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FOOD SAFETY MONITORING AND SURVEILLANCE SYSTEM FOR SRI LANKA

THE GLOBAL PERSPECTIVE ON FOOD SAFETY AND FOOD BORNE ILLNESS

Food safety creates major public health issues worldwide. Food borne illnesses are common, costly, and a so far preventable public health problem. The food borne illnesses are defined as diseases, usually either infectious or toxic in nature, caused by agents that enter the body through the ingestion of food or water (WHO: Fact sheet N°237, 2007). These contaminations in food and water can create an enormous social and economic burden on a society and their health system in both developed and developing countries such as Sri Lanka. When foodborne illness is considered both biological and chemical agents are involved. The estimated reported global burden of foodborne illness is caused by 31 bacteria, viruses, parasites, toxins and chemicals (WHO, 2016). The commonly identified biological agents are *Campylobacter spp., E.coli O157:H7, Listeria monocytogenes, certain serotypes of Salmonella enterica, Shigella spp, Clostridium botulinum*, *Staphylococcus aureus, Norovirus, Toxoplasma gondii* and foodborne trematodiases (WHO: Fact sheet, 2016).

It has been reported that globally there are nearly 1.7 billion cases of diarrheal disease every year and this kills around 760 000 children under the age of five years (WHO: Fact sheet N°330, 2013). A great proportion of these cases can be attributed to contamination of food and drinking water. Developing countries such as Sri Lanka also bears the brunt of the problem due to the presence of a wide range of foodborne diseases.

PREVAILING STUDIES AND KNOWLEDGE GAP ON FOOD BORNE PATHOGENS AND ITS IMPACT

Passive surveillance studies have being carried out in Sri Lanka regarding the identification of food borne pathogens. In Sri Lanka most frequent were diarrheal diseases caused by *Campylobacter* spp., and Norovirus. In 2012, a total of 4003 clinically confirmed human cases of foodborne illnesses were reported. Among those, the majority were young children below 9 years of age (Annual Epidemiological Bulletin, 2012). In a study conducted in 2012 it has been found that the prevalence of *Bacillus cereus* was 56 % in Chinese style fried rice that was available in Colombo city. The organism was responsible for causing the symptoms of diarrhea and vomiting. The identified risk factors in that study were storage of boiled rice at room temperature for more than forty eight hours and the cooking frequency (Perera and Ranasinghe, 2012). Toxigenic *Aspergillus* species, Aflatoxin B1, Aflatoxin G1 have been also identified in parboiled rice and raw milled rice due to the increased storage time and the storage method (Bandara *et al.,* 1991a, Bandara *et al.,* 1991b). Ocratoxin has been identified in the consumable food samples in the North Central Province of the country (Wanigasuriya *et al.,* 2008).

Fish collected from the Negombo area and distributed in suburbs of Colombo had been positive for the presence of *Escherichia coli*, *Salmonella* spp and *Listeria monocytogenes* along the different steps of the supply chain such as at the boat, the ice manufacturing plant and at post-harvest handling. Fish is important in the context of contamination as it is easily perishable (Ariyawansa *et al.,* 2016). *Salmonella* species have been identified in both captured and cultured shrimp at a prevalence of 12.8 % in a study conducted in 2008. A *Salmonella* infection could results in nausea, vomiting and abdominal cramps (Kamalika *et al.,* 2008). In dried fish from the markets in Kandy area the presence of different fungal isolates including *Aspergillus niger* and *Aspergillus flavus was shown* (Atapattu and Samarajeewa, 1990). Traces of heavy metals such as Ca, Cd, Cu, Fe, Hg, K, Mg, Mn, Na, P, Sr and Zn have also been found in Tilapia reared in the water reservoirs. The standards were below the international recommended levels during the year 2009 (Allinson *et al.,* 2009).

Rajasooriya *et al.,* (2002) have conducted a study on ground water quality at one region of Valigamam and identified a large proportion of wells having high level of nitrate which exceed the WHO standard due to intensive agriculture practices through high inputs of artificial and natural fertilizers. However, this water is used for different farming practices and also in the farmers' houses. The possible contamination of fecal coliforms in drinking water resources in Jaffna area has been documented (Muralithas *et al.,* 2011).

Foodborne illnesses are of major concern in the YOPI (Young, Old, Pregnant and Immunosuppressed) group of people because of the reduced immunity levels (Havelaar *et al.,* 2015, Barbuddhe *et al.,* 2012, Kirk *et al.,* 2015). In 2014 the annual health bulletin of Sri Lanka had indicated 1072 cases of typhoid fever were reported and 27.6 % was found in the age group of 5-14 years old. The number of dysentery patients was 4832 cases (33.7% were children 1-4 years) and 2056 viral hepatitis cases (27.6% were 5-14 years).

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Some pathogens that are reported from food borne illness cases emerge as multi drug resistance type and this cause further challenge to control the disease (Garedew *et al.,* 2015; Routh *et al.,* 2015; Liu *et al.,* 2013).

Continuous screening and monitoring of antimicrobial susceptibility in bacteria from any animal or plant originated food is extremely important to ensure the betterment of global public health and economy as well. The Food Microbiology Laboratory at the Department of Veterinary Public Health & Pharmacology, Faculty of Veterinary Medicine & Animal Sciences, University of Peradeniya, Sri Lanka has been participating in studies on antimicrobial resistance and residues of animal originated food, through the World Health Organization (WHO) program of External Quality assurance System (EQAS) since 2005. However, these program activities are able to produce a glimpse of what is the real situation of antimicrobial use, antimicrobial resistance, and antimicrobial and other chemical residues in water, plants and animal originated food in Sri Lanka. The WHO has also established the Foodborne Disease Burden Epidemiology Reference Group (FERG) in 2010 in which Sri Lanka collaborated (Havelaar *et al.,* 2015).

The annual health bulletin of Sri Lanka in 2014 reported the leading 11th cause of hospitalization was intestinal infectious diseases (128,733 cases) and 9th cause among the leading cause of hospital deaths. In year 2014 the ministry allocation for health was 162 billion rupees. This is mainly spent on recurrent and capital expenditure. The amount spent on recurrent expenditure was 77 % (Sri Lanka National Health account 2005-2009). The main part is spent on curative health which is for the inpatient and outpatient care. The percentage spent on inpatient/ hospitalized patients was 95% from the recurrent expenditure (Public hospital governance in Sri Lanka, 2015). From this the percentage spent on gastrointestinal patient (total number of GIT infectious disease people/ total number of hospitalized patients) was around 2%. This accounts for 2.37 billion rupees.

In Sri Lanka, Central Food Control administration comes under the purview of the Ministry of Health. The Food Act no 26 of 1980 enables the legal authority regarding the manufacturing, storage, sale and distribution of food in the country. This is antecedent and how well it addresses the existing need of the country is of concern. When recent past is considered there is an increasing trend towards food borne illnesses and the public interest stirrup occasionally with frequent news bulletins. The passive surveillance research already conducted in Sri Lanka has not yet been adequate to fulfill the requirement of preventing the economic loss that had been occurring in the country. Therefore more scope remains for the research activities in the area of food safety.

There are numerous successful stories where food borne illness has been successfully controlled by strengthening the surveillance system in both European and Asian countries such as Denmark, Thailand and Malaysia (INFOSAN 2014/ 2015;, Pulse Net 2016).

RISK ANALYSIS AND THE NEED OF FOOD SAFETY MONITORING AND SURVEILLANCE SYSTEM IN SRI LANKA

The world-wide practiced approach for the identification of food borne illness is the systematic risk assessment at every step involved to rule out or rule in the suspected cause. The risk is defined as the probability of occurrence of an undesired event and its consequences. The food borne pathogen can be chemical, biological and physical in nature (Codex Alimentarius, 2010).

Sri Lanka is in need of an active surveillance system to reduce the disease burden. The country can learn from these examples and adopt according to its requirements. The world practiced approach for monitoring food safety through systematic surveillance at each step along the food chain is briefly explained.

Once a suspected case of food poisoning is reported there may be different culprits such as the environment or the food handlers but most of the time it is directed towards the food itself. In the ideal situation the samples will be examined from all the suspected routes of entry. This will be conducted via microbiological testing whether to rule in or rule out each cause. When the food hygiene is considered, it involves sequential steps from farm to table. The procedure can be categorized as pre-processing stages and post- processing stages.

If meat production is considered the preprocessing stage involves the sequential steps starting from the farm environment, animal feed, animals on farm, transport to the market or lairage, from there to abattoir and processing. The post processing stage involves storage and retail, domestic trade and retail catering to the consumers. All along the chain there are numerous routes from where the introduction and the transmission of pathogens could take place. If the chemical agents are considered it can be heavy metals, pesticides, veterinary drugs and growth promoters, preservatives and additives. The biological agents are bacteria, virus and parasites that are from water, soil and animal cross contamination.

The OIE risk definition is mainly concerned with the international product import and export. The risk is defined as "The likelihood of the occurrence and the magnitude of the consequences of an adverse event to animal or human health in the importing country during a specified time period". Here we are concerned with the local consumption and this should be identified as the likelihood of occurrence and the magnitude of consequences of adverse event to animal/ human health during the specified time period. According to OIE, Risk assessment is "A systematic way of gathering, evaluating, and recording information leading to recommendations for a position or action in response to an identified hazard (hazard=food borne illness)".

According to the Codex alimentarius, risk assessment is "the identification of biological, chemical and physical agents capable of causing adverse health effects and which may be present in a particular food or group of foods".

The risk assessment consists of 4 steps: (i) release assessment, (ii) exposure assessment, and (iii) consequence assessment and (iv) risk estimation.

With regard to food of animal origin at the release assessment step the veterinarian plays the key role. Release assessment is the releasing of pathogenic organism to the environment from the source. This step identifies the point where the pathogenic agent had entered the food chain both at pre-processing and the post-processing. Pre processing stages are in the farm where apart from pathogenic organisms, the drug residues, fungal toxins and heavy metals can enter the food chain. The releasing factors can be categorized as biological, country and commodity factors. The post processing stage involves first meat inspection.

Exposure assessment expresses the biological pathways necessary for exposure of humans to the hazards (biological or chemical) released from a given risk source i.e. the frequency of contamination of a food by an agent and its level in the food over time before consumption. It should be considered although the pathogenic organism can be present at one step, at another step it can be completely destroyed by cooking at a higher temperature or freezing at a lower temperature.

Consequence assessment describes the adverse health consequences that may arise as a result of being exposed to such biological or chemical agent. As indicated earlier, causing nearly an estimated amount of Rs 2.37 billion loss and 128,733 cases per year, the foodborne illnesses trigger considerable losses to the economy and the health of the people of the country. Apart from the direct financial loss there is the associated socio-economic loss. The socio-economic impact of the diseases relates to the loss of manpower to the government and/or the private sector, and to the family of the person as a result from being sick. This is calculated by the disability adjusted life year (DALY) which is based on the loss of number of years due to the disease burden (ill health and death).

Based on the results of the risk assessment the risk estimation is done qualitatively or quantitatively. Qualitative risk assessment is carried out by developing the risk matrix where the ultimate risk is categorized as high, medium and low. Quantitative risk assessment is carried out by deterministic or stochastic models.

Once the risk is identified it should be managed to an acceptable level. This is instigated by awareness, policy making and creating standards. At international level for importation of food products it is essential to achieve Food Safety Objectives (FSO) and follow Good Hygiene Practice (GHP) /Good Manufacturing Practice (GMP). Considering the local market, the created standard should be able to provide appropriate level of consumer protection. Special attention should be paid at the local market since Sri Lanka is becoming a popular tourist destination.

In USA, CDC has announced that by reducing the food related illness by 10%, the Americans have reduced 5 million people getting sick every year. From the consumer aspect they should be encouraged to buy the products that are certified and that can be traced back.

In conclusion the need remains for implementing a proper food safety surveillance system in the country with a multi-disciplinary approach at every step involved. With the present economic growth rate of Sri Lanka of 6.2%, the purchasing ability of general public is improving and the need for quality food products will be in demand. This will create a suitable environment for such organized systems. The government should be made aware of the role of veterinarian in this context. Further, the research capacity should be strengthened as to address how the system can be improved to meet the gap between the public health challenges and preventing the economic losses to the country.

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