

# Eat clean and safe food: a food-based dietary guideline for the elderly in South Africa

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As the population of elderly individuals in South Africa (SA) grows, there is a need to promote the continued health of these persons as they progress through the life cycle. Food Based Dietary Guidelines (FBDGs) for the SA elderly were developed to address this need. These thirteen guidelines for the elderly collectively offer a basis of health practices that the elderly can follow to ensure that they are taking the right steps toward maintaining their health. While the guideline 'Eat clean and safe food' is not included in the current SA FBDGs, this recommendation is of particular importance to the elderly, who face a much higher risk of foodborne illness than most of the general population due to a number of factors. Reduced immunity and other physiological changes are a result of ageing, malnutrition, diseases and and/or medication side effects. All these factors play a role in the elderly's risk of foodborne illness. Increased susceptibility to certain pathogens also causes higher rates of foodborne illness infection. Lastly, elderly people's food safety knowledge and pre-established beliefs and practices regarding food handling and preparation can be influential in their sensitivity to foodborne disease. These risk factors, coupled with the heavy burden of foodborne illness and existing gaps in food safety policy, practices and education in SA, substantiate the need for a dietary guideline to address the importance of clean and safe food consumption among the elderly in SA.

**Keywords** elderly, Food Based Dietary Guidelines, food safety, South Africa

## Introduction

Coinciding with the growth of the elderly population, increased awareness of the risk of foodborne illness to societies has fostered a growing need for improved food safety policies and practices worldwide. These efforts are particularly critical in areas of the world heavily burdened with foodborne illness, such as Africa.<sup>1</sup> In order to promote the health of the growing elderly population in South Africa (SA), it is important to address health concerns specific to this population. Neither the first set of Food Based Dietary Guidelines (FBDGs) for SA, published in 2001,<sup>2</sup> nor the revised SA FBDGs, published in 2013,<sup>3</sup> included a separate FBDG addressing food safety. As individuals age, a number of physiological changes occur. One of the major consequences of this process is increased susceptibility to foodborne infections.<sup>4</sup> Reduced immunity and other physiological changes brought about by the ageing process or by other means, along with increased susceptibility to certain pathogens, all put elderly individuals at a higher risk of infection.<sup>5</sup> Beyond physical threat, the long-established food safety beliefs and practices present among the elderly population can also play a role in the acquisition of foodborne illness.<sup>6</sup> In order to combat this increased risk of foodborne illness, the elderly are strongly encouraged to follow general food safety practices and avoid high-risk foods.<sup>7–8</sup> Because of the physiological changes, reduced immunity and the higher risk of infection and susceptibility to foodborne diseases, the working group that investigated the FBDGs for the elderly recommended another FBDG, namely 'Eat clean and safe food' specifically for the elderly in SA.<sup>9</sup>

The aim of this paper is to examine information concerning the importance of food safety among the elderly population in order to support the evidence and need for this guideline for the elderly. Policy-makers, donors and programme implementers may further utilise the information to promote food safety practices among SA elderly.

## Definition of food safety

The Food and Agricultural Organization of the United Nations (FAO) defines food safety as: 'the absence, or safe, acceptable levels, of hazards in food that may harm consumers' health'.<sup>10</sup> Safe food permits the sufficient intake of nutrients and thus helps people to achieve a healthy life.<sup>11</sup> Conversely, consumption of unsafe food, contaminated with bacteria, viruses, parasites or chemical substances, can result in signs and symptoms as mild as abdominal cramps and as severe as fatal illness.<sup>11–12</sup> Unsafe food causes more than 200 diseases; the World Health Organization (WHO) conservatively estimates that 600 million people worldwide become sick and 420,000 people die from unsafe food consumption each year.<sup>13</sup>

## Food safety and its relation to health and nutrition of the elderly

No part of the world is untouched by foodborne illness; however, the burden of foodborne illness varies greatly by region. The African region has the highest burden per 100,000 population. Moreover, in the AFRICANE subregion (which includes African countries with high child mortality and very high adult mortality according to the WHO's grouping system

for global assessment defined by the WHO [2001]) in which SA lies, an estimated 1200 Disability Adjusted Life Years (DALYs) per 100,000 population was observed. These results point to the immense threat that foodborne illness poses and the need for food safety improvements in all parts of the food system.<sup>1</sup> While it is the primary responsibility of food producers to ensure that food is safe, the mishandling or improper preparation of food by consumers is a considerable driver of foodborne illness incidents. Consumers play an important role in protecting their own health and the health of others and should therefore be educated and encouraged to follow food safety practices.<sup>13</sup>

While foodborne illness should be a concern to all people, the elderly are more vulnerable than others to the effects of unsafe food consumption and susceptible to foodborne illness.<sup>11</sup> Among these, the elderly population is one of particular concern in SA, as a variety of biological, physical and behavioural characteristics of this growing population place these individuals at greater risk of foodborne illness.

## Health problems addressed by this FBDG

### **Reduced immunity in the elderly**

The gradual accumulation of molecular and cellular damage that occurs during the ageing process leads to a general decrease in physiological reserves. These changes are largely unavoidable and vary widely among individuals, even those of the same age.<sup>14</sup> As individuals age, their immune function is reduced due to a decline in both mucosal immune function and adaptive immune function. Low levels of stomach acid and decreased intestinal motility (as a result of the natural ageing process or medication side effects) reduce older adults' ability to fight off infection in the gastrointestinal tract (GIT). Loss of adaptive immune function reduces individuals' response to new pathogens, such as those present in contaminated foods.<sup>7</sup> As ageing occurs, the immune system shifts from utilising naive T-cells (those which have never been exposed to an antigen) to the predominant use of memory T-cells. The reduction in naive T-cells leads to a decreased ability to respond to new antigens, such as those present in newly encountered diseases, mutated disease agents, and those in vaccines. A decrease in naive T-cell levels further leads to failure of Interleukin-2 (IL-2) gene transcription, resulting in lowered T-cell responses in elderly individuals. Reduction in T-cell and B-cell efficiency causes lowered immune response among the elderly population.<sup>4</sup>

Beyond the reduced immunity that occurs with old age, immunodeficiency can also be brought on by a number of conditions. Malnutrition has a major impact on immunodeficiency in elderly individuals, as it has a deleterious effect on numerous immune functions.<sup>4,15</sup> Malnutrition at any age can result in an increased rate of infections and slow wound healing.<sup>6</sup> Furthermore, if older adults are infected with pathogens, the harmful side effects of infection, such as diarrhoea and vomiting, can result in nutrient losses and poor nutrient absorption. The resulting malnutrition can further exacerbate the effects of foodborne illness and make these individuals even more susceptible to infection.<sup>16</sup> Smith<sup>4</sup> identified a number of physiological, behavioural and environmental risk factors that exist for reduced food intake (a precursor to malnutrition) among older adults. These include: changes in sense of taste and smell, premature satiety, medication side effects, changes in emotional and mental health, digestive disorders, dental problems, chronic

illness, physical disability, poverty, loneliness, cigarette smoking and alcohol abuse.<sup>4</sup>

About 40% of SA adults 60 years and older are living in poverty. The poor also face the highest levels of moderate and severe food insecurity. The percentage of food-insecure South Africans has remained fairly constant in recent years; 26% of the population are categorised as having some degree of food insecurity and another 28.3% are at risk of food insecurity.<sup>17–18</sup> An inadequate variety of foods, which can result from food insecurity, can lead to deficiencies in macro- and micronutrients, which can cause lowered immune function.<sup>5</sup> Older individuals suffering from nutrient malabsorption may also experience nutrient deficiencies.<sup>4</sup>

Immunocompromised individuals also include those undergoing major surgeries, such as organ transplants.<sup>19</sup> After major surgeries, a short period of immunosuppression occurs.<sup>4</sup> Chronic diseases like diabetes and kidney disease, and some cancers (or medications taken for these conditions) can also weaken the immune system.<sup>5,20</sup> In cancer patients, for example, the chemotherapy drugs and radiation used to treat cancer also target patients' immune systems, which can leave these individuals nearly defenceless against opportunistic pathogens.<sup>19</sup> Human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) is another contributor to compromised immunity among the elderly. A 2012 national survey found that 7.1% of SA adults 50 years and older have HIV, which destroys the white blood cells that fight infection.<sup>21</sup> Although HIV treatment is now more effective, a rapidly ageing population means that the number of elderly people with HIV is projected to double by 2025.<sup>22</sup>

The cause of reduced immunity, whether it be ageing, malnutrition, surgery or any underlying condition, can influence the degree to which an individual is susceptible to foodborne illness. Regardless of the extent of their vulnerability, however, individuals with reduced immunity must be advised to take precautions to ensure that they are consuming safe foods.<sup>23</sup>

### **Increased susceptibility to disease by the elderly**

The health, physiological function and disease susceptibility of the elderly varies significantly; this variation increases as the elderly population continues to age. In addition to immune deficiency, a combination of other factors increases elderly individuals' risk of infection.<sup>4</sup>

Ageing results in the loss of physical barriers that would otherwise control pathogen entry and proliferation in the body, therefore making infections more likely in the elderly population.<sup>5</sup> Rates of incidence of foodborne illness, morbidity and mortality associated with foodborne illness all increase with age.<sup>20</sup>

Changes in the GIT are largely responsible for many of the causes of increased susceptibility to foodborne illness in the elderly. Gastritis, mucosal inflammation and atrophy occur in a large proportion of adults over the age of 50, with prevalence increasing with age.<sup>4</sup> These conditions may lead to a decrease (hypochloridia) or even complete loss (achloridia) of stomach acid, which may result in a higher number of bacteria present in the intestinal tract.<sup>4,12</sup> The prevalence of *Helicobacter pylori* (*H. pylori*) infection and atrophic gastritis, resulting in hypochloridia, also increases with age.<sup>4</sup> Although *H. pylori* infection

is highly prevalent in the global (50%) population and on the African continent (80%), the clinical manifestations associated with the infection are mild.<sup>24</sup> *H. pylori* infection is common in SA and a study has found that the prevalence increased with age to 100% in the elderly ( $\geq 60$  years).<sup>25</sup>

Overcrowding, poor sanitary practices and unsafe water sources are risk factors for infection with this bacterium.<sup>24,26–27</sup> The faecal–oral route was found to be the most important route of transmission,<sup>26</sup> mainly through contaminated food and water.<sup>26, 28</sup> Hygienic conditions should thus be addressed.<sup>24</sup>

Excessive use of antacids and H<sub>2</sub>-blockers can also result in insufficient stomach acid.<sup>5</sup> Decreased gastrointestinal motility is another effect of ageing.<sup>4</sup> When food passes through the GIT more slowly, bacteria have the opportunity to grow more easily.<sup>12</sup> If an elderly individual is already infected, peristaltic movements are necessary for the elimination of pathogenic bacteria. The use of anti-diarrhoeal medication, however, can counter the necessary action of peristalsis during bacterial infections and result in higher severity of the existing infection and prolonged presence of the pathogen in the GIT. The proliferation of pathogens in the gut can lead to the formation of toxins and damage to the intestinal tract.<sup>4</sup> Continued use of antibiotics can stimulate the overgrowth of pathogens in the colon and loss of the natural gut microflora that help to inhibit pathogenic bacterial growth.<sup>5</sup> Lastly, worsening kidney function, which can occur during ageing, may prevent pathogenic bacteria and toxins from being properly disposed of.<sup>12</sup>

Loss or decline of the senses among the elderly population additionally increases susceptibility to foodborne illness. The frailty, illness and disability associated with old age lead to lowered mobility, hearing, sight, memory capacity, ability to concentrate and ability to care for one's self, all of which can hinder safe food-handling efforts.<sup>29–30</sup> Change in sense of smell, taste or sight that occur with ageing or as a side effect of medication or malnutrition may render the elderly unable to rely on these senses to determine whether food is spoiled.<sup>5,31</sup> Poor vision may prevent them from being able to read important dates or cooking instructions on packaging, which puts them at further risk of consuming spoiled or improperly cooked food.<sup>31</sup> Decreased saliva production can make swallowing difficult and dental problems may cause individuals to avoid eating meat, fruits and vegetables, which need to be chewed; thus, they may be missing out on vital nutrients.<sup>32</sup> Lowered food consumption and the resultant poor nutrition increase the elderly's susceptibility to foodborne illness.<sup>16</sup>

Exercise can also play an important role in the maintenance of good health and immune function in older adults. Regular exercise has been shown to improve several indices of immune function in individuals. Furthermore, long-term, regular exercise appears to improve some T-cell immune functions associated with ageing and is likely a key factor in achieving maximum immune system efficiency.<sup>4</sup> The majority of both elderly men and women in SA, however, have inadequate physical activity levels.<sup>33</sup> In addition, lack of activity can also contribute to loss of appetite, which can lead to malnutrition.<sup>32</sup>

The elderly are prone to a higher rate of chronic and debilitating diseases that result in disability. SA has experienced an increase in the incidence of non-communicable diseases (NCDs) in both urban and rural areas in recent years, largely due to an increase in NCD risk factors across all populations.<sup>34</sup> For both men and

women, self-reported rates of NCDs tend to increase with age.<sup>18</sup> Increased rates of obesity among the elderly have led to a higher rate of chronic diseases, such as diabetes mellitus and diverticulosis, and these diseases are associated with increased risk of infection.<sup>15</sup> NCDs (heart disease, stroke and chronic lung disease) represent the most common health implications in the elderly population worldwide. Sensory impairments, diabetes, dementia and osteoarthritis are the main causes of disability in the elderly.<sup>35</sup> The presence of chronic disease and other health factors, such as immobility, could increase one's susceptibility to infections and the severity of one's symptoms.<sup>5</sup>

The physical environment plays a significant role in older adults' susceptibility to infection. Individuals who are unable to exercise choice or preference in terms of the food made available to them, such as those in hospitals or care facilities, are often at high risk for foodborne illness.<sup>36</sup> Residents of nursing homes may have many of the aforementioned physical and physiological characteristics that make them more prone to infectious disease. Such an environment, where a large number of individuals with high susceptibility to infection live together, has high potential for foodborne illness outbreaks with high morbidity and mortality rates if there is a lapse in safe food handling or personal hygiene practices. Placement of the elderly in care centres can also result in reduced nutrient intake as a result of loss of privacy, inappropriate meal timing and inappropriate meal temperatures,<sup>4</sup> which can lead to a state of malnutrition. Poverty and malnutrition magnify the severity of common infections, especially in developing countries<sup>15</sup> such as SA. Standard of living is also a factor in terms of the risk of acquiring foodborne illness.

Lack of resources, for example electricity availability, limits the use of important electrical equipment, such as refrigerators and freezers that are necessary for proper storage of food at low temperatures.<sup>37</sup> Poor socio-economic conditions, such as inadequate or unsafe water supply, sewage systems and institutional sanitation, can intensify the spread of pathogens. Developing areas also lack the resources necessary to treat distinct conditions among elderly people.<sup>15</sup> Increased risk of foodborne illness is not just a result of severe socio-economic conditions. Even moderate increases in food prices can put a strain on the elderly, which can lead to an increased risk of infection. Some elderly adults report buying food in bulk in response to increasing food prices. If these large quantities of food are not stored properly or eaten before the date indicated, this could further contribute to the risk of foodborne illness.<sup>38</sup>

### **Susceptibility of the elderly to certain pathogens**

With old age comes the increased susceptibility to certain pathogens such as *Escherichia coli* (*E. coli*) O157:H7, *Campylobacter* and *Salmonella* as some of the most common pathogens that affect older adults. *E. coli* O157:H7 is found in undercooked ground beef, unpasteurised milk and juices, contaminated raw fruits and vegetables and water, and can be acquired through person-to-person contact.<sup>12</sup> Among *E. coli* O157:H7 outbreaks, those occurring in nursing homes and acute-care facilities have been found to have a case-fatality rate higher than the overall case-fatality rate. *Norovirus* infections are likely the cause of most outbreaks of gastroenteritis in institutions like nursing homes and hospitals.<sup>5</sup> *Campylobacter* is often present in unpasteurised milk, raw or undercooked meat, poultry and shellfish, and untreated or contaminated water,<sup>12</sup> but can also be transmitted through the environment. Global warming may lead to higher temperatures and heavier rainfalls, which could increase

the environmental transmission resulting in more infections.<sup>39</sup> *Campylobacter* infection occurs less often in older adults than younger adults, but the hospitalisation rate for individuals 60 years and older is more than twice as great as that of any other age group.<sup>5</sup> *Salmonella* is found in raw or undercooked eggs, poultry or meat, unpasteurised milk or juice, cheese, seafood, and fresh fruits and vegetables.<sup>12</sup> The WHO Foodborne Disease Burden Epidemiology Reference Group (FERG) identified non-typhoidal *Salmonella* (NTS) and *E. coli* species as particularly burdensome diarrhoeal disease agents in Africa.<sup>1</sup>

The Centers for Disease Control and Prevention (CDC) also found a higher incidence of people infected with *Vibrio*, *Yersinia* and *Listeria* species in people 60 years and older.<sup>5</sup> *Vibrio* species, often present in raw or undercooked seafood and shellfish, was also identified as a burdensome disease agent in the AFRICAN E subregion.<sup>1,40</sup> The burden of *Yersinia* species in Africa, however, remains unknown.<sup>1</sup> *Listeria* can be found in a variety of cold, ready-to-eat foods, such as pre-made sandwiches, pâté, butter, soft, mould-ripened cheeses, cooked, sliced meats and smoked salmon; contamination cannot be detected with sense of smell, taste or sight. The prevalence of *Listeria* infection has increased dramatically in recent years, especially in the 65 years and older age group.<sup>38</sup> In fact, the world's largest reported outbreak of *Listeria* recently occurred in SA.<sup>41</sup> Caused by contamination of ready-to-eat processed meat products, the outbreak resulted in a total of 1060 reported cases of listeriosis between January 1, 2017 and July 17, 2018.<sup>41</sup> According to the last situation report published before the outbreak was declared officially over in September 2018, of all age groups, adults 65 years and older experienced the highest proportion of confirmed deaths per total reported cases.<sup>42–43</sup>

Persons 50 years and older are at a higher risk than any other age group for hospitalisation and death due to foodborne illness for most pathogens (*Listeria*, STEC O157, *Vibrio*, *Salmonella*, *Yersinia*, *Shigella*, *Cryptosporidium* and *Campylobacter*). Similarly, for many of the pathogens (*Listeria*, *Vibrio*, *Salmonella*, *Shigella* and *Campylobacter*) the fatality rate was highest among those 50 years and older.<sup>44</sup> Older adults are more likely than other age groups to experience long-term complications due to foodborne illness, such as certain cancers or neurological disorders.<sup>16,45</sup> For example, Guillain-Barré syndrome (associated with *Campylobacter* infection) occurs most often in adults older than 50. These individuals are also more likely to have a poor prognosis, such as a higher likelihood of requiring a ventilator, compared with younger patients.<sup>16</sup>

Due to the higher likelihood of some foods containing these aforementioned pathogens, the elderly are advised to avoid such foods. These higher-risk foods include: raw or undercooked meat, poultry, shellfish and seafood, unpasteurised milk and dairy products, unpasteurised juices, unwashed produce, deli meats that have not been reheated, and unpasteurised pâtés or spreads.<sup>8</sup> Choosing lower-risk alternatives to these foods can help reduce the likelihood of elderly individuals contracting a foodborne illness.

A number of factors exist that might influence an elderly individual's susceptibility to pathogens; these include pre-existing immunity from prior exposure to common food and waterborne pathogens, nutritional status, age, consumption patterns that result in different rates of pathogen exposure, the presence of chronic illness, decreased ability to mount an immune response to new pathogens, and non-specific host factors.<sup>5,19</sup>

The type and strain of the microorganism causing the infection can also influence its effect on individuals. While Hepatitis A infection is often mild or even asymptomatic in children, for example, it usually causes illness and is sometimes fatal in older adults.<sup>19</sup> The use of antimicrobials has also become a factor in the risk a pathogen poses; some pathogens are becoming resistant to antimicrobials due to overuse of antimicrobials in agriculture, animal husbandry and human clinical applications.<sup>45</sup> The overuse of antibiotics puts elderly individuals at greater risk of infection.<sup>6</sup> This problem is even more prominent in developing areas with limited resources for treatment, where misuse of antimicrobial drugs results in multidrug-resistant organisms, making the proper treatment of illness within the elderly population a challenge.<sup>15</sup>

### South African situation

A study conducted among households in KwaZulu-Natal Province found a lack in participants' basic food safety knowledge and practices. Needed improvements were noted for hand-washing, cross-contamination, storage, and thawing practices and knowledge.<sup>46</sup> A survey of 863 SA adults found that most participants (82–85%) think about food safety when shopping for, storing and preparing chicken and are aware that their practices can impact the safety of their food. However, the majority of participants were categorised as having moderate or poor chicken- and meat-handling practices (62%) and moderate or poor knowledge levels regarding factors that affect chicken safety (72%).<sup>47</sup> Street foods have become an important source of urban food supply and are often prepared and served under suboptimal hygiene conditions. Also, the hot climate and environmental conditions, such as dusty streets, can further lead to bacterial growth and health risks for the many consumers of street foods in SA.<sup>48</sup> Steyn and co-authors, however, indicated that a study conducted in Bloemfontein and Johannesburg found that 'the safety of street foods was better than expected'.<sup>49</sup> Kok and Balkaran also found that street food vendors in Durban had good knowledge of food safety and provided food of good quality. This may have been due to the periodic screening requirement by health officers and inspectors from the metropolitan, municipal and district areas.<sup>48</sup> Not all street foods are safe, however, as another study has found that street foods were often associated with diarrhoea outbreaks as a result of improper handling and serving practices in India.<sup>50</sup> This may also be true in areas in SA where unhygienic conditions are still prevalent and food handlers do not have food safety knowledge.

In lower income households, lack of sanitary services, sharing cutlery and crockery, keeping domestic animals, as well as sharing water for personal hygiene and washing hands are common practices that have been associated with higher risk of *H. pylori* infection. In households where they rely on fetching dam or river water, or using well, rain and ground water, risks of contamination is high when the containers in which the water is fetched and stored are not cleaned properly. Dams and rivers may be contaminated by both human and animal faeces and bathing or washing in, or consuming vegetables watered by this water can further increase the risk of bacterial transmission and disease.<sup>27</sup> Furthermore, in many low-income communities and rural areas sewage systems are below standard and cause an increased risk of faecal contamination of water sources.<sup>51</sup> The elderly may also still use traditional utensils for food preparation. These may include clay pots, calabash containers, wooden spoons and baskets that may be difficult to clean properly.

Traditional food processing and preservation methods, such as sun drying, fermentation, pickling, canning and pounding grains with a mortar, have been practised for thousands of years.<sup>52–53</sup> These methods form part of the culture of some population groups and constitute a vital body of indigenous knowledge. Sun drying of fruit, vegetables and meat is one of the oldest methods of food preservation and almost all food items can be safely sun-dried. However, in the case of foods that may decay during the drying process, salt may be added to prevent this. This is advised for meat, fish, tomatoes and mushrooms. During drying it is important to protect the foods against insects<sup>53</sup> and rodents. Fermentation is also one of the oldest traditional methods of fruit, vegetable, milk, root, tuber, legume and grain food preservation. Indigenous storage methods include storage in baskets or barns hanging from the ceiling/roof or on raised platforms or shelves. In-ground and pit storage are other traditional storage methods often used for roots and tubers.<sup>53</sup> It is important that all the food safety recommendations be followed when food preservation methods are applied in households.

Older generations present a unique challenge to the issue of contemporary food safety, as these individuals carry with them varying degrees of food safety knowledge and pre-established beliefs and practices regarding food safety that may make proper food handling and cooking practices more difficult to adopt.<sup>54</sup> While older adults have been shown to do a better job handling food than any other age group, certain subgroups within the adult population have been shown to engage in more risky food safety behaviours.<sup>54–55</sup> These include: men, people with higher education, people with higher income, and people with diabetes, kidney disease and cancer.<sup>54</sup> The most common practices that put the elderly at risk of foodborne illness include: improper holding temperatures for foods, poor personal hygiene, using contaminated equipment and insufficient cooking times.<sup>30</sup>

### Implementing the EFBDG and barriers to food safety

The use of improper food safety practices can stem from a number of reasons. First, older adults are less likely than younger adults to know about important foodborne pathogens.<sup>54</sup> Individuals with greater knowledge of foodborne pathogens have been shown to be more likely to follow recommended food safety guidelines.<sup>56</sup> Lack of knowledge of recommended food safety practices may also act as a barrier to following appropriate practices. The evolution of some food-borne pathogens may, too, be the cause of improper food-handling skills or lack of knowledge of the severity of these pathogens in older individuals, as pathogens like *Listeria monocytogenes*, *E. coli* O157:H7 and *Salmonella enteritidis* were not considered pathogens of concern when older adults were first establishing food safety practices.<sup>16</sup>

While some older adults are unaware of the risk of foodborne illness caused by certain behaviours, some may simply choose not to follow proper food safety practices. Beliefs developed over a long period of time and through personal experience observing and interacting with others can influence the interpretation of food safety information. Some unsafe actions may not be perceived as 'risky', as they have been followed for many years. An individual's lay logic (developed from personal experience) may be viewed as equally or more valuable than food safety recommendations from professional sources. Growing up in a time of a shorter production–supply chain,

less consumption of processed foods, and minimal use of date labelling and refrigeration may lead older adults to believe they are at a lower risk of contemporary dangers associated with foodborne illness. Thus, they are at increased risk for foodborne illness.<sup>6</sup> Surveys have found that many elderly individuals do not believe older adults are more susceptible to contracting foodborne illness.<sup>18</sup> Underestimation of the frequency and seriousness of foodborne illness from food-handling practices at home is a significant impediment to improving food safety behaviours. The belief that people are at less risk from a hazard than others, though, may explain the disparity between individuals' food safety knowledge and food handling practices.<sup>57</sup>

### Practical considerations for ensuring food safety for the elderly

In order to combat their high risk of foodborne illness, the elderly are strongly encouraged to follow general food safety practices.<sup>7–8</sup> The WHO promotes general food safety guidelines for all populations through its *Five Keys to Safer Food* campaign to prevent foodborne illness by making safe and informed choices.<sup>58</sup> The core messages of this campaign include keeping hands, surfaces and equipment clean during food preparation as well as separating raw and cooked foods in food preparation and storage. Food should be cooked thoroughly, and cooked food kept at safe temperatures. In general safe water and food should be consumed.<sup>59</sup> The WHO also encourages consumers to be knowledgeable about the food they purchase so that they can make informed choices; individuals are advised to pay close attention to the dates on food labels to help determine that the product is safe and to purchase foods from reputable suppliers.<sup>13</sup> While providing food safety guidance and recommendations such as these is necessary to reduce foodborne illness among all consumers, it is crucial for populations at greater risk of foodborne illness, such as the elderly.<sup>60</sup> Food-based dietary guidelines offer a viable medium through which scientific evidence-based recommendations may be disseminated to a target audience such as the elderly.<sup>3</sup> Sufficient scientific evidence exists for a food-based dietary guideline addressing clean and safe food consumption among the elderly population in SA and should, therefore, be utilised to promote the health of this population with a higher risk of foodborne illness.

### Note on COVID-19

The outbreak of epidemics has caused concern globally since the early 2000s. Major examples include the severe acute respiratory syndrome (SARS) in the early 2000s, followed by Ebola and the Zika virus during the early mid-2010s and mid-2000s respectively.<sup>61</sup> More recently, the human coronavirus, SARS-CoV-2, has infected millions of people. The SARS-CoV-2 virus spreads easily through close contact respiratory droplets from the nose and/or mouth causing COVID-19,<sup>62</sup> a new viral respiratory illness. At the time of writing, COVID-19 was considered a global pandemic<sup>63</sup> also affecting the elderly in SA. Although it may be possible that COVID-19 can spread by touching the mouth, nose or possibly the eyes after touching surfaces or an object, including food or food packaging, no evidence of this method of transmission exists.<sup>62,64</sup> There are a few reports of the virus being present on food ingredients and packaging materials. Those reports did not specify how the virus was identified, or that the quantity of it was viable and infectious.<sup>62</sup> Thus, food packaging, food, including pre-packaged foods from supermarkets and those prepared by

restaurants and take away outlets, or treated water is considered a low risk of SARS-CoV-2 transmission.<sup>64</sup>

In the light of the elderly being susceptible to infections due to compromised immunity, it is recommended to wash hands after shopping, handling food and other packages, before preparing food and before consumption of meals, snacks and beverages.<sup>64</sup> The following food safety practices are recommended at all times, not only during the COVID-19 pandemic, to ensure food safety.

### Recommendations for food safety at home

Food safety and hygiene must be borne in mind at all stages, from purchasing and storing food until it is cooked and ready for consumption.

#### Food safety when purchasing

- Always look for the expiry, 'sell by' and 'use by' date.
- Do not buy any food items with broken seals or packaging.
- Buy fresh food such as milk, meat and vegetables on the same day that it will be eaten, especially if no refrigeration facilities are available.<sup>65</sup>
- Choose foods with no danger signs as listed in Table 1.
- Do not buy partly thawed foods when buying frozen foods. Buy only solidly frozen foods.
- First buy dry and canned goods. Pick up perishable, refrigerated and frozen foods last on the way home.<sup>64–67</sup>
- Place raw meat, poultry, fish and seafood in plastic bags separately from other foods.
- Separate ready-to-eat foods from those that are raw.
- Look at the 'sell-by' and expiry date or 'best before' date on milk, refrigerated and frozen food items.<sup>68–69</sup>

#### Food safety during storage

- Unpack groceries and store within 2 hours of purchasing.<sup>64</sup>
- Keep all food items in a clean container or in the original packaging during storage.

Table 1: Danger signs of unsafe food<sup>70</sup>

Food type	Food items	Danger signs
Fresh foods	Fish, meat, dairy products, fruit and vegetables, roots	<ul style="list-style-type: none"> <li>• Bad smell</li> <li>• Visible signs of mould</li> <li>• Fish with dull eyes, loose scales, soft flesh, pale gills</li> <li>• Soft meat with a bad smell or greyish colour</li> </ul>
Dry foods	Flour, grains, nuts, legumes, sugar	<ul style="list-style-type: none"> <li>• Damp</li> <li>• Mouldy</li> </ul>
Oils and fats		<ul style="list-style-type: none"> <li>• Unusual taste</li> <li>• Rancidity</li> </ul>
Canned foods		<ul style="list-style-type: none"> <li>• Swollen</li> <li>• Leaking</li> <li>• Badly dented</li> <li>• Food looks, smells or tastes bad</li> </ul>

- Do not use soap or detergent, but wash fresh vegetables and fruit under running water and keep in a refrigerator until use. If no refrigerator is available, cover clean vegetables with a clean, damp cloth and store in a cool, airy place. When pre-cut items are labelled as pre-washed and/or ready-to-eat, they can be used/eaten without washing.
- Keep dried foods such as legumes, flour and seeds in a cool, dry place where they are protected against rodents and insects, on a shelf and not on the floor.<sup>70–71</sup>
- Store foods at the right temperature.<sup>70</sup> Always read food labels for storage instructions (Table 3).<sup>65</sup>
- Place the food on a plate or in a sealed container in the refrigerator to prevent juices from dripping on other food items when refrigerating meat, chicken or fish.
- Keep refrigerated foods in the refrigerator (4°C) in a cool area and keep frozen foods in the freezer until use.<sup>65</sup>

In Table 2, the refrigerated and freezer storage times for different foods are included. These storage times will keep refrigerated foods safe from spoiling. Freezing may keep food safe indefinitely and the recommended storage times are thus for quality only.<sup>72</sup>

#### Food safety during food preparation and serving

- Do not use foods after the expiry, 'sell by' or 'use by' date.
- Throw out food with strange smells or colours.<sup>65</sup>
- Wash vegetables and fruit that will be eaten raw in clean water, and preferably under running water.<sup>70–71,74</sup>
- Scrub uncut firm fruit and vegetables (e.g. potatoes) with a clean brush.
- Wash fresh vegetables and fruit before peeling or cooking. Wipe with a clean cloth or paper towel.
- Prepare food on a clean table or in a clean container where dirt and dust cannot reach it easily – clean and sanitise regularly.
- Boil raw, unpasteurised milk (cow's or goat's milk) for drinking, using in cooking or making sour milk.
- Cook eggs before eating and do not use raw or cracked eggs.<sup>70–71</sup>
- Thaw meat and fish in the refrigerator before use, and do not place in warm water or outside to thaw – never leave meat, poultry, fish or seafood outside the fridge for more than two hours.<sup>64</sup>
- Do not rinse meat, chicken, fish or seafood before use.
- Keep meat in the refrigerator while it is being marinated.
- Make sure during preparation of any meat that it is steaming and cooked right through as heat will destroy harmful bacteria. The meat should not be pink in the middle and no red juices should be visible when it is cut.<sup>65,73</sup>
- Thaw any food item before cooking it in a microwave oven to prevent it from being undercooked in the middle and overcooked on the outside.<sup>65</sup>
- Serve food as soon as possible after preparation. If food cannot be eaten immediately, keep it warm in an oven at a temperature of at least 60°C.<sup>65,73</sup>
- Always use clean plates to serve and eat food.
- Do not use the same serving spoon for different dishes.
- Never place cooked food back on a cutting board or container that previously was used for raw food.

Table 2: Refrigerated and frozen storage times of various food items<sup>72</sup>

Food item	Refrigerator 0-4°C	Freezer ≤ -4°C
Eggs:		
Fresh in shell	3–5 days	Do not freeze
Egg yolks or whites	2–4 days	1 year
Mayonnaise, opened	2 months	Do not freeze
Deli and vacuum-packed foods:		
Store-packed chicken, ham and other cold cuts	3–5 days	Do not freeze
Bacon	7 days	1 month
Sausage, raw	1–2 days	1–2 months
Hamburger patties	7 days	1–2 months
Meat and meat products:		
Ham, cooked and sliced	3–4 days	1–2 months
Raw cubed meat	1–2 days	3–4 months
Minced meat	1–2 days	3–4 months
Steak	3–5 days	6–12 months
Chops	3–5 days	4–6 months
Roasts (e.g. leg of lamb, topside)	3–5 days	4–12 months
Organ meats (e.g. liver, kidneys, tongue)	1–2 days	3–4 months
Cooked meat and meat stews	3–4 days	2–3 months
Meat gravy	3–4 days	2–3 months
Poultry:		
Fresh chicken, whole	1–2 days	1 year
Raw chicken pieces	1–2 days	9 months
Giblets	1–2 days	3–4 months
Fried and cooked chicken	3–4 days	4 months
Dairy products:		
Butter	1–3 months	6–9 months
Buttermilk	1–2 weeks	3 months
Hard cheese (Cheddar, Gouda)	6 months sealed or 3–4 weeks after opened	6 months
Cottage and cream cheese	1 week	Do not freeze
Cream	1 month	Do not freeze
Margarine	6 months	12 months
Milk	7 days	3 months
Sour cream	7–21 days	Do not freeze
Yoghurt	7–14 days	1–2 months
Fish:		
Lean fish (hake, haddock)	1–2 days	6–8 months
Fatty fish (mackerel, salmon, tuna)	1–2 days	2–3 months
Cooked fish	3–4 days	1–2 months
Miscellaneous:		
Pizza	3–4 days	1–2 months
Soup (vegetable or meat added)	3–4 days	2–3 months
Fruit juice	3 weeks unopened or 7–10 days after opened	8–12 months

- Refrigerate leftovers immediately after they have cooled. Use shallow containers or a water bath to speed up the cooling process.<sup>65</sup>
- Keep food covered at all times.<sup>74</sup> Different types of covers can be used such as foil, netting and plastic wrapping.
- Use leftover foods within three days.<sup>65</sup>
- Reheat food right through when serving leftover food.<sup>73</sup>
- Do not smoke in the kitchen or during food preparation.<sup>74</sup>
- Use safe and clean water at all times for cleaning and cooking.<sup>73</sup>
- Never overload the fridge or freezer. Cold air should circulate freely to keep food properly cold.
- Clean spills in the refrigerator immediately and clean the refrigerator and freezer regularly.<sup>75</sup>

### Keeping a clean kitchen

- Clean the floor at least once a day with hot, soapy water. Mop excess water with a clean mop, rinsed in a bleach solution of one cup of bleach in one container

(4–5 litres) of water (or one teaspoon in three cups of warm water).<sup>76</sup>

- Mop up spills immediately.
- Use hot, soapy water to wash hands and all food preparation utensils such as cutting boards and dishes, as well as countertops/tables before any food preparation.<sup>65,77</sup>
- Air dry dishes and food preparation utensils rather than drying them with a kitchen towel.<sup>75</sup>
- All countertops or tables should be kept clean during food preparation by mopping up spills immediately.
- Use a bleach solution to disinfect all worktops before food preparation.
- Wash or replace sponges, kitchen towels and cloths regularly.
- Wipe up spills immediately.
- Avoid cross-contamination by:
  - washing all surfaces that have been in contact with raw meat, poultry, eggs and fish products before preparing other foods;
  - using a clean plate for serving cooked foods;
  - keeping raw and cooked foods separately;
  - not using marinades or sauces that have been in contact with raw meat for basting or as an ingredient for other dishes.
- Do not use disposable containers more than once.<sup>65,76</sup>
- Keep rubbish bins closed at all times.
- Keep animals away from food preparation areas.
- Clean the lids of cans before opening.
- Clean the can opener after use.<sup>70</sup>

### Personal hygiene during food preparation

- Wash hands with soap and clean running water (preferably warm water) for at least 20 seconds before food preparation, before eating meals, and after touching animals, dirty areas, soil, or visiting the bathroom.
- Keep hands away from other body parts such as the nose, mouth and hair.
- Cover all sores and cuts with new plasters or clean bandages before food preparation. If possible, wear a disposable glove over the bandage.<sup>65,75</sup> Dirty bandages are carriers of harmful micro-organisms.
- Keep food preparation utensils such as spoons and ladles away from the mouth and nose.
- Use utensils to mix food and avoid touching food with the hands while preparing meals.<sup>65</sup>
- Do not cough or spit near food.<sup>71</sup>
- Do not prepare food when suffering from diarrhoea, vomiting, fever, respiratory infection or a sore throat.<sup>74</sup>

### Keeping food safe when travelling

- Keep food in the refrigerator until ready to leave.
- Keep perishable food on ice packs in a cooler bag when travelling on a hot day.<sup>66</sup>
- Choose food items that can safely be kept outside a refrigerator. Examples are fresh fruit, bread, savoury and sweet biscuits, canned products, cheese spread and cheese portions.<sup>65</sup>

Table 3: Temperature guide for optimal food safety<sup>74</sup>

Temperature (°C)	Action
100	Boiling point
74–100	Cooking temperatures of food during which bacteria are destroyed
65–80	Keep hot food above 65°C Warming and holding temperatures. Bacterial growth is prevented, but some bacteria will survive 70°C is the optimum temperature for pie warmers and hot closets. <i>Salmonella</i> and <i>Listeria</i> are killed 80°C is the optimum temperature for food served hot. However, this is controversial and detrimental to quality
52–65	Some bacterial growth may occur. Most bacteria will survive. South African legislation specifies 60°C as the cut-off point
16–52	DANGER ZONE for holding and storing perishable food. 37.2°C is body temperature and the most favourable temperature for the growth of bacteria
6–16	Some growth of food poisoning bacteria may be possible
5	Optimum temperature for all food served cold, e.g. sandwiches, salads (10°C is the maximum temperature at which cold food should be served)
0–4	Refrigeration temperature. Will permit slow growth of some bacteria that cause spoilage. <i>Listeria</i> breed in 46 hours at 0–2°C Do not store raw meat for > 5 days Do not store poultry, fish or minced meat for > 2 days
–18–0	Freezer temperatures – all bacterial growth is stopped, but some bacteria may survive

### Conclusion

The elderly constitute a population with a high susceptibility to foodborne illness due to a multitude of factors.<sup>7,13</sup> Reduced immunity and other physiological changes brought about by the ageing process or by other means, along with increased susceptibility to certain pathogens, all put elderly individuals at a higher risk of infection.<sup>7</sup> Additionally, long-established food-safety beliefs and practices present among the elderly population can also play a role in the development of foodborne illness.<sup>8</sup> These risk factors, along with a high burden of foodborne illness and a nationwide need for improvements in food safety policy, practices and education, make the need for the promotion of food safety among the elderly in SA critical.<sup>5</sup> Dietary guidelines regarding practices for clean and safe food consumption among the elderly are therefore vital to promote the health of this population as it continues to grow.

### Author contributions

All authors assiduously contributed to the preparation of this manuscript and gave their respective approvals.

*Disclosure statement* – No potential conflict of interest was reported by the authors of this study.

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