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# Food Borne Health Issues and Their Relevance to Pakistani Society

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**Abstract**

Food borne illness is a common issue of Pakistan like other developing countries. They transmit either through microbial contamination or by chemicals exposure. Among them the microbial food borne outbreaks are of wide range and abundant. Most common pathogens are *Campylobacter* spp., *Toxoplasma gondii, Salmonella* spp., *Listeria monocytogenes* and norovirus. In addition to that, there are various routes of toxic chemicals exposure during food preparation, storage and handling due to over all unhygienic conditions and lack of awareness. As outcome, excluding some leading brands of readymade food items, consumers are bound to avail such contaminated victuals as fresh produce and also in prepared form. In the current review, it was noticed that an urgent sound mechanism is required at government and consumers level to check and control this serious food mishandling to avoid loss of food resources, potential and of national economy.

***Keywords:*** Foodborne illness; microbial contamination; unhygienic conditions; fresh produce; readymade food items.

## 1. Introduction

Food borne illness is referred to as that group of disorders which occur due to intake of either microbial or chemically infected food stuff. They can also transmit even through infected water, utensils and by eater's own hands. Food related diseases are more common in third world countries than the developed ones. But it does not mean that any regain of the world is free from such disorders [1]. There are various general symptoms of food related disorders but frequently it is detected by the malfunctioning of GIT.

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With the help of scientific progress, now a day's every country is trying to reduce food bore health issues by improving hygienic conditions either of food to be presented to the consumer or by creating awareness among the masses about healthy food. Alike other parts of the world, food related diseases are also root cause of illness in Pakistan and a number of cases are frequently reported here. In the current review, a small effort has been done to present a bird eye view of Pakistan's major food borne issues, their sources and various factors which enhance them yet, in this region of world.

Various food borne diseases are quite common in Pakistan like different forms of hepatitis, typhoid, animal contact diseases, influenza, and aerosolized dust along with soil contact diseases etc [2]. No doubt, their root causes and mode of infection vary from disease to disease but basic sources of food borne illness dispersal in Pakistan are unhygienic conditions, absence of food standards, poor sanitation, poverty and illiteracy in addition to lack of awareness. Approximately half reported cases are those who are unable to avoid the above mentioned root causes so people are bound to use such sub standard food stuff. Thus our society needs preventive measures at commercial level to upgrade food quality and parallel to this, same serious approach is required to condemn water borne disorders. Because food can initiates epidemics and serves as growth substrate for bacterial and other food poisoning causing agents. The advanced nations employ elaborate food preparation standards, whereas, in third world countries still root cause of foodborne diseases is unavailability of safe water [3].

Among different frequently reported food borne health issues, it is found that microbial ones are more common than those originate from chemical sources. In addition to that it was also observed that pesticide sprays have potential to transmit HVA and Salmonella through consumption of fresh products. Because such sprays are based on water and due to utilization of such water which is already contaminated with sewerage and other effluents, ultimately transfer pathogens to fruits and vegetable along with pesticide sprays [4]. Similar results were also obtained by Verhaelen and coworkers [5] that excess application of pesticides can be source of norovirus transmission in humans through fresh produce.

Moreover, recently estimation of food borne illness was done and it was noted that most (58%) infections were caused by norovirus, followed by nontyphoidal *Salmonella* spp. (11%), *Clostridium perfringens* (10%), and *Campylobacter* spp. (9%). Foremost reasons of illness in admitted patients in hospitals were nontyphoidal *Salmonella* spp. (35%), norovirus (26%), *Campylobacter* spp. (15%), and *Toxoplasma gondii* (8%). Major reasons of raised mortality rate were nontyphoidal *Salmonella* spp. (28%), *T. gondii* (24%), *Listeria monocytogenes* (19%), and norovirus (11%) [6].

Now days, food borne illness are rising due to eating fruits and vegetables. No doubt, they are beneficial to human health but also serve as career for various toxic contaminants. Two such hazardous sources are human pathogens (e.g., *Salmonella, E. coli*) and agricultural pesticides (e.g., organophosphates, carbamates). They are commonly found due to lack of proper food handling and preparation. They contribute to an array of illnesses, including acute gastroenteritis, organ failure, arthritis, and heart disease. In addition to it, agricultural pesticide exposure can result in dizziness, nausea, abdominal cramps, diarrhea, tremors, anxiety, confusion, neurological disorders, developmental and reproductive disorders, and even death. Similarly, sea food may be a vector for transmission of pathogens (e.g., *Vibrio* spp.), heavy metals (e.g., mercury) and other toxins (e.g., dioxin).

Chronic mercury poisoning due to seafood intake results in a neurological and psychological symptoms, including tremors, motor/cognitive dysfunction, and memory loss. While exposure in uterus can cause serious lifetime illness, including mental retardation, sensory loss, developmental delay, cerebral palsy, and seizures [7].

The food borne outbreaks which are frequently observed; among them, *Salmonella* is considered the most common pathological agent and restaurants are the most probably the setting places where foods are cooked to serve [8]. Similarly, in Pakistan with over all change in life patterns, eating trends are also transforming and people has started to prefer readymade food stuff to minimize budget and for saving of time and resources. Moreover, it was recently reported that Street vended food has become a major source of masses health problems and directly concerned to people. Main leading ways to microbial entrance in food are the kitchens, utensils used for cooking and serving, raw food, time and temperature imbalance use for edible items and the poor hygienic state of vendors. Several studies explored the causes of food borne diseases concerned to street foods, may be the pathogens of the genera *Bacillus, Staphylococcus, Clostridium, Vibrio, Campylobacter, Listeria* and *Salmonella* are common. Recently, it was noticed that Listeriosis results in septicemia in humans, animals and birds. It occurs less frequently and sporadic in poultry but if develops then leads to intestinal colonization of poultry and its causative agent is found in feces of ruminants. In this cycle, human indirectly receives infection from raw broiler contaminated meat due to *Listeria* and standard states of its processing vicinity. Therefore, awareness the poultry handlers and its consumers related to such issues is required [9]. In short, implementation of proper evaluation methods required to ensure public health and safety [10].

## 2. Types of food borne illness

Basically food borne diseases are classified in to two major groups which are as follows:

- Microbial infections
- Diseases due to chemicals

But above mentioned forms have further much branches and modifications which are as under:

### *2.1 Microbial infections*

In the light of different reported cases, there are a variety of sources for microbial diseases in third world countries like in Pakistan. As In 2007, Hussaina and colleagues [11] reported the prevalence of *Campylobacter* in different food items like meat and milk in Pakistan. As an outcome, among meat samples, the highest prevalence (48%) of *Campylobacter* was observed in raw chicken meat than in raw beef (10.9%) and raw mutton (5.1%). In this regard, among other food stuffs, vegetable/fruit salad (40.9%), sandwiches (32%), cheese (11%) and raw bulk milk samples (10.2%), exhibited the leading risk rates. Similarly, Fowoyo [12] reported air microflora contamination in ready to eat food. The found bacterial species were *Bacillus subtilis, Micrococcus spp., Staphylococcus aureus, Salmonella spp., Shigella spp.*, and *E. coli.* From vended food samples, the obtained fungal species were *Aspergillus spp., Penicillium spp.,* and *Mucor spp.* Furthermore, in the following table some major microbes are mentioned here under along with their infection targets [13].

**Table No. 1:** Leading food borne illness causing microbial agents

| **Parasites** | **Enteric pathogen** | **Sites of infections and Toxins** |
|---|---|---|
| *Ancylostoma duodenale* | Adenovirus | **Elementals contaminants**<br><br>Lead, mercury, cadmium, manganese, arsenic |
| *Angiostrongylus cantonensis* | *Aeromonas spp.* | **Mycotoxins**<br><br>Aflatoxins, ochratoxin, fumonisin, trichothocenes |
| *Angiostrongylus costaricensis* | Astrovirus | **Food additives**<br><br>Sulphites, nitrites/nitrates, benzoic acid |
| *Anisakis simplex* | Bacterial toxins (*B. cerus*) | **Pesticides**<br><br>Organophosphates, carbamates, DDT, pyrethrins |
| *Ascaris lumbricoides* | Bacterial toxins (*C. perfringens*) | **Organic industrial contaminants**<br><br>Persistent organic pollutants |
| *Blastocystis hominis* | Bacterial toxins (*S. aureus*) | **Veterinary drugs/residues**<br><br>Antibiotics, hormones - but not antimicrobial residues |
| *Capillaria philippinensis* | *Brucella sp.* | **Seafood toxins**<br><br>Tetrodotoxin, ciguatera, shellfish toxins, DSPs, PSPs, histamines |
| *Clonorchis sinensis* | *Campylobacter sp.* | **Process contaminants**<br><br>Acrylamide, PAHs, choropropanol |
| *Cryptosporidium spp.* | *Clostridium botulinum* | **Allergens**<br><br>Peanuts |
| *Cyclospora spp.* | Enteroaggerative *E. coli* (EAggEC) | **Natural toxicants**<br><br>Cyanide in cassava, aminoglycosides |
| *Dicrocoelium dendriticum* | Entero-pathogenic *E. coli* (EPEC) | **Radionuclides and depleted uranium** |

Moreover, there are many other causes and media of transfer of food borne microbial illness. Still it is not possible for consumers to avoid them due to various reasons like lack of individual and collective efforts. Major such unavoidable sources of microbial contamination are:

### *2.1.1 Water*

It has been noticed that during food preparation, the use of water is essential. But in case of contamination, the use of such water like in food processing and cooking, drinking and in utensils washing, may raise suddenly the risk of food borne illness. Water is renowned medium of transmission for enteropathogens such as *E. coli, Salmonella* spp. and *Campylobacter* spp. amongst others [14-18]. Studies from various zones of Asia, Africa and South America have recurrently revealed the lack of safe water for food cooking and serving. Due to the poor availability of hygienic potable water, many vendors prefer to reuse it, especially for cleaning utensils and the reported evidences revealed the bacteriological quality of the used water and repeated contamination due to different coliforms was noticed [19-21].

### *2.1.2 Utilization of low grade raw materials*

To get more economic benefit, some vendors and restaurant management use cheap and adulterated ingredients containing unpermitted chemical additives from unauthorized sources which may enhance more, the prepared foodstuff associated risks. Moreover, raw meat, poultry and vegetables are usually contaminated with a variety of bacteria, including potential food borne pathogens such as *B. cereus, C. perfringens, C. jejuni, E. coli, L. monocytogenes, Salmonella* and *S. aureus* [22, 23]. Spices are considered to carry great amount of members of the genus *Bacillus*, anaerobic sporeformers, enterococci, and of Enterobacteriaceae, various yeasts, moulds and pathogens like coagulase positive staphylococci. The spices have found to serve as spore carriers and eventually may also cause food poisoning [24-26]. These spore formers in spices, if survive even during the heat exposure then later on reproduce, on availability of optimum conditions [25, 27]. Similarly, pathogens like *B. cereus, S. aureus, C. perfringens, V. metschnikovii* and *E. coli* were reported in raw meat and in a number of vegetables. Their presence may be before purchasing by consumer or after cross contamination at some point in food handling and during preparation [28]. Recently, it was also noticed that Poultry meat is nutritionally dense and commonly use in Pakistan. However, chances of poultry meat contamination by food borne pathogenic microorganisms are always elevated during slaughtering, processing and marketing [29].

### *2.1.3 Role of utensils*

Utilization of appropriate utensils for cooking and storage of prepared food is often important to the safety of available food items. Low quality of food stuff due to unsafe handling may result to toxin formation, pathogen growth and recontamination. The shape, texture and hygienic state of equipments and utensils are significant to food safety. Unhygienic pots may be a source to buildup residues of victuals, microbial growth and ultimately of contamination. Thus suitable selection of utensils can hinder the cross contamination from raw materials [30].

Moreover, it has been investigated that the serving utensils at the retailing site are often contaminated with *Micrococcus* spp. and *Staphylococcus* spp. Due to early exposure of the sellers' contaminated hands, areas,

dishcloths, from dish washing water and from points of cross contamination among dishwater, food preparation surfaces, and the food itself [31, 32].

It is stated that used dish washing water and its other sources may adhere pathogens to the utensil surface and can represent a risk in the food selling. Microbiological analysis of utensils surface and knives have detected the presence of *Salmonella* and *Shigella* [21]. Another report supported the same results that during the preparation of food, when the raw material is cut and chopped repeatedly by single knife devoid of cleaning serves as vector for contamination of flies' fecal matter, dirt and other pathogens [31].

#### *2.1.4 Ignorance of hygiene*

It's a serious issue that most handlers of street food in the developing are ignorant of basic food safety measures yet. Consequently, for example, street food stuff is commonly exposed to various contaminants at different stages of handling [10]. In this regard, rapidly spreading species are *Escherichia coli*, *Bacillus* species, *Neurospora* species and *Aspergillus niger*. These findings point out that roadside roasted victuals and other uncovered foods are contaminated by the polluted environments. Their excessive intake can increase the level of heavy metal contamination in the body which may affect the health of the consumers. Likewise, most of the vendors cannot afford to rent a shop due to the economic situation of the country, and they preferred to stay by the roadside mostly close to the drainage in order to be near to passers- by or consumers of their foods or wares. The wire gauze used in preparing the samples contaminate the sample in two ways, the cast iron wire gauze rusts easily on contact to moisture leading to chemical contamination while accrual of dirt on the wire gauze leads to microbial contamination [33].

### *2.2 Chemical contamination*

There are various sources of chemical contamination in food stuff and frequently observed ones are:

#### *2.2.1 Leaching of container*

It has been observed that some improper containers leach perilous chemicals like copper, lead and cadmium into food, so utilization of such harmful containers should be rejected. In this regard, predominantly reported cases are of acidic food and beverages [34]. So it is highly serious issue and due to lack of awareness food handlers use any sort of containers. It is common practice in Pakistan to reuse industrial poisonous chemicals containing containers in food handling without proper sterilization and treatment. Similarly, use of plastic bags is still in practice here and a large percentage of people are unaware of its carcinogenic nature.

#### *2.2.2 Pesticides*

Now days, overdosing of pesticides and insecticides in third world countries are causing various health issues in consumers. Their main medium of transmission is raw vegetables and fruits. It is common observation that firstly, there is no proper system and check of raw food washing before entering in to market and secondly, consumers also lack awareness of hygiene, harmful effects of various pesticides and health safety. As Gil and

coworkers [35] in 2013 reported methomyl pesticide intoxication and it was observed that after eating pesticide containing beans patients showed toxicity symptoms as chest tightness, unusual stomach sensation, dizziness, and ataxia and finally died.

In another case, methanol ingestion was reported and it was found that after 3-5minutes of infected meal intake, methanol intoxication symptoms started like depression, headache, dizziness, nausea, confusion and coordination disturbance even after 1-2hrs death was reported too [36]. Similarly, agricultural lands contamination due to pesticides and antibiotics is a challenging dilemma that is demanding our attention. Whereas, honey is globally consumed not only as food but also as medicine and its contamination may induce foodborne illness. Reported data indicates that honey and other bee products are contaminated with pesticides, heavy metals, bacteria and radioactive materials. So along with honey, indirect intake of such residues can cause genetic mutations and cellular degradation, whereas presence of antibiotics might increase resistance of human or animal's pathogens. Moreover, many cases of infant botulisms have showed the root cause is contaminated honey having origin from toxicants containing plants, so proper way out should be soon implemented to avoid further complications [37].

### *2.2.3 Irradiated food*

Food irradiation technique is used to kill bacteria and other pathogens from food e.g., meat [38-42]. Irradiated foods are suggested for consumers with suppressed immune systems and a great threat for food borne illness like young infants, children in day care, elderly, individuals with human immunodeficiency virus, patients undergoing immunosuppression bone marrow transplantation therapies and pregnant women at risk for *Listeria monocytogenes* [43]. So irradiated food can become source of chemical contamination because of reported health disorders after usage of such food and it is still uncertain that either such food items are safe or indirect source of carcinogens formation due to radioactivity [44]. While in Pakistan, such irradiated foods are quite expensive so it is not in excess of common masses. Only limited class is availing such products and is prone to risk of irradiation toxicity.

### *2.2.4 Heavy metals bioaccumulation*

Due to the rapid industrialization and urbanization, the addition of heavy metals in our water bodies is a common issue now days. Like in Pakistan, the industrial effluents are even used for irrigation propose and they are drained into other water bodies yet without proper treatment. As an outcome, bioaccumulation of the heavy metals cannot be ignored as source of foodborne disorders. Similar results were reported by Fleming and coworkers [45] about Arabian Gulf coastal areas which are facing heavy metals marine contamination over the past several decades. Heavy metals (e.g., mercury, cadmium, zinc), recurrently mixed in industrial and municipal effluents and sometimes may be due to Gulf shipping traffic, bioaccumulate in tissues and enter in the food chain [46]. Whereas, lethal effects of indirect metal intake by humans vary according to the ingested dose and the concentrations of them. Major dangers of human infirmity consist of neurological effects (including IQ loss among children of pre-birth exposure) following mercury, lead, or manganese exposure; moreover, cadmium exposure results in cancer while cardiovascular disease may be outcome of arsenic exposure [47].

### *2.2.5 Food additives*

Food additives are a fundamental constituent of the prevailing food system. A vast variety of chemicals are components of processed foodstuff. But recent studies have highlighted many health problems in users due to food additives [48]. According to Millstone and Lang [49], approximately 200 food additives are under observation due to reported cases of severe intolerance and allergic reactions, even of cancer development.

While in Pakistan still due to lack of awareness and to gain economic benefits, seller and producers use low grade and harmful substances as food additives. The addition of substandard food colors is common practice in formation of various food products especially those vended at or near different educational institutes of major Pakistani cities. In this regard, different types of food items were analyzed for isolation and identification of the added synthetic food colors. It was found that the majority of branded food items contained permitted colors however some foods manufactured locally, contained non-permitted colors. According to this survey, about 11% branded and 44% unbranded food items, respectively, were observed with not permitted colors for human consumption. Similarly, 4% branded and 30% unbranded beverages were evaluated unhealthy as containing banned colors. Incidences of the use of non-permitted food colors were higher in case of unorganized foodstuff makers.

So constant vigilance is needed to guarantee that the local manufacturers fulfill the regulations of food colors not only in terms of non-permitted food colors but also about the control and limits of permitted food colors. Moreover, consumption of colored food items should also be controlled by making the society aware of the perilous effects of food colors [50].

**Table 2:** After effects of some food additives intake [48]

| **Organ/system** | **Examples** |
|---|---|
| **Heart** | Palpitations; arrhythmias |
| **Dermal issues** | Skin Urticaria; angiodema; puritus; eczema; rashes |
| **GIT** | Digestive Abdominal pain; nausea; vomiting; colic; flatulence; diarrhoea |
| **Lungs** | Respiratory Asthma; coughing; wheezing; rhinitis |
| **Skeletal muscles** | Musculoskeletal Muscle/joint aches; fatigue; weakness |
| **Nervous system** | Behavior/mood changes; ADHD; migraine; numbness |

## 3. Factors cause food borne diseases

In food borne disorders spreading, the temperature of stored food is also an influential booster. The time length between preparation and utilization of food, storage in thermally variable state, insufficient cooling and reheating, unhygienic processed food items, and semi-cooking are regarded as the potent factors that enhance chances of food poisoning outbreaks [51]. According to a recent estimation, food is transmitting medium for different and commonly occurring enteric pathogens is transmitted by food. Even among them, *T. gondii, L.*

*monocytogenes* and *Campylobacter spp.* are the pathogens with the most frequent occurrence [52]. Thus food borne illness causing and supporting parameters are as under:

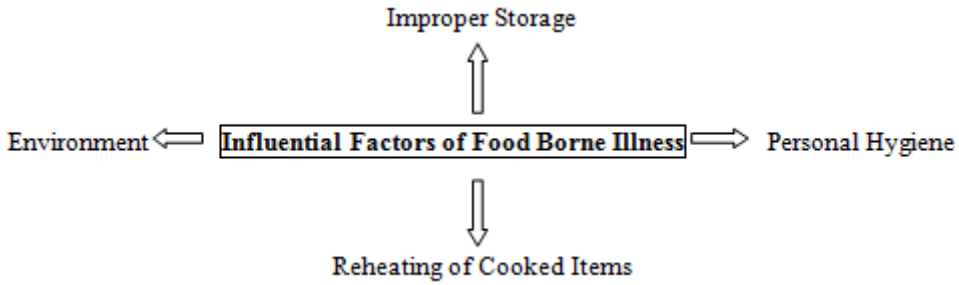


**Figure 1:** Basic effecting factors of food borne diseases

### *3.1 Improper Storage*

In Pakistan food is stored in two major forms:

- In raw state in cold storage
- In cooked or semi cooked form by vendors and sellers

Like fruits, vegetables and meat are stored in cold storage systems. So lack of proper cross ventilation, constant humid environment and proper cleaning may cause food spoilage and various pest infestations in stored food items. As usually they are not packed in such a way to ensure their better shelf life. Similarly, in whole sale markets of Pakistan, like of different grains, there is no check and control to the exposure of insects and rodents e.g. mice. As an outcome, such already exposed foods, when receive by consumers may cause different health issues.

Likewise, when food products are held for long time in unstable thermal conditions have been found as chief accelerator for food poisoning outbreaks [53]. Foods are frequently held for several hours is a common practice, after cooking and sometimes this may be overnight holding at improper temperatures, until sold, and as outcome can harbor elevated microbial flora. In addition to that such food stuff is also heated again and again after intervals during holding time and may result in enteric pathogens outbreak [10, 54-58].

In such foods, the colony forming units of *Escherichia coli*, *Staphylococcus aureus*, *Bacillus cereus* and *Clostridium perfringens* are found to be elevated [59]. In another study, *B. cereus* was obtained from 42 (26.3%) fried items and other food products are evident of their surviving spores even during the cooking [60, 61]. The incidence of this specific bacterium under the food storage conditions of ambient temperatures and humidity for a number of hours may result in the perilous product. In addition to that *B. cereus* has been responsible for foodborne illness epidemics as it generates heat liable found and heat sensitive (diarrheal) toxins when food items are placed under optimum state for microbial growth [28, 31].

Moreover, salmonellosis is also a food-borne bacterial disorder having a zoonotic cosmopolitan importance.

Although wide range of food products have been involved in salmonellosis transmission, yet major contributors are originated foods typically from poultry products including eggs. During a survey of marketing outlets of Faisalabad to analyze their food storage conditions, the surface of eggs and egg storing trays were examined. Egg yolk and albumin was also analyzed for the presence of *Salmonella* spp. and positive results were obtained [62, 63].

### *3.2 Reheating of cooked items*

Time–temperature exposures during reheating need to be sufficiently high or long to inactivate a variety of infectious agents that could increase for the period of the long holding practice. Several food vendors often partially or fully cook some products ahead of time, store them and then reheat them when requested by clients [65]. However, this reheating is not sufficient to devastate thermostable enteric pathogens, they continues to propagate in food [10].

### *3.3 Personal Hygiene and Food Handlers*

According to WHO [51], food handling staff play vital role in securing victuals safety in all the chain of food production, processing, storage and preparation. Mismanagement and ignorance of hygienic measures by the food makers may provide options to pathogens to come into contact with foodstuff and even sometimes give chances to propagate disease initiation in the consumer. Moreover, some sick food handlers may establish outlets of cross contamination after handling raw materials [31, 34]. Whereas most of the vendors pack the food items in polythene bags and during this, they blow air into the polythene bags to open them, so may pass disease causing agents to the purchaser [10]. In addition to that, a study in Santa Fe de Bogota, Colombia exposed that over 30% of food handlers carriers pathogenic germs including *Salmonella typhi*, *Staphylococcus aureus*, *Salmonella enteritidis*, , and *Shigella* [64].

### *3.4 Environment*

In Pakistan over all environmental conditions are moist with moderate temperature, majority microbes can avail optimum conditions for their survival. In this regard it was found that, some members of Enterobacteriaceae are able to survive in relatively low-moisture for extended durations. Whereas reported food-borne outbreaks are found associated with dry food products involve *Salmonella* contamination. In this regard the food manufacturers should consider this challenge of *Salmonella* control [66].

To compete with environmental stress, drying is a renowned way for food preservation. That is why; dry food products are considered at major component of our diet. Such food stuffs have considerable shelf life and are usually stable for years [67]. The water activity of such dry food product is directly influenced by parameters such as storage temperature and composition. Naturally available less moistened common items are nuts, cereals, honey, dried fruit and fruit conserves, soup mixes, milk-based powders, preserved meat and fish, chocolate, peanut butter, pasta, herbs and spices, grains and seeds, and animal feeds.

The prevailing misconception about less moistened foods is that they are not prone to rapid microbial

contamination. As an outcome, manufacturers can form contaminated produce [68]. Thus with the water activity evaluation, manufacturers can get a clue of the microbial growth susceptibility of their product along with an indication of variety of germs that may propagate on availability of certain specific conditions [66].

### *3.5 Prevention measures*

At global level, food safety insurance is a serious issue but in developing countries food borne outbreaks are more common. Meanwhile microbes' resistance is also enhancing and it is an alarming threat for consumers' health. Food safety is well recognized as a primary mark of economic growth in the developing world therefore, a wave of realization has spurred both at public and government levels for safe food supply.

Current food safety questions are deleteriously reshaping the life style of the population in the developing world. Socioeconomic status of the residents in poorer economies is one of the major determinants to delineate the availability of safe food to the susceptible population. Evaluation of the prevalence of food borne diseases in developing world is the most neglected part to health control. Botulism, Shigellosis, Campylobacteriosis, *Escherichia coli* infection, *Staphylococcus aureus* infection, Salmonellosis, Listeriosis and Cholerae are extremely ubiquitous and consider as major threat to consumer health in underdeveloped countries. The present food safety status of African, South Asian, Central, and South American like developing countries is distressing therefore; it takes considerable duration to emphasize the improvement for ensuring availability of safe food. The prevailing food safety state in such developing countries and its expected outcomes basic problem, are suggesting foodborne outbreaks to be the most harmful threat for human health and economic growth [69].

## 4. Conclusion and Future perspective

Developing countries lack any integrated food safety agenda which consequently poses a damaging impact throughout the food supply chain. Microbiological contamination of food and resulting food borne illness are therefore, a usual incidence in underdeveloped nations especially the countries of South Asia, Latin America and Africa, though majority of the food borne illness cases go unreported and unrecognized botulism, campylobacteriosis, *E. coli* infection, *Staphylococcus aureus* infection, salmonellosis, listeriosis and C*holerae* are of great importance to ensure food safety perspective of these poorer economies like of Pakistan. Assuring food safety in diverse food chain consisted of industries, hotels and restaurants may be gained through authoritarian checking in the countries of third world. Moreover, street vending of foods is believed to be a potential source of illness and thus needs to be specifically focused along with chemical contamination. Assessment of the burden of food borne infections and identification of food borne illness outbreaks obviously are not possible without monitoring and surveillance. This target to strengthening surveillance and disease control is hard to accomplish in the absence of political commitment, intervention of international agencies, awareness and strict legislation in the developing world.

The food industries and allied entrepreneurs are frequently inclined to get them certified in the developing countries as a strategy to promote business and often elude applying the systems with a professional spirit. Categorically, the prevailing food safety situation is highly uncertain in the developing countries like Pakistan

and the recent challenges like antibiotic resistance, emergence of new and more potent bacterial strains and increasing demand for food to feed the rapidly growing population among the nations of developing world require to be sagaciously addressed for wellness and prosperity in these regions to avoid loss of food, downfall of economy and to ensure better health at individual level [69].

## 5. Recommendations

In Pakistan, the researchers should focus to find out ways to eliminate the major contamination exposure causes in food chain to avoid food borne health issues.

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