

ESCHERICHIA COLI AS A POTENTIAL PATHOGEN IN BEEF BURGER

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ABSTRACT

A total of 125 random samples of raw beef burger were collected from different localities in Alexandria Governorate 75 from super markets (25 each of three meat producing companies), 25 from butchers and 25 from small restaurants. All samples were examined for detection and enumeration of E. coli, results revealed that 45.7% of total examined samples were contaminated with E. coli. The highest incidence was among butcher's samples 64%. Also results investigate that 31.6% of positive samples were over the allowable limit of 10^2 /gram for E. coli.

- 10 selected burger samples with E. coli greater than 10^3 /g were collected and cooked to investigate the effect of heating on E. coli count result investigate 98% reduction percent in E. coli count due to sufficient cooking.*
- The sensitivity of isolated E. coli strains to different antibiotics was also discussed together with the public health significant of isolates E. coli strains.*

INTRODUCTION

A beef burger is a sandwich that consists of patty of ground meat that is fried, steamed, grilled, or boiled, and is generally served with various toppings inside a sliced bun. (*Edge and John, 2005*). Beef burger is liable to contamination from different sources during its production, handling, packaging and storage. Insufficient cooking also plays an important role in surviving of some pathogens. Coliform

organisms specially *E. coli* have probably received more attention than most other groups of pathogenic bacteria occurring in beef burger product owing to their importance as indicator species in routine analysis to ascertain the quality of this product and other meat products. Various diseases in animals and human are associated with different types of *E. coli* (**Brien et al., 1982 and Strockbine et al., 1986**) various strains of *E. coli* causes haemorrhagic colitis with mortality rate of 36% (**Riley, 1987**), and Haemolytic Uremic Syndrome (HUS) which causes long term kidney damages and death several years after (**Morrison et al., 1986**). *E. coli* O157 poisoning is called “Barbecue season syndrome” which often happens when people cook beef burgers on barbecue improperly. Its medical name is Hemorrhagic colitis (**Kenneth et al., 2002**). *E. coli* poisoning diseases costs their victims all over the world millions of dollars, (**Pritzker and Ruochonem, 2006**). Thus monitoring of beef burger for *E. coli* is needed to throw light on the hygienic quality of the beef-burger sold at the market.

MATERIAL AND METHODS

A total of (125) random samples of frozen beef burger sectioned into 5 groups (25 each) according to its source. Groups A, B are representing 2 of the biggest meat producing company. C (small meat producing company. D (butcher shops) and E (small restaurants). All samples were transferred to the laboratory with a minimum time of delay in an ice-box and examined microbiologically.

The collected samples were prepared for examination quantitatively for incidence of *E. coli* according to (**APHA, 1992**), to be counted by the most probable number technique (MPN/g) according to (**Banwart, 1979**). This technique was applied on Lauryl sulphate tryptose broth as selective

media (*ICMSF, 1978*), followed by confirmation on Brilliant green lactose bile broth. Positive culture were confirmed on selective agar media which was MaConkey agar. 5 typical pink pigmented colonies were picked from each sample and indole test was applied according to (*Kovacs, 1978*), methyl red test and Vogus proskeur test (*Macfaddin, 1976*), Citrate Utilization (*Simmon, 1926*). (10) selected beef burger samples with *E. coli* m.o. count of greater than $10^3/g$ were cooked to compare the number of *E. coli* in beef burger samples before and after cooking. Typical strains of *E. coli* were tested for its anti-biotic sensitivity by means of antibiotic discs which are Commercially available. As cephalosporines, Gentamycin, Tetracycline, Streptomycin, Ampicillin, Novobiocin. Isolates proved biochemically to be *E. coli* were subjected to serological identification in the Laboratory of Ministry of Health, Cairo, Egypt.

RESULTS

Table (1): Statistical analytical results of total *E. coli* count in examined beef burger samples.

No. of examined samples	Positive samples		Min.	Max.	Mean \pm S.E.
	No	%			
125	57	45.7	0.7×10	2.4×10^3	$3.8 \times 10^2 \pm 6.4 \times 10$

Table (2): Statistical analytical results of *E. coli* count in examined beef burger samples groups.

Group	No. of examined samples	Positive samples		Min.	Max.	Mean \pm S.E.
		No	%			
A	25	13	52	0.7×10	2.4×10^3	$4.1 \times 10 \pm 1.7 \times 10$
B	25	9	36	0.7×10	1.5×10^3	$3.6 \times 10 \pm 1.4 \times 10$
C	25	12	48	1.5×10	1.1×10^3	$2.4 \times 10^2 \pm 1.2 \times 10^2$
D	25	16	64	7.5×10	2.4×10^3	$6.5 \times 10^2 \pm 1.6 \times 10^2$
E	25	7	28	3.5×10	1.1×10^3	$2.3 \times 10^2 \pm 1.4 \times 10^2$

Table (3): Statistical analytical results of *E. coli* count in raw, and cooked beef burger samples.

Type of product	No. of samples	Positive samples		Min.	Max.	Mean \pm S.E.	% of reduction in the mean value
		No	%				
Raw	10	10	100	1.0×10^3	2.4×10^3	$1.2 \times 10^3 \pm 1.3 \times 10^2$	% 98
Cooked	10	4	40	0.7×10	3.5×10	$1.9 \times 10 \pm 0.6 \times 10$	

Table (4): Antibiotic sensitivity patterns for typical *E. coli* isolates.

Cephalosporine	Gentamycin	Sterptomycin	Tetracycline	Ampicillin	Novobiocin
+++	++	++	++	--	-

Table (5): Serological identification of the typical polyvalent *E. coli* isolates.

The isolates		The result of the polyvalent O	Classification of the species
No	%		
5	9.6	<i>E. coli</i> polyvalent O4	- Enteropathogenic class II - Enteroinvasive
52	90.4	<i>E. coli</i> polyvalent O3	- Enteropathogenic class I
Total	57	100%	

DISCUSSION

From the results achieved in Table (1) it is evident that *E. coli* was isolated from 57 (45.7%) of the total examined 125 raw beef burger samples, that indicates general high percentage of contamination among the produced beef burger samples at the market. This percentage is much more than obtained by *Iman (1990)*, *Yassien et al. (1998)*, *Marcela and Valeria (2003)*, *Stampi et al. (2004)* and *Hussien (2007)*. The mean value 380 cfu/g is much more than permissible limit of *E. coli* in beef burger product according to (*Egyptian Organization for Standardization and Quality Control, 2005*) and (*Canadian Food Inspection Agency, 2005*), and much more than the mean value administrated by (*Geoff et al., 2008*) which may unfortunately due to lower level of hygiene in producing our meet local product.

Results obtained from Table (2) reveal that the highest incidence of *E. coli* was among butcher shops (64%), that represents quiet high load of contamination among the hand made beef burger, which was much more than the results obtained by (*Cagney et al., 2004*), but it agrees with that obtained by (*Stampi et al., 2004*).

Results obtained by Table (3) reveal that that cooking temperature has caused 98% reduction of the *E. coli* total number in the examined samples. This result is nearly similar to (*Bryant, 2001*) and (*ETATS, 1997*).

Table (4) showed the high susceptibility of *E. coli* to Cephalosporines followed by moderate susceptibility to Gentamycin, Streptomycin and Tetracycline and little susceptibility to Ampicillin and Novobiocin such results nearly agree with that obtained by *Fontana and Bada (2006)* and *Aslam et al. (2006)*.

Table (5) results of the serological identification of positive *E. coli* isolates revealed that 9.6% of the isolates belonged to enteropathogenic *E. coli* class II, and enteroinvasive *E. coli* and 90.4% enteropathogenic *E. coli* class I such results show quite different from results obtained by (*Giono and Angles, 1994*) and (*Adwan and Adwan, 2004*) which may attributed to weather strains were more predominant in each locality.

The results of this work indicated that there is poor quality of the general beef burger processing and there is a gap in awareness of quality control measures all over the beef burger industry process with a concept that hand made products are the worst polluted ones, hence that normal cooking process temperature is a very efficient to almost elimination of *E. coli* in beef burger.

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الاشريكية القولونية كمرضعة احتمالية فى البرجر البقرى

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تم جمع 125 عينة من الهامبورجر المجمد من خمسة مصادر مختلفة من اسواق مدينة الاسكندرية ، كل مصدر يحتوى على 25 عينة وهم كالاتى: المجموعة الاول والثانية من شركات مصنعات اللحم الكبيرة والمعروفة . أما المجموعة الثالثة فهى لاحدى شركات مصنعات اللحم الجديدة بالنسبة للسوق حاليا. المجموعة الرابعة تعبر عن محلات الجزارة التى تقولم بتصنيع الهامبورجر بطريقة يدوية ، أما بالنسبة للمجموعة الخامسة والاخيرة فهى تعبر عن عينات نيئة من المطاعم الصغيرة والباعة الجائلين.

نظرا لاهمية تأثير الحرارة المستخدمة فى الطهى فى القضاء على ميكروب الاشريكية القولونية بنسبة كبيرة لهذا تم اختيار بعض العينات وعددها عشرة عينات وجد انها تحتوى على عدد اكبر من (310) ميكروب/جرام من الهامبورجر لتهيها فى درجة الحرارة المنزلية ثم إجراء اختبار العد ثانية لدراسة مدى تأثير الطهى الجيد على الحد من تواجد هذه الميكروبات.

وقد أسفرت الدراسة عن النتائج الآتية:

وجد ان نسبة تواجد ميكروب الاشريكية القولونية وصلت الى 45% فى العينات المختبرة وهى نسبة عالية لتواجد هذا الميكروب فى منتج الهامبورجر ، كما وجد ان اعلى معدل لتواجده بين الخمس

مجموعات كان فى مجموعة الجزائرين 64%. متوسط العد الكلى لميكروب الايشيريشيا كولاى كان 380

ميكروب/جرام أما بالنسبة لنتيجة العد بعد الطهي فقد وجد ان متوسط نسبة الاختلاف في العد قبل الطهي وبعده في العشر عينات المختبرة كان 98% وهي تعد نسبة جيدة كمؤشر لمدى تأثير هذه الحرارة في القضاء على الميكروب.

أسفرت نتائج قياس مدى حساسية ميكروب الاشريكية القولونية للمضادات الحيوية ان مضاد السفالوسبورين هو الاكثر تأثيرا يلية الجنتاميسين والاسترينومايسين والتتراسيكلين ويأتى النوفوبايوسين كأقل المضادات الحيوية تأثيرا على الميكروب.

تم تصنيف معزولات ميكروب الايشريشيا كولاي الناتجة عن الدراسة وتم ارسالها الى المعمل المركزى الخاص بوزارة الصحة بالقاهرة فظهرت فصيلة ال: انتيروباثوجينيك كلاس 1 ، انتيروباثوجينيك كلاس 2 ، الانتيروانفسيف وهي فصائل تسبب اعراض الاسهال واضطرابات الجهاز الهضى وارتفاع درجات الحرارة بسبب ما تفرزه من سموم.

وقد نوقشت أهمية الميكروب المعزول من الناحية الصحية كما نوقشت النتائج التي تم الحصول عليها وتم مقارنتها بنتائج الباحثين السابقين.