Phenotypic and Genetic Characterization of Sorbitol-Fermenting

Escherichia coli O157: H7 Isolated from

Retail Beef and Mince Beef

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KEYWORDS

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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, rfbO157 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 stx1, stx2, 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 (5.3x10⁶ CFU/mL) while those from Garankwa had the lowest level of contamination (1.3x10⁴ 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 (1.8x10³ - 4.1x10⁶) 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 (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 rfbO157 gene fragments. Among the isolates from beef, the stx2 gene was present in all the 8 isolates while only 3 isolates possessed the stx1 gene. Similarly, the stx2 gene was frequently (13) detected among the isolates from mince beef when compared to the stx1 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.