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Review

# Unlocking Food Safety: A Comprehensive Review of South Africa's Food Control and Safety Landscape from an Environ-mental Health Perspective

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**Abstract:** Food fraud (often called fake food in South Africa), the deliberate misrepresentation or adulteration of food products for financial gain, is a growing problem in South Africa (SA) with severe public health and financial consequences for consumers and businesses. The recent public outcry against food fraud practices, especially in communities that have lost loved ones due to the consumption of allegedly unsafe foodstuffs, highlights the grave danger that food fraud poses to consumers and the potential for significant reputational damage to food manufacturers. Despite the risks, food fraud often goes undetected, as perpetrators are becoming increasingly sophisticated. The precise magnitude of food fraud remains obscure, as incidents that do not cause consumer illnesses are frequently unreported and, as a result, are not investigated. Food fraud costs the global economy billion annually. This cost is borne by consumers, businesses, and the government. Food fraud can occur at any stage of the food supply chain, from production to processing to retailing or distribution. This is due in part to the limitations of current analytical methods, which are not always able to detect food fraud. This systematic literature review of food fraud in SA looks at several factors that may be contributing to epidemic of food fraud (fake food), including lenient penalties, inadequate government commitment, a complex labelling regulations, emerging threats such as e-commerce, and a shortage of inspectors and laboratories. The review recommends establishing a single food control/safety authority, developing more food safety laboratories, and adopting innovative technologies to detect and prevent food fraud. SA faces a serious food fraud crisis unless decisive action is taken.

**Keywords:** fake food; environmental health; food safety; legislation; poisoning

## 1. Introduction

Historically, food consumption was primarily driven by physiological and caloric needs, but the rise of global food malpractice (i.e food fraud/ fake food) has heightened public awareness of food safety concerns [1]. SA, with its well-established food industry, is not immune to the scourge of food fraud [2,3]. Consumers of commercially sourced food rely on the food supply chain to provide safe and authentic food products, as they cannot personally verify the production, processing, distribution, and storage conditions of their food. Governments play a vital role in ensuring food safety by designing and implementing appropriate food safety regulations and standards that oversee the entire farm-to-fork process to protect consumers from food-borne hazards [4].

Recent high-profile food fraud cases worldwide, including in SA, have highlighted the vulnerabilities of global food control and safety systems and their enforcement mechanisms, raising concerns about their effectiveness [5–9]. SA's recent listeriosis outbreak and high-profile food fraud cases, including the discovery of a counterfeit food production hub in Gauteng Province and the deaths of children attributed to the consumption of poisonous fake foods have been a cause of concern, have raised concerns about the effectiveness of the country's food control and safety system and its

enforcement mechanisms [8–12]. Despite the mounting evidence of food fraud scandals, South Africa's regulatory framework for food control and safety conspicuously lacks a formal definition of food fraud, deviating from the recommendations of the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) [13]. This absence of a clear and comprehensive definition poses substantial obstacles to effective monitoring, prosecution, and deterrence of food fraud activities. Without a well-defined framework, authorities struggle to accurately identify and categorize fraudulent practices, potentially leading to an underestimation of the true scope of food fraud and hindering efforts to curb its proliferation.

Food safety challenges in Africa receive less policy attention than food security and major public health issues like malaria, HIV/AIDS, and tuberculosis [13]. Hence, many small outbreaks and sporadic cases of foodborne illness (including those caused by food fraud) go unreported and unnoticed [2,14]. SA's food control and safety system plays, or should play, a vital role in protecting public health. However, recent food fraud scandals and the listeriosis out-break have highlighted the need for improvements. SA's food control system is a multi-agency system, which means that it involves multiple government agencies (The Departments of Agriculture, Forestry and Fisheries (DAFF), Health (DoH), Trade & Industry (DTI)) working together to ensure the safety of the food supply [12]. This is in line with the definition of a multi-agency food control system provided by the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) in 2004 [15]. The general strengths and limitations of SA's multi-stakeholder food control system are comprehensively analyzed in both local and international literature [12–17]. The main aim of this systematic review is to explore South Africa's food control and safety landscape in light of recent listeriosis and fake food scandals. The review will be of interest to a wide range of stakeholders, including policy makers, food control and safety authorities, food businesses, consumer groups, and academics. It is anticipated that the review will contribute to national dialogue on how to improve SA's food control and safety system and ensure that all SAs have access to safe and nutritious food.

## 2. Materials and Methods

This systematic literature review provides an in-depth examination of the intricate web of food control and safety in South Africa. An exhaustive search of numerous databases, encompassing Medscape/Medline, NIOSH, Science Direct, Google Scholar, and the Social Science Citation Index, yielded a comprehensive repository of journal articles. Furthermore, the review integrates a diverse spectrum of academic and media articles, complemented by pertinent government policies, to present a meticulous assessment of South Africa's food safety and control framework. The search strategy employed a broad range of keywords, including "fake food," "food fraud," and "food safety in South Africa," ensuring a capture of relevant and up-to-date information. This review delves into the multifaceted challenges and opportunities that characterize South Africa's food safety landscape. It critically analyzes the existing food control mechanisms, including legislative frameworks, regulatory oversight, and enforcement practices.

## 3. Results

### 3.1. Lenient penalties for food safety violations and fraud in SA

Environmental Health Practitioners (EHPs) at the National Department of Health (Port health) and Metropolitan and District municipalities (Municipal Health Services) are the primary stakeholder responsible for ensuring compliance with food safety laws in SA. One challenge of this approach is that some municipalities lack the financial resources and personnel necessary to effectively enforce all food regulations [18]. Consequently, many small and medium-sized domestic businesses operate without proper oversight, while larger businesses regulate themselves [7,12,19]. The Foodstuffs, Cosmetics and Disinfectants Act (FCD Act) 54 of 1972 and the National Health Act (NHA) 61 of 2003 as amended, are overarching legislation that empowers EHPs to enforce most food control and safety laws in the country.

Numerous regulations have been enacted under the FCD Act, including the Powers and Duties of Inspectors and Analysts (GNR 328 of 20 April 2007), the Labelling and Advertising Regulation (GNR 146 of 1 March 2010), and the Food Premises and Food Transport Regulations (GNR 638 of 22 June 2018). The FCD Act and other regulation (i.e GNR 328 of 20 April 2007) enacted under it are

known to be reactive in the sense that they rely on approved and acceptable sources (i.e National Health Laboratory Service (NHLS)) to provide information on the safety of food for regulatory purposes [20]. Under the FCD Act, selling unsound, adulterated, or contaminated food is a criminal offense. Inspectors can remove (detain or seize) such food from sale based on visual inspection, but further legal action requires laboratory confirmation [20]. The reliance on laboratory evidence for legal action against food fraud poses a significant hurdle in South Africa, as the sophistication of food fraud necessitates advanced analytical forensic methods that are still in development [6]. Additionally, the lack of a dedicated food safety laboratory in the country further complicates the process of identifying and prosecuting food fraud cases [21].

Similar to other forms of crime, engaging in food fraud activities, is punishable by law. The FCD Act sets out the maximum penalties that can be imposed for food safety offenses (section 18) under the Act. These penalties are progressive and they increase in severity for repeat offenders. Upon conviction, an individual may face a fine of up to 400 South African rands (ZAR), imprisonment for up to six months, or both, for a first offense; a fine of up to 800 ZAR, imprisonment for up to twelve months, or both, for a second offense; and a fine of up to 2,000 ZAR, imprisonment for up to twenty-four months, or both, for a third or subsequent offense. While regulations enacted under the FCD Act can prescribe penalties for contraventions, they cannot exceed those prescribed in the Act itself (Section 15). Hence, some regulations (i.e GNR 328 of 20 April 2007) enacted under the FCD Act still refer to the Act for the penalties for contraventions of food control or safety laws.

The relatively lenient penalties for food safety violations, such as fine of ZAR400 or six months imprisonment for a first conviction, are unlikely to deter food fraud, especially for large-scale fraudsters who can generate significant illegal profits [13]. These fines may be seen as a cost of doing business, by food fraudsters who make millions from their illegal activities. The low likelihood of detection due to the fragmented food control system and limited enforcement resources further reduces the deterrent effect of fines [20]. This is exemplified by the case of an individual who admitted to engaging in fraudulent activities for over 11 years, including selling expired food items, counterfeit bread, and fake bottled water [22]. The punishment for food fraud offenders in SA is still uncertain, despite the deadly consequences of food fraud, as evidenced by the deaths of children in Gauteng in 2002 [23], Soweto and the West Rand in 2023 [9] and Vrededorst in 2023 [11] all linked to the consumption of contaminated, unsafe and adulterated food. The persistence of food-related fatalities in South Africa can be partly attributed to the inadequate enforcement of existing food safety regulations and the lack of robust accountability mechanisms [1,13].

It is unclear whether the prescribed penalties for food fraud in SA, a multi-billion rand industry, are effective deterrents, especially when compared to the more severe penalties imposed in Europe [6,24]. The classification of food fraud cases resulting in human casualties in South Africa is unclear. In Europe, food fraud cases resulting in human casualties are typically categorized as homicide or murder [6]. Conversely, non-fatal food fraud cases are commonly classified as offenses related to the production and marketing of hazardous food products, endangerment of life and property through inherently risky conduct or materials, or a combination of these offenses [6]. Effective food fraud prevention requires empowering EHPs as Peace Officers. Establishing a dedicated law enforcement system (i.e municipal courts) tailored to EHPs' needs and fostering collaboration with Police Officers possessing specialized food safety knowledge may enhance investigation and prosecution efforts [6]. By adopting best practices like Finland's mandatory police notification for suspected food fraud offenses, South Africa can strengthen its food safety framework [24].

### 3.2. SA's Disproportionate Response to Food Safety Crises

Food related crisis are treated differently by food control/ safety authorities in SA. This was evident in how government responded to the listeriosis outbreak and how is responding to ongoing food fraud (fake food) crisis. In response to the listeriosis outbreak, SA established a multi-sectoral incident management team (IMT) led by the Department of Health with support from other food control/ safety stakeholders (DAFF, DTI) and the World Health Organization (WHO). Additionally, the country developed an updated Listeriosis Emergency Response Plan (ERP) to intensify response activities to control and end the outbreak, and to strengthen food safety systems with an aim of preventing future foodborne outbreaks [25]. The state also instructed Tiger Brands, the company that

manufactured and distributed the deadly polony, to announce major recalls of many of its products and suspended its distribution and export licenses for some time [26].

In contrast, SA's response to the fake food scandals has been much more muted. The government has not established a dedicated IMT or ERP, however no evidence has been found which suggests that steps have been taken to strengthen food safety regulations or enforcement, despite the proposal of appointing tuckshop (spaza shop) patrollers [9]. The government's inconsistent response to food safety crises, as exemplified by the contrasting reactions to the listeriosis outbreak and the ongoing fake food scandals, raises concerns about the prioritization of food safety measures. This is further corroborated by the lack of evidence of food recalls or food safety alerts by the food control/safety authorities in the ongoing fake food scandals.

Food fraud is a serious problem that costs the global economy billions of dollars each year and can lead to food poisoning, illness, and even death [8–11]. A key strategy to combat food fraud is proactive enforcement of food safety regulations by government authorities [13]. The risk of food fraud is further complicated by a dearth of government food safety laws, particularly in the informal sector [7]. The South African government, in particular, has been repeatedly criticized for its failure to adequately regulate and enforce food safety standards [12]. However, when food authorities fail to take action against fake food scandals, it creates a vacuum in which food fraud can thrive. In the face of inadequate government action, consumer activism has emerged as a powerful force against food companies engaging in unsafe practices [27]. Notably, South Africa has witnessed the rise of civil movements like the Dudula Movement, which has assumed the mantle of combating food fraud in the absence of effective government enforcement [12,28,29]. Such movements inspect, seize, and burn any foodstuffs they perceive as expired, often based on the unfounded belief that food becomes "rotten," "off," "toxic," or "unsafe" after its expiry date [28,29].

The FCD Act and the Labelling and Advertising Regulations (R146/2010) make it a criminal offense to sell or offer to sell unwholesome, unsound, contaminated or unsafe food. However, food does not necessarily become unsafe by simply reaching the expiry date. These dates are more concerned with quality than safety [30]. What is considered illegal under the law is tampering with, changing, or in any way altering the expiry date once it has been applied to a foodstuff. However, the actual expiry dates are not prescribed by law, and the manufacturer determines how long these periods can be [30]. The uncertainty among consumers about the meaning of the expiry dates, is believed to contribute significantly to household food waste [31]. Others argue that food manufacturers use sell-by dates primarily to protect their brands, rather than to indicate food safety concerns [30,31]. Confusion around expiry date, is a clear indication that consumers' education is lacking in the country.

These civil movement groups, which are often vigilante in nature, appear to target foreign-owned shops and are sometimes accused of looting the very food they accuse of being unsafe [28,32,33]. Violence and intimidation towards foreign nationals seem to be part of their modus operandi [34]. While the intentions of civil movement groups may appear to be morally justifiable, their actions are often misguided and illegal. The South African government and the Health Professions Council of SA (HPCSA), under various statutes and regulations, has vested EHPs with the powers to inspect, detain, sample, and seize food. EHPs are trained professionals with the knowledge and expertise to identify and address food safety hazards. The inadequate action of food authorities against fake food scandals undermines food safety enforcement in several ways. It may legitimize the actions of unauthorized civil movements, and undermines EHP's authority, and may create fear and uncertainty among consumers. This can negatively impact the economy and food supply chain [13].

The recent move to close down non-complying tuck-shops (spazas) in SA should be commended [35,36]. However, enforcement of food control and safety laws should be extended to all food premises, whether they are formal or informal. Various media reports suggest that informal food premises (tuck-shops or spazas) are often shut down because the owners lack the necessary permits and licenses, rather than because they are found to be selling fraudulent or expired food [35,36]. Despite the ongoing shortage of EHPs, the government plans to appoint spaza shop patrollers to close establishments that violate food safety regulations [8,9]. This move is likely to worsen the shortage of EHPs, who play a critical role in protecting public health from foodborne illnesses [12]. The COVID-19 and listeriosis outbreaks underscored the significance of food safety and public health surveillance,

highlighting the necessity for more EHPs. The South African government should prioritize recruiting and training more EHPs to ensure the country's capacity to safeguard public health. Additionally, EHPs must have the technical expertise (aided by cutting-edge technologies) to physically detect food fraud, as advised by FAO & WHO [17].

### *3.3. Criminal Liability for Food Poisoning Outbreaks and Food Fraud*

Contrary to SA, several food companies have been held criminally liable for food poisoning outbreaks in developed countries [6,24]. In 2012, Eric and Ryan Jensen were sentenced to five years' probation for unknowingly distributing adulterated cantaloupe. Stewart Parnell was sentenced to 28 years in prison for knowingly selling contaminated food that caused a Salmonella outbreak, affecting 714 people and resulting in nine deaths. In 2020, Blue Bell Creameries was fined \$17.25 million for shipping contaminated products linked to a listeriosis outbreak [37]. These cases demonstrate that developed countries has a strong legal system for holding food companies accountable for food safety violations. This can deter risky practices that could lead to food poisoning outbreaks and provide justice for victims. In addition to criminal liability, food companies in the United States can also be held civilly liable for food poisoning outbreaks, meaning that victims can file lawsuits to recover damages for their injuries [37]. This is a powerful tool for victims, as it can help them to obtain compensation for medical expenses, lost wages, and other losses.

SA can learn from the United States' legal system in several ways [37]. First, SA should consider enacting laws that would hold food companies criminally liable for food poisoning outbreaks emanating from disregard of food safety and hygiene principles. This would send a strong message to food companies that they must take food safety seriously. Second, SA could make it easier for victims of food poisoning to file lawsuits against food companies. The Tiger Brands listeria class action litigation case is a landmark case for food safety in SA. This case challenges food manufacturers' legal liability for foodborne illness outbreaks [38].

### *3.4. Food Labelling Crisis in SA*

Driven by heightened health awareness, consumers demand greater transparency and accuracy in food product information [39]. Food safety concerns, including fraud, mislabeling, and expired products, have eroded consumer trust in the food supply chain and regulatory bodies [12]. In response, South African regulatory bodies have enacted legislation, such as the Regulations relating to the Advertising and Labelling of Foodstuffs (R.146/2010) and the Consumer Protection Act (R.467/2009), to mandate accurate food labeling and protect consumers from exploitation. These regulations require producers to provide truthful information that aligns with the actual product content, empowering consumers to make informed food choices [40]. According to labelling regulations common allergens such as eggs, milk, buckwheat, peanuts, and soybeans are to be included on the label. While certain measures to enhance food labeling have been implemented, critical gaps persist. Notably, nutritional information tables remain non-mandatory and are only required when specific nutritional claims, such as "high/medium fat," are made. This omission disenfranchises consumers who require comprehensive nutritional information, such as individuals with diabetes or insulin resistance [41]. Furthermore, selling of food products passed expiry date is not prohibited under these legislation. Additionally, South Africa lacks official labelling regulations for GMOs, organic and halal food products [19]. GNR 146/2010 comprise 53 pages of regulations and 50 pages of guidelines. While the draft of the new labelling legislation (No. R.3337 of 21 April 2023) defines fake food, it is significantly longer at 249 pages, comprising 171 pages of regulations and 78 pages of guidelines. Sunley argues that it is unrealistic to expect EHPs to manage this level of complexity in addition to other responsibilities [42].

Prior the enactment of R.146/2010 and R.467/2009, a study in South Africa revealed that half of sea-food samples were mislabelled [43]. Despite the implementation of these regulations, SA experienced a horse-meat scandal similar to the one that rocked a well-known UK supermarket chain. Testing of meat products labeled as "100% pure beef mince" and "beef biltong" from local supermarkets revealed traces of pork, donkey, water buffalo, and even giraffe in rare cases [44] Another study found that 68% of processed meat samples contained undeclared species, with the highest prevalence in sausages, burger patties, and deli meats. Soya and gluten were the most common undeclared plant proteins (>28%), while pork (37%) and chicken (23%) were the most

common undeclared animal species. Unconventional species such as donkey, goat, and water buffalo were also detected in some products [39]. The substitution of high-value meat species with cheaper alternatives for economic gain is a prevalent form of food fraud [40]. It affects not only meat producers and packers but also restaurants and retailers due to the ease of concealment at these stages [40]. The lack of clear labelling requirements for ready-to-eat foodstuffs in SA raises critical concerns for consumer protection and public health. Insufficient labeling can impede informed decision-making, especially for individuals with allergies or dietary restrictions. This lack of clear information can lead to the unintentional consumption of allergens or ingredients that conflict with their dietary needs.

Despite the existence of food labeling legislations in Sub-Saharan Africa (SSA) designed to safeguard consumers, effective implementation remains a challenge, and South Africa is no exception [7]. Collectively, these studies underscore the prevalence of processed meat mislabeling in SA, which contravenes food labelling regulations and poses economic, religious, ethical, and health risks. While most meat mislabeling incidents do not pose immediate health risks, they constitute consumer fraud and may violate religious principles. For example, Muslims and Jews adhere to dietary restrictions that prohibit pork consumption, while Hindus avoid beef products [40]. Mislabeled meat products could compromise the constitutional rights to dignity and freedom of religion, as argued by Rive (2013) [44]. Specifically, mislabeled meat products could potentially mislead consumers of kosher (Jewish), halal (Muslim), or Hindu products into consuming pork or beef unknowingly, which would constitute a violation of their religious beliefs [40,44].

The prevalence of seafood and meat product fraud in South Africa suggests that existing standards, legislation, and enforcement measures are insufficient to address this issue. This may be attributed to the rapid pace of economic development, urbanization, and dietary changes, which often outpaces the development and implementation of effective food safety governance frameworks [12]. However, to date, no studies have assessed the quality of food labelling and regulatory compliance in SA since the new food labelling legislation came into effect in March 2012 [39]. This is compounded by the lack of public disclosure of food safety compliance statistics by food control/safety authorities [21]. The lack of prosecutions under labelling legislations [42] is supported by Mokoatle et al. (2016), who found that EHPs' were unable to enforce the legislation in its entirety, including ensuring that people who violate food safety laws are prosecuted [45].

### 3.5. Future Food Fraud Crisis

The absence of food safety regulations for e-commerce (online food stores) in SA poses a significant risk of fraudulent food products, ingredients, or packaging being deliberately substituted, added, or misrepresented for economic gain [13]. The COVID-19 pandemic has fueled a significant rise in online shopping in South Africa, but this increased online activity has also led to a corresponding rise in complaints against online retailers, including food retailers [46,47]. E-commerce platforms offer numerous opportunities for food fraudsters to operate, such as creating fake online stores, selling mislabelled or counterfeit products, or tampering with products during delivery. Consumers are especially vulnerable to food fraud through e-commerce because they have limited ability to inspect food products before purchase [13]. SA food regulatory authorities can learn from China's success in implementing food safety laws for e-commerce food sales [48].

The lax enforcement of food regulations in SA's informal sector poses a significant public health risk, particularly in urban and metropolitan areas where a substantial portion of the population relies on street vendors for their daily meals [49]. The informal sector, a key producer and distributor of fresh and processed food products, including street foods, for direct consumption, often operates outside the purview of official food control systems and remains largely unregulated [12,17]. Numerous disturbing cases have brought to light the widespread prevalence of food fraud in the informal sector of SSA [7]. To address this pressing issue, stringent enforcement of food safety regulations is essential to ensure that food products sold in the informal sector meet the acceptable standards. This will safeguard public health by minimizing the risk of foodborne illnesses and ensuring that consumers have access to safe and wholesome food.

In response to weak food law enforcement, the formal food retail industry has resorted to a self-regulatory system that includes the use of internal and third-party audits, worker training, external testing, and consumer education [12]. South Africa's approach to food safety mirrors that of many African nations, characterized by insufficient prioritization of this crucial public health domain. This

is evident in the absence of food legislation that aligns with internationally recognized standards. [17]. Formal food producers in SA, particularly those involved in export or with international operations, often implement best international food safety practices and seek accreditation from international authorities, even if these requirements are not explicitly mandated by local food control/safety laws. Examples of such systems include Food Safety System Certification Scheme (FSSC) 22000, (British Retail Consortium) BRC, and Hazard Analysis and Critical Control Point System (HACCP) [50]. Self-regulation by the formal food sector could be attributed to absence of well-trained inspectors who can serve as both enforcers and quality assurance advisors to the food industry or lack of trust in the existing food laws [12,17].

Robust food analysis capabilities at the national and regional levels are essential for enforcing food legislation and prevention of foodborne diseases. Food control authorities rely on laboratories to provide essential analytical data to inform their decisions and resolve disputes. Laboratory results are often used as evidence in court or in negotiations between exporting and importing countries [15]. SA food control/safety authorities can further benefit from the integration of foodborne illness and food monitoring data (from the dedicated food safety laboratory) to inform risk-based food control policies. This can help the country to combat food fraud by identifying foodborne illness patterns and trends that indicate food fraud, such as a sudden increase in food poisoning cases linked to a particular food. The inadequacy of food control/safety laboratories in Africa, including SA, poses a significant challenge to ensuring food safety [17]. The limitations in testing capabilities, particularly for chemical contaminants and naturally occurring toxins, hinder the ability to detect adulterated food products, leaving consumers vulnerable to health risks [16]. The uneven distribution of laboratories across SA further exacerbates the issue, with only two provinces (namely Gauteng and Western Cape) equipped to conduct a limited range of food safety tests [16]. Additionally, the scarcity of reference laboratories restricts access to specialized testing. To address these challenges, African governments, including South Africa, must prioritize strengthening their food control laboratories. Collaborations among neighboring countries on inter-laboratory testing programs, joint training initiatives, or sub-regional laboratories could enhance testing capabilities and expertise [16]. Public-private partnerships between laboratories can also optimize resource utilization and foster knowledge sharing. Furthermore, academic institutions with food safety testing capabilities can play a crucial role in augmenting government efforts to ensure food safety in SA. Their widespread presence across provinces and their expertise in conducting a diverse range of tests make them valuable partners in protecting consumers from food safety crises. By addressing the limitations in food control/safety laboratories, African governments can safeguard public health and ensure that consumers have access to safe and wholesome food. Internationally, the development of portable testing devices for detecting food fraud is also at an advanced stage, and these devices have the potential to shift testing from laboratories to the field. DNA barcoding has proven to be an effective and efficient tool against food fraud in China [13]. Block chain technology can also play a key role in enabling food control and safety authorities to conduct product traceability in the field or on-site [13].

### *3.6. Regulatory Frameworks*

SA's food control system is highly regulated, with a complex and fragmented regulatory framework comprising numerous acts and regulations (more than fourteen) administered by various authorities at the national, provincial, and local levels [51]. Some of the legislations (i.e. FCD Act) are more than 40 years old and do not reflect the latest food safety standards and best practices. This can leave the system vulnerable to emerging food safety threats such as food fraud (commonly known as fake food in SA) [17]. This complexity, which has likely grown over time, makes it difficult for food businesses to comply with all applicable laws and regulations, and for food control authorities to coordinate their enforcement efforts [52]. FAO (2004) advise countries to develop relevant and enforceable food safety laws to guarantee food safety. Furthermore such food safety laws should adopt best food fraud preventive approaches throughout the food chain. This is an essential component of modern food control systems [14]. Governments should also adopt up-to-date food standards, tailored to the national context, while taking full advantage of existing Codex standards, guidelines, and recommendations, as well as food safety lessons learned from other countries.

SA food control authorities are fragmented and lack a centralized governing body, unlike the US Food and Drug Administration (FDA) [16,21]. This centralization allows the FDA to coordinate

its efforts more effectively and respond to food fraud incidents more quickly [53]. The fragmented nature of SA's food control and safety system has led to calls for the establishment of a single National Food Control/Food Safety Authority (FCA) [21]. Experts in the field support the creation of an FCA, arguing that it would improve the efficiency and effectiveness of food safety regulation [21,43]. Anelich [21] stresses the importance of establishing a well-defined and adequately resourced Food Control Agency (FCA) in South Africa. This FCA must operate independently from political influence, prioritizing consumer health protection and trade facilitation [21]. Failure to provide adequate resources could lead to the replacement of one ineffective food control system with another, resulting in only superficial changes [21]. The functions of an FCA can encompass inspections, sampling, and certification of food producers, suppliers, and retailers, along with the certification of food for import/export control. Such an FCA could play a crucial role in preventing and detecting food fraud. For example, the FCA could develop and implement standards for food traceability and authenticity, and conduct audits and inspections to ensure compliance with these standards. The FCA could also collaborate with other government agencies and stakeholders to develop and implement a comprehensive food fraud prevention and response plan as recommended by the [13]. Furthermore, FAO (2004) recommend that food inspectors, the key people who interact with the food industry, trade, and the public, be qualified, trained, efficient, and honest to ensure the effectiveness of official control services [15].

Notwithstanding the implementation of numerous government policies and standards, food fraudsters in SA have continued to infiltrate the supply chain with adulterated products, as evidenced by media reports [3,8–11]. To protect consumers from malicious actors who seek to make illegal profits by selling adulterated food, the government and food industry should consider investing in innovative technologies [13]. Mitigating the food fraud crisis in South Africa requires continued adherence to internationally recognized standards for food testing and implementation of comprehensive quality management systems. This includes the HACCP system (Hazard Analysis and Critical Control Points), detailed prerequisite programs such as Good Agricultural Practices (GAP), Good Manufacturing Practice (GMP), Good Laboratory Practice (GLP), and Good Hygiene Practice (GHP) [7]. Countries that have adopted food safety and anti-food fraud such as adoption of Vulnerability Analysis and Critical Control Point (VACCP) system and HACCP have reduced the ever-increasing risk of food fraud to a reasonable extent [13]. Furthermore, local food control/ safety laws (i.e labelling and advertising regulations) must be aligned to Codex Alimentarius. Despite the existence of legislation such as R146/2010 and the Consumer Protection Act, which play a vital role in combating food fraud, challenges remain in implementing these regulations. Experts have long recommended a shift from reactive (removing unsafe food and punishing responsible parties) to preventive food control/safety systems, whereby industry and trade develop and implement in-plant control based on best international practices (i.e HACCP) [14]. Additionally, investment in advanced technologies is essential to increase the frequency of analytical testing and detect fraudulent practices. One promising technology is multi-isotopic and multi-element analysis, which can identify the origin, properties, and production methods of food [5,7]. By investing in these technologies, SA food regulatory bodies can significantly increase the likelihood of detecting food fraud and deter fraudsters from manipulating the food supply chain.

#### 4. Conclusions

The South African food control and safety system faces numerous challenges that contribute to the prevalence of food fraud in the country. These challenges include lenient legislation, uneven government response to food safety crises, unclear liability for food fraud, the proliferation of online food sales, non-compliance by street vendors, and a shortage of food testing laboratories. The complexity and fragmentation of the regulatory landscape, with multiple agencies and overlapping responsibilities, further complicates the fight against food fraud. To effectively address these challenges and safeguard public health, a comprehensive approach is necessary. This approach should include strengthening food safety legislation, enhancing government oversight, promoting consumer education, enhancing laboratory capacity, streamlining the regulatory framework, and promoting ethical food production and trade. By addressing these challenges and implementing comprehensive strategies, South Africa can strengthen its food control and safety system, effectively combat food fraud, and safeguard the health and well-being of its citizens.

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