PRINT: ISSN 0970-9274 ONLINE: ISSN 2456-6608
JOURNAL OF HUMAN ECOLOGY
International Interdisciplinary Journal of Man-Environment Relationship

PRINT: ISSN 0970-9274 ONLINE: ISSN 2456-6608
J Hum Ecol, 56(1,2): 20-30 (2016)
DOI: 10.31901/24566608.2016/56.1-2.03

Phenotypic and Genetic Characterization of Sorbitol-Fermenting *Escherichia coli* O157: H7 Isolated from Retail Beef and Mince Beef

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KEYWORDS *E. coli* O157:H7. Shiga-toxin. 16S rRNA Gene. *rfbE*$_{O157}$ Gene. *fliC*$_{H7}$ Gene

ABSTRACT *Escherichia coli* occur as normal flora in the gastrointestinal tract of humans and animals. However, shiga-toxin producing *E. coli* and most especially serotype O157:H7 are a major group of food-borne pathogens. The consumption of undercooked contaminated food products of animal origin particularly beef has identified as a potential source for the transmission of these pathogens to humans. The aim of this paper was to determine the level of *E. coli* O157:H7 contamination in beef and mince beef samples obtained from some supermarkets and evaluate the virulence gene profiles of the isolates. A total of 128 beef and mince beef samples were collected from selected supermarkets and butcheries in the North West Province of South Africa. Samples were analysed for heterotrophic bacterial counts on PCA and potential *E. coli* O157:H7 counts on SMAC. Preliminary (oxidase test, TSI agar test) and confirmatory biochemical (API 20E, O157 and H7 serological assays, *rfb*$_{O157}$ and *fliC*$_{H7}$ PCR analysis) tests were used to identify *E. coli* O157:H7 isolates while the virulence profiles of the isolates were determine through amplification of the *stx*1, *stx*2, *eaeA* and *hlyA* virulence genes. Despite the fact that all the beef samples were contaminated with heterotrophic bacteria none of those from Ventersdorp and Rustenburg were contaminated with potential *E. coli* O157:H7. Beef samples from Swaartruggens had highest heterotrophic microbial count ($5.3x10^6$ CFU/mL) while those from Garankwa had the lowest level of contamination ($1.3x10^4$ CFU/mL). All (100 percent) the mince beef samples collected from the different sampling stations were contaminated with both heterotrophic and potential *E. coli* O157 bacteria. Mince beef samples from Potchefstroom, Rustenburg, Klerksdorp, Ventersdorp, Zeerust, Mafikeng, Swaartruggens, Vryburg, Bloemhof and Taung had very high levels ($1.8x10^3$ - $4.1x10^6$) of potential *E. coli* O157:H7 contamination. All the isolates from beef except for those isolated from Rustenburg and Ventersdorp as well as those from mince beef were Gram-negative rods. A large proportion (71.4 percent to 100 percent) of the isolates from both beef and mince beef were oxidase negative. Large proportions (92.9 percent to 100 percent) of isolates from beef as well as small proportions (14.3 percent to 42.9 percent) of those from mince beef fermented the sugars in the TSI medium. Small proportions (7.1 percent to 42.9 percent) of the isolates from both beef and mince beef produced gas and hydrogen sulphide from the TSI agar test. A total of 39 and 38 *E. coli* isolates were obtained from beef and mince beef samples respectively while a large proportion 27 (70.1 percent) of these isolates were positively identified as *E. coli* O157:H7 using a serological assay. Only 8 *E. coli* O157:H7 isolates were positively identified in the beef samples while large proportions (23) of the isolates from mince beef were positive for the *fliC*$_{H7}$ and *rfb*$_{O157}$ gene fragments. Among the isolates from beef, the *stx*2 gene was present in all the 8 isolates while only 3 isolates possessed the *stx*1 gene. Similarly, the *stx*2 gene was frequently (13) detected among the isolates from mince beef when compared to the *stx*1 gene. Putative virulence genes *hlyA* and *eaeA* were detected in 12 and 6 isolates respectively from mince beef. Six isolates from beef possessed both the *hlyA* and *eaeA* gene fragments. The findings of this study revealed that beef and mince beef samples obtained from some supermarkets in the area may pose severe health risks to consumers if they are not properly cooked before consumption.