

# Food Safety in Saudi Arabia: A Public Health Priority

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## Abstract

Food safety is a very important issue, and many challenges remain. Protecting people from foodborne illness, quality control issues and food fraud is an ongoing journey and critical to the health and wellbeing of all of us. Unsafe foods containing pathogenic microorganisms and toxic chemicals are responsible for several diseases ranging from diarrhea to cancer. Rapid rise in foodborne diseases is posing serious threats to public health and economy worldwide. Food safety is considered as one of the major pillars for sustainable public health and economic development. Kingdom Saudi Arabia (KSA) is one of the largest countries with the highest economy in the Middle East region occupied by approximately thirty million citizens. Due to limited agricultural productivity, about 80% of its food demand is met through import from other countries, which might contribute to great challenge to national/individual economy, food safety, nutrition and public health. In general, food safety in KSA faces many issues including weakness in the application of risk analysis, lack of academic programs, lack of scientific organizations, shortage of specialized training programs, and limited numbers of food safety science programs in KSA. This review is aimed at highlighting the field of food safety with regards to current situations, policies, practices, and academic education. Also, it addresses weaknesses, strengths, challenges, and opportunities of food safety in KSA. Efforts to improve the food safety system and building its capacity require high-quality education, trainings programs and active research at universities and allied institutions. This study is expected to provide guidelines to policy makers for tackling the challenges of food safety in KSA and to prompt academic institutions and scientists to support food safety programs, education, and research.

**Keywords:** Food safety; Nutrition; Public Health; Saudi Arabia

## Introduction

Next to air and water, food is the main prerequisite for sustainability and living of all humans. Nevertheless, food can also be a vehicle for transmission of many hazards such as foodborne pathogens that may cause serious diseases and death. Owing to globalization of food supply chains, food safety could play an important role in the sustainable development of many countries that are interested in enhancing trading and tourism activities. <sup>[1,2]</sup> Concept of “safe food” varies from community to another; therefore, there is lacks of consensus over single definition of food safety. <sup>[3]</sup> Many individuals may consider a food as “safe food”, if it does not cause sickness, while, others might define it as a food that appears consumable and has been handled in the correct way, in terms of handling, distribution, and storage at appropriate temperature. Similarly, some consumers may define safe food as food that is not “contaminated”. <sup>[4]</sup>

Safe food might be described as the food that is appropriately handled during all steps of production, processing, and distribution until consumption. <sup>[5]</sup> In food industry, definition of safe food depends on specifications of raw materials and final products. Such specifications determine acceptable limits for chemical, physical, and microbiological hazards. World Health Organization (WHO) and Food and Agriculture Organization (FAO) define safe food as the food that does not contain any hazard that might cause food to be harmful to a consumer's health. <sup>[6]</sup> Recently, WHO defined food safety as an expression

that commonly refers to methods and approaches used to ensure that the food is produced, preserved, distributed and consumed in a harmless manner. <sup>[7]</sup> On the other hand, foodborne diseases are emergent public health problem in many countries. Consumption of contaminated food might raise the risk of consumer acquiring an illness caused by foodborne pathogens. It is reported that foodborne and waterborne diarrheal diseases kill approximately 2.2 million people every year, including 1.9 million children. <sup>[8]</sup> This makes the healthcare cost of foodborne diseases a heavy economic burden for many countries. In fact, this economic burden could be reduced if food protection and safety principles are precisely followed. <sup>[1]</sup> Due to global changes in food industry, especially in developing regions, there is higher risk for emergence of novel foodborne outbreaks. <sup>[9]</sup>

## Literature Review

Ensuring the safety of food supplied to consumers is considered to be the most important task of governments, community members, food scientists and the food industry as a whole. Recent performances in producing, distributing, and preparing

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**How to Cite this Article:** Alsubaie ASR, et al. Food Safety in Saudi Arabia: Public Health Priority. *Ann Med Health Sci Res.* 2020;10:1142-1147.

foods demand an increased emphasis on the practices of hygiene at the different phases. Besides, developing interest in conducting research on safety of food to guarantee a safer total food supply is also a great challenge. Development of system that manages issue of food safety e.g. hazard analysis critical control point (HACCP), in food industry is a shift to the correct path. <sup>[10]</sup> Still, technical barriers and other reasons might make companies refuse to implement the HACCP program particularly in different types of enterprises. Several scientists discussed those barriers namely; type of industry sector, product type, lack of understanding of the HACCP program, staff rotation, lack of worker incentive, absence of training, the impression that the products are safe and under control, enterprise size. <sup>[11-13]</sup> Such factors might be widespread in many developing countries and Saudi Arabia is one of those countries.

On the other hand, food safety organizations play crucial role towards diminishing of food hazards that cause the illness through their enforcement officers. They contribute much in protecting public and promoting good health and hygiene practices, by development and enforcement of laws and regulations. Administration officer or inspector warrants that the owner, manager and employees are following indispensable directions and guidelines conveyed in food safety legislation. These doings might include ingoing and inspecting establishments, reviewing food poisoning outbreaks, and elimination of dangerous food. <sup>[14,15]</sup>

Main objective of this review is to give an overview about general features of Saudi Arabia food production, consumption and import, food management and safety in Saudi Arabia. Factors affecting food safety management and application of food control systems are also deliberated. Examples of food outbreaks and food poisoning studies recorded in different cities of the Kingdom presented. Major challenges of food safety in Saudi Arabia are intensively discussed. Purposes to promote academic institutions and scientists to support food safety programs, education, and research in Saudi Arabia are also discussed.

### Geographic and administrative features of Saudi Arabia

Since foundation in 1932, the Kingdom of Saudi Arabia comprises the largest desert part of the Arabian Peninsula, with a hot desert climate and the temperature in summer normally exceeds 40°C and reach up to 50°C. Estimated population is almost 30 million, with a growth rate of 2.9 per annum. <sup>[16]</sup> Economically, Saudi Arabia is classified as one of the highest income country (UNDP 2014), a part of G-20 major economies with a high Human Development Index (HDI). <sup>[16]</sup> Indeed, per capita Gross Domestic Product (GDP) is estimated at \$51,779 in purchasing power parity. Its rank is eleventh in the world in terms of nominal GDP/capital. <sup>[16]</sup> This is because Saudi Arabia holds 25% of the world's verified petroleum reserves in addition to being the world's largest oil exporter. <sup>[17]</sup> Administratively, it is divided into 13 regions, with subdivisions of governorates, and then sub-governorates. It has been reported that there are 269 municipalities all over the Kingdom, <sup>[18]</sup> approximately 47

municipalities are located in the capital region. Interestingly, enforcement of food safety laws and legislations at a local level is primarily the responsibility of municipal authorities, though policy making and regulations are divided among many governmental agencies. <sup>[18]</sup>

### Food production and consumption

Generally, share of agriculture sector in the Kingdom's huge economy is very limited (4.8% of the GDP and employed 0.5 million workers, in 2007) and has increased to 6% in last couple of years; however, the government is dedicated to alter and improve the agronomic sector, in order to diminish food import costs and realize self-reliance in the long-term. Notably, major part of Saudi Arabia is characterized as a desert land due to harsh climate. Yet, in certain regions climate is favorable for agriculture productivity at small scales. The Saudi per capita per day food consumption is 3130 calories. However, due to the low local agricultural production, the Kingdom food needs are mostly (over 80%) imported from different countries. The food and drink imports value is \$14.2 billion/year and due to the population increase and economic growth, consumption will grow 55.5% in 4 years to reach \$70 billion/year. <sup>[19]</sup> Therefore, food sector is considered as one of the most important sectors with greater impact on the country economy. <sup>[20]</sup>

### Management of food safety in Saudi Arabia

Certifying safety of many locally produced and imported food is the responsibility of several governmental and non-governmental organizations in Saudi Arabia. Ministries of Health, Commerce & Industry, Municipal & Rural Affairs, Agriculture, the Saudi Standards, Metrology and Quality Organization, and the Customs Clearance Agency are governmental bodies concerned with food safety system. Non-governmental organizations include; Saudi Society of Food and Nutrition, Consumer Protection Association, and the National Standing Advisory Committee on Food Irradiation. The Saudi Food and Drug Authority (SFDA) is a governmental organization and is in a development process since 2003 as a new principal organization which anticipated to arrange for enhanced coordination and guarantee the safety and quality of local and imported food. <sup>[16,18,20]</sup> Significant involvement and the major contribution of governmental organizations in food safety are presented in Table 1, with gradual transfer of tasks and responsibilities concerning food safety to SFDA since 2003.

In fact, two crucial organizations play major part in management of food safety processes in Saudi Arabia namely; Ministry of Municipality and Rural Affairs and Saudi Food and Drug Authority (SFDA). Ministry of Municipality and Rural Affairs has constitutional and implementation roles in the food safety sector. Particularly in preparation of food legislation related to health circumstances, food and health assessment regulation, control of commercial adulteration, supervising slaughterhouses. It also participates in reacting to the outbreaks of food poisoning, carryout food and water sampling and registers food and health establishments. <sup>[18]</sup> Actually, the organization assigned for several major food safety tasks ranging from; legislation, inspection, investigation on outbreaks and licensing activities.

**Table 1: Tasks and responsibilities of different governmental organizations involved in food safety.**

Organization	Tasks & Responsibilities Regarding Food Safety
<b>Ministry of Health (MoH)</b> <ul style="list-style-type: none"> <li>In 1983, General Department of Preventive Health (GDPH) was established</li> <li>Environment Health Administration (EHA) is part of GDPH</li> </ul>	<ul style="list-style-type: none"> <li>Cooperation with other governmental bodies e.g. Municipalities in development of environmental health works.</li> <li>Reacting to food poisoning outbreaks.</li> <li>Review the medical claim related to food; monitor the food suppliers in the hospitals of the ministry.</li> </ul>
<b>Environment Health Administration (EHA)</b> established Food Safety Program	<ul style="list-style-type: none"> <li>Regulate food poisoning outbreaks</li> <li>Educate society regarding issues of food safety</li> <li>Train teams that investigate food poisoning outbreaks.</li> </ul>
<b>Ministry of Commerce and Industry (MCI, 2013)</b>	<ul style="list-style-type: none"> <li>Commodities and products safety and quality safeguarding in addition to the protection of the citizens from adulteration and fraud</li> </ul>
<b>Ministry of Agriculture (2013)</b>	<ul style="list-style-type: none"> <li>Examination and analysis of imported foods</li> <li>Licenses the poultry farms and dairies, monitors the production of poultry</li> <li>Yearly endorsement, updates, and modifies local standard specifications in agreement with WTO.</li> </ul>
<b>Saudi Standards, Metrology and Quality Organization (SASO)</b>	<ul style="list-style-type: none"> <li>Establishment of national standards and specifications</li> <li>Regulating certificate granting and quality marks.</li> <li>Inspecting local food producing factories to ensure application of Saudi food standards.</li> <li>Grants licenses food premises to use a Quality Mark on their products.</li> <li>Conducts inspections at marketplaces and in manufacture regions.</li> </ul>
<b>Ministry of Municipality and Rural Affairs</b>	<ul style="list-style-type: none"> <li>Statutory and implementation roles in food safety sector</li> <li>Preparation of food legislation related to health circumstances.</li> <li>Participates in reacting to outbreaks of food poisoning</li> <li>Food Premises Licensing, this task was based on municipalities law issued by Royal Decree in 1977</li> </ul>
<b>Saudi Food and Drug Authority (SFDA)</b>	<ul style="list-style-type: none"> <li>Ensure that imported as well as local food products conform to national and international standards</li> <li>Enforcement of legislative rules related to food safety</li> <li>Approve rules and regulations, review procedures and rules related to food and drugs as major concern for public health</li> <li>Covering laws and regulations of food control and safety</li> <li>Responsibility of all issues linked to food safety, drugs and biological as well as chemical substances for peoples and animals.</li> <li>Educate consumers by regulating awareness campaigns</li> </ul>

With respect to food Legislation, Municipality passes several circulars addressing the healthy conditions of poultry farms, slaughterhouses and other food and health establishments especially for food and workers. Ministry has issued 25 national standard guidelines related to health conditions of the food and other workshops establishments like restaurants and cafeterias. Recently, Municipality issued specific regulatory guides for sanitarian and HACCP implementation, besides other guides for use of food additives, microbial poisoning, food safety and instructions for food handlers. Also, ministry review food inspection in markets through “Public Administration of Environmental Health”.

On the other hand, SFDA was established to guarantee food safety of imported as well as locally produced foods and to ensure that it is following national and international acknowledged standards. In fact, SFDA is a central authority that unifies all efforts of enforcement and legislative rules related to food and health safety that were previously performed by different government organizations. The Authority currently holds responsibility of all issues linked to food safety and drugs for peoples and animals in addition to the safety of biological and chemical substances. [4,18] Food safety issues cover all laws and regulations of food control and management, surveillance of foodborne illness and inquiry systems, inspection services, recall and tracking systems and food monitoring laboratories to protect society. [18] Through organization of awareness’s campaigns and education of consumers SFDA plays crucial role in Public health sector.

However, most of SASO functions concerning food safety

legislation, health protection, promotion of good practice in the domestic industry, and dissemination of the authoritative knowledge about the field have been transferred to the SFDA since 2011. [18] Unfortunately, absence of coordination and consistency between organizations often destabilize the efficacy of food safety systems in the kingdom.

### Harmonization of food safety measures with International Organizations

As a membership in World Trade Organization (WTO) and a key member in Gulf Corporation Council (GCC) and Middle East and North Africa (MENA) countries, Saudi Arabia develops great concern over food safety. In fact, there is a steady increase in food safety due to significant episodes of microbial and chemical contamination of food especially in GCC countries. [21,22] Saudi Arabia, as a member in GCC, as well as other MENA countries dedicates much efforts to update and strengthen food management and safety systems as well as the application of recent approaches in risk-analysis. Actual implementation of these concepts and approaches realized through harmonization of national food standards with Codex Alimentarius, codes and guidelines. [23] Furthermore, there is developing increase in the use of Good Manufacturing Practices (GMP), Good hygiene Practices (GHP), Good Agricultural Practices (GAP) and hazards Analysis Critical Control Point (HACCP). [21] Actually, harmonization of national with international food standards will ensure that public health and food safety are efficiently met. However, application of certain Codex regulation in Saudi Arabia not commonly harmonized with international regulation especially due to severe climatic conditions.

## Current situation in food safety outbreaks

As in many countries in the world food safety and hygiene in Saudi Arabia is becoming an issue of major public health concern. In Saudi Arabia, studies on the major food outbreaks due to microbial food poisoning and foodborne pathogens have been reported especially during Hajj and Umrah seasons in Mekka and other cities. [18,24-28]. Recently, Bakri et al. [28] reported the most challenging outbreaks documented in 12 cities along Saudi Arabia during the last 10 years. The dominant causative agents are; *Salmonella enteritidis* group D, *Staphylococcus aureus*, *Bacillus cereus*, *Clostridium perfringens* and *E. coli*. Nevertheless, many incidents remain undocumented due to less tendency to visit health facilities or inaccurate food inspection and analysis. [18] On the other hand, street food trade in Saudi Arabia often flourish during Hajj and Umrah seasons, when millions of Muslims come to Mecca and AL Madinah every year to perform pilgrimage and Umrah rites. Majority of food vendors do not follow food safety and hygiene practices or even unable to convert their food safety knowledge and attitudes into practices. [29-31] Generally, most of food poisoning and illnesses can be overcome by implementation of preventive measures especially hygienic practices during food handling and processing. Besides, recognition of community awareness programs that support the implementation of good food safety and hygiene to prevent outbreaks. [32-36]

## Current challenges of food safety system in Saudi Arabia

### Food inspection and risk analysis

Al-kandari and Jukes [21] revealed that food inspection in the GCC, including Saudi Arabia, is controlled by official organizations. Taking into account the country's heavy reliance on imports of food from different countries, there is urgent need for food control and inspection. The number of inspectors employed for this purpose is limited compared to their assignments. Most of inspectors in the Gulf Countries, including Saudi Arabia, are public health inspectors with inadequate training and qualification. So, providing inspectors with recent knowledge, education, and training especially in implementation of the HACCP system is essential. [21-37] Reduction of risk from foodborne pathogens to an acceptable level is not accomplished through food inspection and analysis of final food product but all over food chain. Applying preventive measures such as GAPs, GMPs, GHPs, along with the application of HACCP is highly critical to reach acceptable levels in food safety. [38] Al-kandari and Jukes [21] reported that GMP and HACCP preventive measures are applied in Saudi Arabia for inspection of imported foods.

### Lacking of academic programs for food safety specialists

Recently, new generalized program focuses on food safety and environmental protection has been established. Unfortunately, graduates of this program still constitute only a minor number of the required labor force. Indeed, limited efforts have been made to improve the skills and knowledge of those who completed

training on food safety before introduction of this program. [18] Only few colleges of food and agriculture sciences and colleges of agriculture and veterinary medicine are established in Saudi universities. Colleges offer undergraduate degree in food science and nutrition with limited emphasis on food safety. Unfortunately, there is no national education program in Saudi Arabia that is focused on improvement in food safety knowledge and practices. Efforts to improve food safety system and building its capacity requires launching of specialized food safety programs housed in academic institutions.

### Limited research on food safety

In general, there is limited research on food safety issues, especially addressing food poisoning cases in Saudi Arabia. [39] This is due to the limited number of food safety educational programs, lack of postgraduates programs in Saudi Universities and shortage of Saudi food safety specialists. Although most of authorized food control facilities in GCC including Saudi Arabia have satisfactory infrastructures with well-equipped laboratories and regularly subjected to calibration and maintenance. However, majority of laboratories need Standard Operating Procedures (SOP) manuals to guarantee analysis and results. Besides, scientific and technical expertise are insufficient and when exist, are not internationally acknowledged. Therefore, current status reflects the need for continual development in food control facilities and personnel. [21]

### Lack of coherence between organizations

Although the SFDA is the key element in food control management within Saudi Arabia, it seems that Saudi Arabia Standards Organization (SASO) plays an actual and crucial role in establishment, modify and update of food control management policies and procedures at central and local levels. [38] This often results in duplication and overlapping of duties, lack of synchronization between organizations, and information stagnation across the Kingdom of Saudi Arabia. Lack of coordination and consistency between organizations often undermine the efficiency and effect of food safety systems.

In order to build and maintain effective food safety systems, strong links must be established between all sectors that have a bearing on food safety, including public health, agriculture and fishery, consumer and school education, science and research, tourism, trade, industry, and regulatory authorities. It is the public health sector that needs to take the challenge and lead in building this community of stakeholders and sharing common goals and responsibilities. [40]

### Change in lifestyle and food consumption habits

As in many countries in the gulf region, Saudi Arabia underwent rapid development and changes in lifestyle and consumer demands. These variations have a profound effect on food production, supply and demand, availability and consumption. As a result of food globalization consumer demand has grown, importation of food has increased, and consequently new products, ingredients and additives are regularly entering the market. Additionally, outdoor eating in restaurants, fast food outlets and street vendors increased. [41,42] Therefore, food safety

**Table 2: SWOT analysis of food safety status in Saudi Arabia.**

<p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>Well established food safety organizations e.g. SFDA</li> <li>Existence of laws and legislations align with international organizations</li> <li>Availability of jobs for food inspectors</li> <li>Existence of risk-analysis based inspection</li> <li>Record for major foodborne outbreaks</li> </ul> <p><b>Weaknesses</b></p> <ul style="list-style-type: none"> <li>Inadequate legislative and laws, especially related to climatic conditions, for protection of public</li> <li>Lack of coherence between organizations</li> <li>Limited resources and research laboratories</li> <li>Lacking of Academic Programs for Food Safety Specialists</li> <li>Specialized staff and laboratories are not enough to cover the 29 ports distributed throughout the Kingdom</li> <li>Absence of professional and scientific food safety organization to enhance and promote food safety and hygiene in Saudi Arabia</li> <li>Criteria, inspection and analysis of local food market (e.g. Restaurants, cafeteria, local market, traditional food market....etc.) not completely controlled or supervised</li> <li>Absence of well-established system for immediate reaction with foodborne outbreaks</li> <li>Threats from imported food</li> <li>Changes in lifestyle and food consumption habits</li> <li>Language barrier due to large number of foreign labor force in the food industries and food markets</li> </ul>	<p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>Enhancement of community awareness towards the importance of food safety and hygiene</li> <li>Adopt and promote food safety awareness program in educational institutes (e.g. Schools, colleges and universities)</li> <li>Implement effective legislation implying food safety in traditional local market</li> <li>The food business owners need to have enough skills and knowledge regarding food safety to obtained their license</li> <li>Continual harmonizing national standards with international ones</li> <li>Continual government commitment and funds towards better food safety system</li> <li>Encourage research on food matters</li> </ul> <p><b>Threats</b></p> <ul style="list-style-type: none"> <li>Low food safety culture in Saudi Arabia</li> <li>The majority of food handlers and workers are foreigners</li> <li>Shortage of high specialized food safety staff and scholars</li> <li>Difficulty in ensuring HACCP certified suppliers</li> <li>Rapidly growing population with remarkable increase in food demand</li> <li>Limitation in agriculture and increased dependence on imported food</li> <li>Difficult to cover the entirely numerous ports distributed throughout the Kingdom</li> <li>Critical climatic conditions that challenging transport and distribution of food safety</li> <li>Overgrowth of tourism industry with inappropriate food catering environments especially during Haj (Mecca- pilgrim) and Umra seasons</li> </ul>
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programs in the Saudi Arabia need to apply a holistic approach with all these changes.

### SWOT analysis of food safety system in Saudi Arabia

According to available data on food control and management in Saudi Arabia, examination and analysis of strengths, weaknesses, opportunities and threats (SWOT analysis) of food safety is shown in Table 2. The analysis provides clear overview about the status of food safety in Saudi Arabia. Emphasis was given to weaknesses due to many factors including; inadequate legislations, lack of coherence between organizations, increase in import, lack of qualified inspectors, limited research laboratories and lacking of academic programs for food safety specialists, absence of system for immediate reaction with outbreaks, change in life style and language barrier. Also, main challenges especially due to; low food safety culture, foreigner food handlers and absence of specialized staff, limited HACCP certified suppliers, overpopulation with increase in food demand, limitation in agriculture and dependence on import, increase number of tourists especially during Hajj (Mekka- pilgrim) and Umra seasons, and critical climatic conditions are highlighted.

### Discussion and Conclusion

In Saudi Arabia food safety for protection of citizens and residents remains a great challenge especially due to absence of food safety specialists. Hiring external employees, food safety technicians as well as dependence on non-specialists graduated from agriculture or veterinary programs are considered temporary solutions. Therefore, launching food safety program in different and newly established Saudi universities is urgently needed. Also, there should be strong food safety organizations to tackle the challenges of food safety and food hygiene, as well as to advance the field and the profession of food safety in KSA. To be a competitive member in international trade and tourism, there should be an adequate fund allocation for food safety activities. Continuous efforts should be done to manage and decrease foodborne diseases through the integration of research

data, food control monitoring, epidemiological investigations and disease surveillance.

### Competing Interests

The authors declare that they have no competing interests. All the listed authors contributed significantly to the conception and design of study, acquisition, analysis, and interpretation of data and drafting of the manuscript, to justify authorship.

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