Detection of Selected Bacterial Pathogens in Salad Vegetables and Home Based Measures for Ensuring Food Safety and Nutrition

Abstract

Raw fresh vegetables taken alone or mixed together as accompaniment with meal or single dish are known as salads. Salad vegetables are generally consumed without cooking or any other processing. Intake of salads known to reduce risk of non-communicable diseases and also have number of health benefits. However, salad vegetables sold in markets possess high risk of contamination. The present study was carried out to detect presence of common pathogens E. coli and salmonella in salad vegetables carrot, cucumber, radish and beet and to apply treatments of washing with water and peeling for reduction in contamination. The vegetable samples were obtained from markets of Amravati city, India. Standard procedures for bacterial analysis were followed. The results revealed that salad vegetables brought from different markets were detected contaminated with pathogens E. coli and salmonella. The findings supported the benefits of washing and peeling to reduce the microbial load. For nutritional benefits of consuming whole salad vegetables, instead of peeling, washing thoroughly with clean water is recommended.

I. INTRODUCTION

The nutritional value as well as safety of a food has utmost importance in health and wellbeing. Foods give nourishment to the body and supplies energy and nutrients like — protein, fat, carbohydrates, vitamins and minerals. Apart from nutrients, food provides...
number of functional components, for e.g. fibre which have established role in maintaining health and disease prevention. The quality of food is also determined by how safe it is for consumption. Contaminated foods possess health risk not only to person who consume it but also to others. Based on keeping quality, foods are broadly divided as perishable and non-perishable. Vegetables (except roots and tubers), fruits, milk and milk products and flesh foods are categorised as perishable whereas cereals, millets, pulses, legumes, nuts, oilseeds and condiments as non-perishable foods.

A vegetable generally described as a plant or part of plant used as food. Vegetables are rich in nutrients like vitamins and minerals, fibre and phytochemicals. Salad is a term broadly applied to many food preparations that have a mixture of chopped or sliced ingredients which may be mainly vegetables. Vegetable are widely exposed to microbial contamination through contact with soil, dust, water and by handling at harvest or during post-harvest processing therefore harbour a diverse range of microorganism including plant and human pathogen (Carmo et al, 2004). Enteric pathogens such as Escherichia coli, salmonella and shigella are among the greatest concerns during food-related outbreak (Buck et al, 2003).

Tambekar and Mundhada (2006) analysed different salad vegetables from Amravati city. Among the pathogens isolated, Escherichia coli was found to be predominant followed by pseudomonas spp., Staphylococcus aureus and Salmonella spp. observed on all samples of salad vegetables. The study revealed the potential hazards of street vended salad vegetables and recommended vigorous washing of vegetables with safe running water before consuming to reduce the number of microorganism.

Shobha (2014) examined 75 samples of vegetable and fruits from Bhopal city and various pathogens were isolated and identified. Among them E.coli was found to be pre-dominant followed by Enterobacter, staphylococcus, salmonella and shigella sps. The treatment with antimicrobial agents was found suitable for eradicating pathogenic bacteria from these produce after rinsing by them.

Ankita Rajvanshi (2010) evaluated bacterial load on street vended salad in Jaipur city. Viable bacterial count on the surface of salad was studied after imposing following main and sub treatments. Main treatments were (i) Washing with ordinary tap water and (ii) Washing with warm tap water (40 Main °C). The sub treatments were (i) Peeling and (ii) No peeling. The results indicated that washing with warm water is superior over ordinary tap water washing. Peeling also reduced the bacterial load over no peeling treatment.

Various treatments are applied to salad vegetables to reduce the microbial load and make them safe for consumption. Commercially, some chemicals are used as antimicrobial agents. Home based simple and cost effective treatments include soaking and washing with clean water, removing outer layer known as peeling, rubbing surfaces with common salt, etc. The present study was taken up with the objectives – to detect presence of pathogens E. coli and salmonella on selected salad vegetables, to apply treatments of washing and peeling to reduce the contamination and to suggest suitable treatment from food safety and nutrition point of view.
II. MATERIALS AND METHODS

A. Study Area and Sample collection – The study was conducted in Amravati city, state of Maharashtra, India. The samples were procured from well-known crowded local vegetables markets namely, Itwara, Rajapeth, Chaprasipura and Gadgenagar. The vegetables were sold in small kiosks but majorly on street sides. Total 16 samples, 4 each of carrot, cucumber, radish and beet were obtained from these markets in sterile bags and then transferred to the laboratory for sample analysis. The samples were analyzed within two hours of procurement.

B. Treatments - Washing and peeling were the treatments given to the samples. The samples were washed with sterile distilled water and peeled with peeler with precautions to avoid further contamination. All the salad vegetable samples were analyzed before and after treatments.

C. Sample Analysis – The samples were screened for the presence of pathogenic bacteria. Isolation and identification of bacterial pathogens – E. coli and Salmonella was carried out by conventional methods based on the use of selective media such as MacConkey Agar and Bismuth Sulfite Agar respectively followed by their identification with gram staining and biochemical tests as per standard protocol.

III. RESULTS AND DISCUSSION

According to Rodey, Escherichia coli is normal inhabitant of the intestinal tract of human but many strains can cause acute diarrhoea in infants and adults. They are present in the human and animal intestine and are excreted in faeces. The incubation period is twelve hours to two days and the symptoms include cholera like illness or a dysentery like syndrome with fever chills, profuse watery diarrhoea with mucous and blood and colitis.

Table 1: Presence of E.coli in salad vegetables

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<thead>
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<th>Source</th>
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<th>Washing Treatments</th>
<th>Peeling</th>
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<td></td>
<td>CA     CR RA BE</td>
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<tr>
<td>Gadge Nagar</td>
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<td>Rajapeth</td>
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<td>Chaprashi Pura</td>
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<td>Itwara</td>
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CA = Carrot, CA = Cucumber, RA = Radish, BE = Beet; Present = +, Absent = -

Table 1 depicts that out of 16 samples of salad vegetables 13 (81.25%) samples were found to be infected with E.coli. All the salad vegetables samples brought from Rajapeth market indicated presence of E.coli. Samples of carrot from Gadge Nagar and Itwara market and radish from Chaprashi pura market showed no presence of E.coli. The presence of E. Coli, as indicator organisms indicates faecal contamination of these vegetables. After washing
and peeling treatments, pathogen E.coli was found to be highly reduced. For washing it was 3 in 16 samples, for peeling 1 in 16 samples. So it can be said that the treatment of washing and peeling were effective to reduce presence of E.coli in salad vegetables.

Salmonella is the commonest cause of bacterial food-borne disease and the most serious. Organism of salmonella group causes an infection in the intestine. Illness occurs when living organism is allowed to multiply in food then infection can results. Incubation period is twelve to 24 hours and the duration of illness is from one to seven days. Symptoms include abdominal pain, chills, fever, vomiting, dehydration, enteritis or local infection may also occur, watery, greenish, foul-smelling stools. (Rodey, S.)

Table 2: Presence of salmonella in salad vegetables

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For the presence of salmonella, it is observed from table 2 that out of 16 samples of salad vegetables, 10 (62.05%) sample and all the samples of radish were found to be infected with Salmonella. After washing and peeling treatments, the presence of salmonella was detected to be reduced significantly as 2 in 16 samples, 1 in 16 samples respectively. Both the treatments seen to be effective in minimizing the pathogen.

The results indicated the contamination of salad vegetables bought form different markets. Observation of these markets revealed unhealthy surroundings, exposure to dirt, dust and unclean water sprinkled to keep vegetables fresh, passing of stray animals in the close vicinity and unhygienic handling by the vendors. Contamination of salad vegetables with pathogens E.coli and salmonella was also reported by Tambekar and Mundhada (2006) Aboh Itohan et al., (2011) and Shobha Shrivastava (2014).

From nutrition point of view, salad vegetables brings many health benefits that they lower individual’s risk of chronic diseases as well as good for bowel functioning. When eaten in right amount, salad vegetables give feeling of fullness while eating fewer portions of other foods. So they accelerate weight loss in obese people by cutting down the calories. These benefits are exerted by the fibre present in it. Evidences shows that high fibre diets lower blood pressure and serum cholesterol levels. It also lowers risk of developing cardiovascular diseases (Anderson, 2004), diabetes (Montonen et al., 2003), some cancers and other non-communicable diseases.

Peels of salad vegetables contains major portion of fibre than whole and substantial amount phytochemicals. However, being outermost layer, they get contaminated easily making unsafe for consumption. Finding of this study supported the fact that peeling of the salad
vegetables greatly reduces the contamination making them safe for consumption but on account of loss of fibre and phytochemicals. Considering food safety and nutritional benefits together, it is suggested to wash the salad vegetables thoroughly with water to reduce the contamination. Rubbing or brushing while washing with water reduces microbial load significantly. Kilonzo et al., (2006) found the same effect by soaking vegetables in water and rinsing after it.

IV. CONCLUSION
Salad vegetables carrot, cucumber, radish and beet were detected contaminated with pathogens E. coli and salmonella. The findings supported the benefits of washing and peeling to reduce the microbial load. For nutritional benefits of consuming whole salad vegetables, instead of peeling, washing thoroughly with clean water is recommended.

V. REFERENCES

TO CITE THIS PAPER