat samples based on their APC count and *E.coli* incidence was 26.66% & 73.33% and 46.66% & 26.66%& 60% & 66.66% in raw chicken thigh , raw chicken breast& raw beef, respectively, while all samples were accepted based on their Enterobacteriacae, Coliform & *Staph. aureus* counts.

4. DISCUSSION

As shown in Table (1), the highest APC (cfu/g) was in raw chicken thigh followed by that in raw beef. Also, the highest Enterobacteriaceae, Coliform and *Staph. aureus* (cfu/g) was in raw beef followed by raw chicken thigh in Enterobacteriacae and *Staph. aureus*, raw chicken breast in Coliform.

Table 1 Mean values of bacterial load (cfu/g) in the examined chicken and beef meat in a university student hostel.

Samples	APC	Enterobacteriacae	Coliform	*S. aureus*
Raw chicken thigh(15)	$4.10^{a}\times10^{7}\pm0.01\times10^{7}$	$4^{bc}\times10^{2}\pm0.03\times10^{2}$	Less than 10	$5.3^{a}\times10^{3}\pm0.02\times10^{3}$
Raw chicken breast(15)	$2.47^{ab}\times10^{7}\pm0.02\times10^{6}$	$6^{b}\times10^{2}\pm0.02\times10^{2}$	$4.3^{ab}\times10^{2}\pm0.01\times10^{2}$	$2.3^{bc}\times10^{3}\pm0.01\times10^{2}$
Cooked chicken thigh (15)	$2.4^{b}\times10^{3}\pm0.03\times10^{2}$	Less than 10	Less than 10	$6.2^{c}\times10\pm0.02\times10$
Cooked chicken breast (15)	$5.3^{b}\times10^{4}\pm0.02\times10^{3}$	Less than 10	Less than 10	$6.9^{c}\times10\pm0.02\times10$
Raw beef (20)	$4.0^{a}\times10^{7}\pm0.02\times10^{7}$	$1^{a}\times10^{3}\pm0.03\times10^{3}$	$1.3^{a}\times10^{4}\pm0.01\times10^{3}$	$3.9^{ab}\times10^{4}\pm0.01\times10^{3}$
Cooked beef (20)	$4.0^{b}\times10^{3}\pm0.03\times10^{2}$	$2.2^{c}\times10\pm0.02\times10$	Less than 10	Less than 10

^{abcd} values within a row with different superscript letters were significantly different at ($P \leq 0.05$).

Table 2 Incidences of APC, Enterobacteriacae, Coliform , *S. aureus* and *E. coli* isolated from the examined chicken and beef meat served in a university student hostel .

Samples	No. of ex. samples	Enterobacteriaceae.		*Coliform*		*S. aureus*		***E.coli***	
		+ve samples	%	+ve samples	%	+ve samples	%	+ve samples	%
Raw chicken thigh	15	12	80	-	-	9	60	11	73.33
Raw chicken breast	15	13	86.7	12	80	9	60	-	-
Cooked chicken thigh	15	-	-	-	-	5	33.33	-	-
Cooked chicken breast	15	-	-	-	-	5	33.33	5	33.33
Raw beef	20	15	75	15	75	4	20	7	35
Cooked beef	20	7	35	-	-	-	20	-	-

Table 3 Acceptability of examined samples according to CFS guidelines based on their APC, Enterobacteriacae, Coliform, *Staph. aureus* and *E. coli* isolated.

Samples	No. of ex. samples	MPL acc. to CFS	APC		Enterobacteriacae		Coliform		*Staph. aureus*		*E.coli*	
			Accepted	%	Accepted	%	Accepted	%	Accepted	%	Accepted	%
Raw chicken thigh	15	$\leq 10^7$	4	26.66	12	100	-	-	9	100	4	26.66
Raw chicken breast	15	$\leq 10^7$	7	46.66	13	100	12	100	9	100	-	-
Cooked chicken thigh	15	$\leq 10^4$	15	100	-	-	-	-	5	100	-	-
Cooked chicken breast	15	$\leq 10^4$	15	100	-	-	-	-	5	100	10	66.66
Raw beef	20	$\leq 10^7$	12	60	15	100	15	100	4	100	13	86.66
Cooked beef	20	$\leq 10^4$	20	100	7	100	-	-	-	-	-	-

MPL =maximum permissible limit. N.B: raw chicken and raw beef samples according to EOS, while cooked samples according to CFS.

Thorough cooking can generally destroy most bacteria on raw meat, including pathogenic ones. In addition, pathogenic bacteria may be introduced into the ready-to-eat cooked meat through cross-contamination and multiply to larger amount as a result of time and temperature abuse of the food, causing foodborne illness in consumers (CFS, 2017). The obtained results were higher than that recorded by Ruban and Fairoze (2011) who found (chicken thigh and breast meat were 2.18×10^5, 6.7×10, 1.78×10^5 cfu/g, respectively) and nearly similar to that reported by Vural et al. (2006) (1.48×10^7, cooked chicken breast) and lower than that recorded by Saad (2011) ($4.78x10^5 \pm 0.96x10^5$, cooked chicken meat)and nearly similar to El- Taher Amna(2009) ($9.05x10^3 \pm 2.51x10^3$,cooked chicken meat), while APC of cooked beef samples was lower than that recorded by Kirralla-Ghada (2007) ($2.20x10^6$cfu/g), also lower than that recorded by Abd EL-Raheem (2013) ($5.4x10^6 \pm 0.33x10^7$cfu/g), while the result was similar to that recorded by Arab (2010) ($3.85 \times 10^3 + 1.27 \times 10^3$cfu/g).

Enterobacteriaceae count used to assess the general hygienic status of a food product and their presence in heat treated food indicates inadequate cooking or post processing contamination (CFS, 2014). It is also could indicates time/temperature abuse during handling or inadequate storage. As these microbial groups are safety indicators, the presence of high counts may indicate possible presence of pathogens (Jay, 2005).

The current results were lower than these obtained by Vural et al. (2006) (6.03×10^3cfu/g, raw chicken breast) also lower than that obtained by Capita et al. (2002) (1.9×10^3cfu/g) and it is shown that there is no Enterobacteriacae count in cooked chicken thigh & breast .

Coliform bacteria are associated with the intestinal tracts of humans and animals. Their presence out-side the intestines may be an indication of contamination with the fecal discharges of humans or animals (Worobo, 1999). Moreover, the highest Coliform count (cfu/g) in raw beef which indicate fecal contamination which may be due to bad personal hygiene. There is coliform in cooked samples and also in raw thigh, while coliform count in raw breast was lower than that recorded by Vural et al. (2006) (8.32×10^4cfu/g, raw chicken).

On the other hand, *Staph. aureus* is more incident in raw beef which may due to improper handling during slaughtering, evisceration and receiving. Cooked samples of chicken showed counts, and this is because recontamination of cooked meat by pathogens such as salmonella or staphylococci comes from the hands of the workers or from the equipment or utensils (Bryan, 1990). Staph. aureus failed to be detected in cooked beef samples and this agree with Mohamed (2000) who failed to isolate and detect *Stap. aureus* from any of the finished heat-treated beef products (ready-to-eat). Moreover, the incidence of Enterobacteriacae, Coliform, *Staph. aureus* and *E.coli* as shown in Table (2) was 80%, failed to be detected , 60, 73.33 in raw chicken thigh, 86.7, 80, 60 , failed to be detected in raw chicken breast, failed to be detected, failed to be detected, 33.33, failed to be detected in cooked chicken thigh, failed to be detected, failed to be detected, 33.33, 33.33 in cooked chicken breast, 75, 75, 20, 35 in raw beef and 35, failed to be detected, 20, failed to be detected in cooked beef. These results agreed with Mohamed-Amany (2014) and Eid and El sheikh (2007) who found that, the effect of boiling and frying as cooking methods reduce the initial count of *E. coli*.

5. CONCULSION

In conclusion, some served meat in university hostel may exposed to bacterial contamination as well as presence of some pathogens during different stages of preparation. Therefore, raw samples were the most contaminated ones and *Staph. aureus* was the most contaminant. So, to improve the hygienic status and safety of served food, certain policies must be applied for public health safety.

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