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Aging Physiology And Susceptibility To Foodborne Illness

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Abstract:
Aging is a multifaceted process of physiological decline, susceptibility to infection, and immunosenescence, and hence the elderly are most vulnerable to foodborne infections. Foodborne infections, caused by harmful bacteria like Salmonella, Listeria, and E. coli, can be particularly dangerous for older adults. To lower the risk, it's essential to practice good food safety habits, such as proper food handling, maintaining hygiene, and thoroughly cooking food. Last but not the least, the chapter presents the role of healthy diet and physical exercise in inducing healthy aging and preventing foodborne infections, and offers practical tips for individuals and caregivers. Gene alterations, oxidative stress, and gut function are the cause of this risk, and malnutrition enhances this risk. Proper nutrition in the forms of antioxidants and phytochemicals, and physical exercise and food safety practice may reverse the risk associated with aging and induce healthy aging. The chapter emphasizes the role of dietary interventions, changes in lifestyle, and prevention behaviors in reducing foodborne infection risks and overall health in the elderly.

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I. Introduction

Aging is a multidetermined process of declining function and the increased risk of mortality and morbidity. Maintaining a well-balanced diet may help slow or even reverse age-related cognitive decline, including conditions like Alzheimer's and Parkinson's disease, by supporting brain health.

That food (unhealthy diets with fewer whole grains, fruits and vegetables, and loads of sugar, salt, saturated fat and ultra-processed foods) is one of the big risk factors of suboptimal health outcomes, has generated greater interest in the 'food as medicine' idea. Eating food contaminated with bacteria, viruses, parasites, or toxins like heavy metals can lead to over 200 different diseases. These foodborne illnesses are a major public health concern, placing a heavy strain on healthcare systems, reducing productivity, and negatively impacting tourism and trade. They significantly contribute to global illness and death rates.

Food contamination can happen at any stage, from production and processing to delivery and consumption. It may result from environmental pollution—such as contaminated water, soil, or air—as well as poor food handling and unsafe processing conditions. These diseases can cause a wide range of health issues, from common diarrheal illnesses to more severe conditions like cancer. While most foodborne diseases affect the intestines, they can also lead to neurological, reproductive, and immune system problems.

Diarrheal diseases are among the most common foodborne illnesses worldwide, but they disproportionately affect children under five and people in low- and middle-income countries, where access to clean food and water is often limited.

Aging

Aging is likely to be the most intricate and multifaceted biological process. Aging is a physiological decline of different biological processes in the organ by progressive loss of cellular plasticity to internal and external damage. Senescence as cellular aging is the feature of aging and is the loss of the ability of the cells to regenerate. [Zia *et al*., 2021]

Aging happens partly because our DNA becomes less stable over time. Damage and mutations build up in our cells due to factors like radiation, chemicals, and errors during DNA replication, which gradually affect how our bodies function.These gene alterations can cause malfunctioning of the cells and produce aging. Heredity genetics is contributing a very negligible role, i.e., only 3% in aging. [Asejejje *et al*., 2024]

Figure 1: Life cycle and Aging process.

Who Is At Risk?

Foodborne illnesses can affect anyone, but certain groups—such as pregnant women, young children, the elderly, and those with weakened immune systems—are at a higher risk of severe complications. (https://www.fda.gov/files/food/published/Most-Common-Foodborne-Illness)

Mechanism Of Aging:

Aging occurs because our body's natural processes lead to a gradual decline in how our organs and systems function as we get older. (Li *et al.,* 2021). The process of aging is generally explained in two ways. One theory suggests that aging is a natural part of development, driven by factors like cell aging, hormonal changes, and shifts in the immune system. The other theory argues that aging happens due to accumulated damage over time, such as genetic mutations and oxidative stress. However, the distinction between these two ideas is becoming less clear, as aging processes are closely linked to certain diseases. (Davalli *et al.,* 2016). Aging begins when internal and external stressors weaken the body's ability to repair itself. It is driven by changes in genetic information, chromosome structure, and protein balance. For example, DNA damage, epigenetic modifications, telomere shortening, and protein misfolding contribute to the aging of cells, tissues, and the entire body. As damage accumulates, the aging process accelerates. Cellular senescence, a permanent cell proliferation block, is a second marker of ageing cells. In ageing phonotypes, reactive oxygen species (ROS) have complex biphasic actions; beneficial at optimal concentrations, but detrimental at excess concentrations [López-Otín *et al.,* 2013]. Cellular senescence has some benefits, such as helping to prevent cancer. However, when too many senescent cells build up, they can speed up the aging process and cause harmful effects on the body[Hoenicke *et al.,* 2012]. Due to the intricate interdependence between ageing phonotypes and ageing processes, ideal anti-aging plans have proven difficult to create. Recent revelations from phytochemical studies show a clear mechanism for retarding human aging to curtail the threat of disease with aging, potentially increasing lifespan and health span.

Physiology Of Aging:

As people age, their body's ability to handle stress and recover gradually declines, a process known as homeostenosis. When these reserves are depleted, older adults become more vulnerable to stress, leading to frailty. However, under normal conditions without added stress, many age-related changes remain unnoticed.Some of these reserves are constantly working to maintain balance in the body, and measuring this effort—known as allostatic load—can help predict aging-related health outcomes. Low-level inflammation and age-related changes may play a key role in these processes. Since aging affects people in different ways, there is a lot of variation among older adults. Additionally, gender differences in aging are gaining more attention as researchers explore how men and women experience aging differently. Likewise, heterogeneity in the erosion of reserves among older persons explains their nonspecific symptom presentations on illness.Understand the special population which older adults belong to by knowing the general age-related changes. [Taffet *et al.,*2024]

Aging is characterized by a continuous, predictable, and progressive alteration in all organs and systems. With the passage of time, each body undergoes changes in physiology at the molecular, organ, and functional level. Optimal function in most organs is found in the third and fourth decades of life with gradual decline. Age-related presentation is insidious, largely asymptomatic, and infrequently impairs everyday function. Yet age-related physiologic adaptations lead to a reduction of homeostatic reserves. Physiologic adaptation in most tissues

is anticipated over time and should be differentiated from pathologic changes that occur as a result of disease. [Dharmarajan *et al*., 2021]

Role Of Diet In Aging

Diet plays a crucial role in how the body ages. Various diet components, present in fruits and vegetables, spices, have been isolated and studied for a number of decades for their possible anti-aging and therapeutic effects. Phenolic compounds present in diets such as phenolic acids and flavonoids contribute to longevity by lowering oxidative stress, regulation of signal transduction, and gene expression [zia *et al.,* 2021].

Free Radicals In Aging

Generation of Pathogenic Free Radicals (H-FRs) with oxygen or nitrogen atoms is influenced by environmental and internal factors. The pathogenic effect of Oxidative Stress, or OS, is initiated by an impairment of body defense mechanisms and production of H-FRs. Aging is marked by a gradual reduction in organ and tissue function. Age pathologies begin as an abnormally high level of H-FRs that prevent cells from dividing, healing, and functioning, according to the OS theorem of aging. [Mustafa *et al*., 2023]. Aging has been commonly referred to as a persistent decline in biochemical and physiological processes following the reproductive stage. In early life, aging has little impact on the body's changes, but its effects increase rapidly with age due to the accelerating aging process. Free radicals contribute to oxidative stress, which the body fights using its natural antioxidant defenses, assisted by certain nutrients from food. However, if free radical production exceeds the body's ability to neutralize them, it can lead to oxidative damage over time. This damage is believed to play a role in aging and age-related diseases such as heart disease, cancer, and neurodegenerative conditions.As people age, both the production of free radicals and the damage they cause tend to increase. The body relies on oxygen to produce energy in the mitochondria through oxidative phosphorylation, but this process also generates free radicals, which can harm proteins, DNA, and lipids, contributing to the aging process.(Rahman *et al.,* 2022)

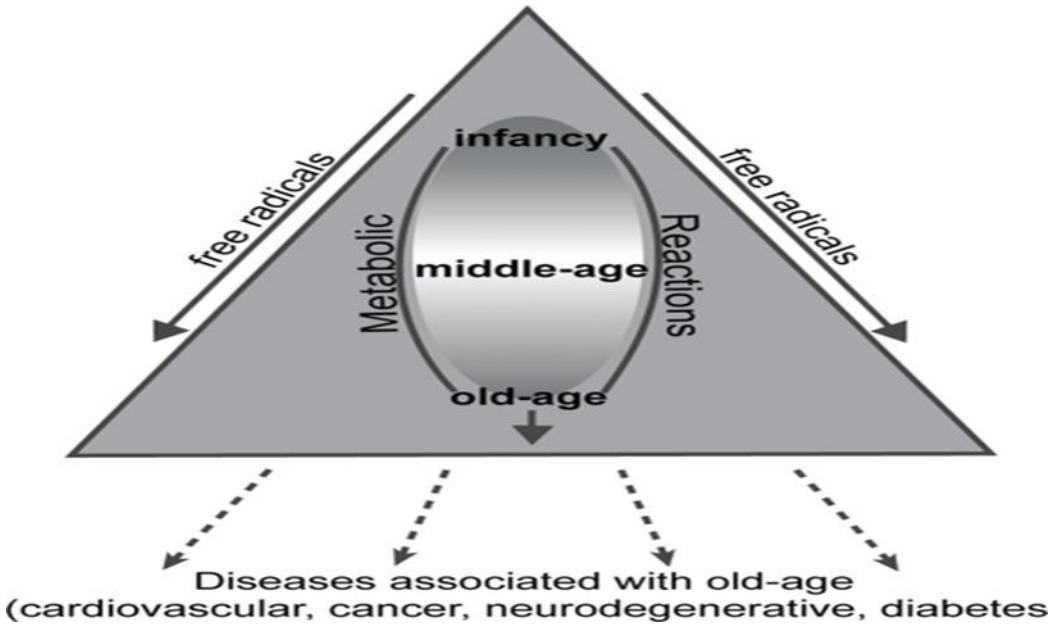

Figure 1: Association of free radicals with age, and age-related diseases.

Antioxidants:

These compounds neutralize free radicals by either donating or accepting an electron, preventing further damage. They act as the body's natural defense against free radicals, which can cause cellular damage and contribute to age-related issues like skin wrinkles. The anti-aging action of antioxidants is attributed to their anti-inflammatory action, slowing or prevention of cancer, diabetes, and brain disorders. Antioxidants also possess the ability to reduce blood pressure and prevent atherosclerosis formation. Antioxidant nutrients are also recommended to diabetic patients to reduce oxidative stress induced because of the excess generation of free radicals. Antioxidants neutralize these poisonous free radicals by absorbing the reactive molecules, hence safeguarding cells from endogenous and exogenous stress agents and enhancing their longevity and functions. [Uwa *et al*., 2017].

Figure 2: The Biochemistry of aging muscle

The Immune System And Aging

The immune system can perform at usual levels as age progresses. The immune system is among the most significant mechanisms of disease resistance and health, and a reduction in the number of cells that are involved in disease fighting is one of the strongest contributing factors in the number of infections that are possible. Apart from the inevitable reduction in immune function with increasing age, extensive surgery also has an impact on the body's resistance to infection. To offset the impact of aging on the immune system, constant consistent long-term exercise is required. (https://www.ndsu.edu/agriculture/sites/default/files/2024)

Foodborne Illness:

Foodborne illnesses occur when food becomes contaminated at any stage, from production and delivery to consumption. They can result from environmental factors like polluted water, soil, or air, as well as improper food storage and handling. These illnesses range from mild conditions like diarrhea to more severe diseases, including cancer. While most foodborne diseases affect the digestive system, they can also cause neurological, reproductive, and immune system issues. Diarrheal diseases, in particular, are a widespread health concern worldwide. (https://www.who.int/news-room/fact-sheets/detail/foodborne-diseases)

Causes Of Food Borne Illness:

Eating raw chicken can cause food poisoning. Consuming raw dough, flour, or eggs also carries a risk of foodborne illness. Similarly, raw milk and products made from it may pose health risks. The resistance bacteria may be transmitted to man from animal foods and animals. Raw turkey may harbor foodborne microbes. (https://www.cdc.gov/food-safety)

Causes Of Foodborne Diseases

Escherichia coli (E. coli) is a common type of bacteria that can live in the human intestines for a long time. While some strains are harmless, others can cause serious illness. E. coli infections often spread through contaminated food or water and are a major cause of foodborne outbreaks worldwide. To reduce the risk, practice safe food handling, cook meat thoroughly, and avoid drinking unpasteurized milk or juices like fresh apple cider.

NOROVIRUS is the leading cause of food- and waterborne illness in the United States, but it can also spread easily from person to person. Symptoms usually appear within one to two days after consuming contaminated food, though they can start as soon as 12 hours. The first sign is often sudden vomiting, followed by diarrhea, stomach cramps, headache, mild fever, and body aches. To protect yourself and others, practice safe food handling and wash your hands thoroughly.

SALMONELLA bacteria can cause two types of illnesses:(1) Salmonellosis – This common infection leads to nausea, vomiting, diarrhea, stomach cramps, and fever. Symptoms usually last a few days and clear up within a week. Many types of food can carry Salmonella, including meat, eggs, fruits, vegetables, spices, and nuts.(2)Enteric Fever – A more severe illness that includes high fever, diarrhea or constipation, body aches, headache, and fatigue. This category includes typhoid and paratyphoid fever. Most cases in the U.S. come from travelers who were infected abroad. Without treatment, enteric fever can be fatal in about 10% of cases. It is usually linked to drinking water contaminated by sewage.To prevent Salmonella infection, cook food thoroughly, wash your hands properly, keep raw and cooked foods separate, and store food at safe temperatures. If you're traveling to an area where typhoid fever is common, consider getting a typhoid vaccine.

CAMPYLOBACTER is a common cause of foodborne illness in the U.S., though most cases occur individually rather than in outbreaks. It spreads through contaminated water, unpasteurized milk or cheese, and

undercooked or raw chicken, as well as some other meats and seafood.Infected individuals typically develop symptoms like nausea, vomiting, diarrhea (which may contain blood), stomach cramps, and fever within 2 to 5 days. These symptoms can last up to 10 days. In rare cases, the bacteria can enter the bloodstream, causing a severe and potentially life-threatening infection.To prevent infection, cook meat thoroughly, practice good food safety habits, wash your hands regularly, and avoid consuming raw or unpasteurized milk and cheese.

HEPATITIS A is a disease caused by the Hepatitis A virus, mainly spreading through contaminated food or water. Common sources include contaminated water, shellfish, and salads, though other foods can also carry the virus. The infection is usually mild, with symptoms appearing 2 to 4 weeks after exposure and lasting 1 to 2 weeks. Symptoms may include fever, loss of appetite, nausea, vomiting, diarrhea, muscle aches, and jaundice (yellowing of the skin and eyes). To reduce the risk of infection, practice good hygiene, especially frequent and thorough handwashing.

LISTERIA Although Listeriosis is not a common foodborne illness, it is one of the leading causes of foodborne-related deaths. Listeria bacteria can cause two types of infections:(1)A mild to severe illness with symptoms like nausea, vomiting, stomach pain, fever, and sometimes diarrhea, which usually resolves on its own. (2) Invasive Listeriosis, a more serious infection that spreads beyond the digestive system to the bloodstream or brain, potentially leading to blood infections, meningitis, and other life-threatening conditions. For pregnant women, Listeria infection can result in miscarriage, stillbirth, premature birth, or severe illness in newborns. To reduce the risk of Listeria infection, practice proper food safety—wash hands thoroughly, keep the refrigerator at 40°F (4°C), store raw and cooked foods separately, and avoid unpasteurized milk and cheese.

Other foodborne illnesses include Botulism, Brucellosis, Campylobacter enteritis, E. coli infections, Hepatitis A, Listeriosis, Salmonellosis, Shigellosis, Toxoplasmosis, Viral gastroenteritis, Taeniasis, and Trichinosis.

Food That May Contain Foodborne Illness

1. Raw foods of animal origin, such as meat, poultry, eggs, unpasteurized milk, and shellfish, have a high risk of contamination.
2.Fruits and vegetables can become contaminated if crops are fertilized with manure or washed with contaminated water.
3. Raw sprouts pose a higher risk of contamination because their growing conditions are ideal for bacteria. Similarly, unpasteurized fruit juices or cider can become contaminated if the fruit used contains harmful pathogens.
4. Food handled by someone who is sick with vomiting or diarrhea, or has recently recovered, can become contaminated. If these foods are not cooked afterward, such as salads or cut fruit, they can spread the illness to others.

Elderly individuals are at a higher risk of foodborne illness and other infections due to several factors. These include a weakened immune system, changes in digestion such as reduced stomach acid and slower intestinal movement, poor nutrition, lack of physical activity, and living in nursing homes. Overuse of antibiotics can also contribute to the risk. Outbreaks in nursing homes have shown that older adults are more likely to suffer severe complications or fatalities from foodborne illnesses caused by bacteria like Campylobacter, Clostridium perfringens, E. coli O157:H7, Salmonella, and Staphylococcus aureus. (Smith *et al*., 1998)

Gastrointestinal System:

The gut microbiota plays a crucial role in protecting against infections and supporting metabolism. While much research has focused on the microbiota in adults, less is known about how it changes with age. In older adults, especially those on antibiotics, disruptions in gut bacteria (intestinal dysbiosis) may have a significant impact on health. (Hopkins and others, 2001)

Digestive System:

Older Adults — Individuals aged 65 and above face an elevated risk of foodborne illness-related hospitalisation and death. The physiological changes that take place in different organs and body systems as one ages are thought to be the cause of this increased vulnerability.

- The digestive system tends to retain food for extended periods, which facilitates bacterial growth, Although the stomach does not necessarily generate sufficient acid to control the proliferation of intestinal bacteria.
- The liver and kidneys have the potential to become less effective in eliminating foreign bacteria and toxins from the body.
- Typically, between the ages of 50 and 60, the immune system begins to deteriorate in most individuals. By the age of 75, many older adults experience a significantly weakened immune response, increasing their susceptibility to foodborne illnesses while simultaneously diminishing their capacity to combat contaminations.

(https://www.fda.gov/food/people-risk-foodborne-illness/food-safety-older-adults-and-people-cancer-diabetes-hivaids-organ-transplants-and-autoimmune)

Alterations in gastrointestinal physiological features:

Alterations in the normal physiological characteristics of the gastrointestinal system can be categorized into three primary areas: modifications in neuromuscular function, structural changes within the gastrointestinal tract, and variations in the absorptive and secretory capabilities of the bowel. Neuromuscular alterations predominantly impact the upper gastrointestinal tract, especially the esophagus, potentially resulting in symptoms associated with various medical conditions, including gastroesophageal reflux and achalasia. Structural changes in the bowel wall are particularly evident in the distal colon and are linked to the most prevalent age-related colonic condition, diverticulosis. (Whiteway et al., 1985). Functional changes in secretion and absorption primarily occur in the stomach, where secretion takes place, and in the small intestine, which is responsible for absorption. However, establishing a consistent connection between these age-related alterations and pathological characteristics proves to be challenging.

Food Borne Illness In Older Adults:

It has been discovered that those 65 and older are more likely to die from foodborne illness and require hospitalisation. Nearly half of those 65 and older who have a laboratory-confirmed foodborne illness caused by Salmonella, Campylobacter, Listeria, or E. coli end up in the hospital, according to the Centres for Disease Control and Prevention (CDC). The risk is higher for older adults than for those 65 and older. Depending on the germ you consumed, your symptoms could be minor, moderate, or severe. The most common signs of food poisoning include fever, dehydration, nausea, vomiting, diarrhoea, and upset stomach and cramping. If you experience any of these symptoms, call emergency medical services immediately. The immune system's response to illness becomes weaker. The digestion system retains food for an extended period, and bacteria multiply. The kidneys and liver might not be able to adequately rid the body of bacteria and poisons from outside sources.It's possible that the stomach doesn't produce enough acid. The amount of microorganisms in our digestive tract is reduced by the acidity. Chronic conditions like diabetes and cancer can also increase a person's risk of contracting a foodborne illness.
[https://www.fsis.usda.gov]

Foods That Hinder Aging

For the prevention and treatment of ageing and age-related disorders, resveratrol may be a helpful and safe compound. Resveratrol was present in most foods, including grapes, red wine, peanuts, and blueberries. The mechanisms of anti-aging of resveratrol were mainly reduced inflammation and oxidative stress. The response, improved mitochondrial performance, and controlling apoptosis.[Zhou et al.,2021]

Safety And Guidance Of Foodborne Illness:

Prevention is always preferable to cure. It is imperative to follow the rules of security to prevent foodborne sickness. Mishandled food can result in foodborne illness.

Following these four easy measures can help prevent foodborne illness:
Clean: Regularly wash your hands and surfaces.
Keep apart: Avoid cross-contamination.
Cook: Bring the food to the right temperature.
Chill: Put in the fridge right away.

Maintaining cleanliness is essential to preventing foodborne illness. Hands should be cleaned using for 20 seconds, use warm, soapy water. If you have any kind of skin abrasion on your hands or infection, wear sterile, disposable gloves at all times. Clean your naked or gloved hands with soapy, warm water. Cutting boards should be cleaned using hot, soapy water. water after each usage. Food and food surfaces should be kept clear of pets, home cleaners, and other pollutants. Cleaning is essential to preventing foodborne illness because bacteria are present everywhere.

Healthy Aging

Healthy ageing is a lived individual experience shaped by healthy behaviours across a lifetime. This encompasses the capacity of a person to: satisfy their basic needs; acquire, develop and make choices; be able to move about; establish and sustain relationships; and contribute to society. An older person's healthy lifestyle entails: healthy eating, regular exercise, maintaining weight at healthy weight, good mental health, social engagement, routine checkup and screening of health, no tobacco smoking and falling prevention. [Chalise et al., 2022]

Healthy ageing refers to "the process of developing and maintaining the functional ability that enables well-being in older age". Food is one of the modifiable predictors of prevention of age-related diseases and maintenance of general good health status during the aging process. Eating habit is one the key modifiable lifestyle characteristics of preventing diseases due to old age and the maintenance of the overall health status throughout the process of aging. Encouragement of healthy nutrition in the elderly population is crucial to support them towards maintenance of health and independent functional ability. [Suey et al., 2021]

Plant Based Supplements For Anti-Aging

1. Adaptogens: Adaptogens are plant-derived products from herbal plants. These products lessen the susceptibility of cells to stress and increase the body's ability to tolerate the injury due to other causative reasons.
2. Bacopa monnieri: Bacopa monnieri or Brahmi. The phytochemicals which are derived from Brahmi help guard the brain against the free radical assault and stimulating mental processes and learning.
3. Curcuma longa: Curcuma longa is a plant belonging to the ginger family, which produces a compound named curcumin. Because curcumin can slow down cellular senescence, it offers anti-aging qualities. It has been demonstrated that curcumin can control and alleviate the symptoms of age-related illnesses including atherosclerosis, cancer and diabetes.
4. Embilica officinalis: It is also known as Amla. The Amla churn is renowned for improving the memory capacity and lowering the cholesterol levels. The dietary intake of Amla is also helpful in lowering the level of cholesterol in the body and even in the brain.
5. Ginkgo bilbo: Ginkgo biloba or Gingko is a functional meal that enhances the tissues' ability to receive oxygen. extract from gingko biloba during Alzheimer's disease treatment and cognitive function. Numerous studies have revealed that the,

When individuals with moderate dementia consume gingko biloba extract, their cognitive function improves. [Dhanjal et al.,2021]

Green Diet:

A ‘‘Green diet’’ is one that food includes high in plant foods together with limited amount of meats. [Chiu et al., 2021], although vegetarianism focuses on dietary patterning in terms of the dietary intake of plant based foods, and the overall amount of food consumed. Plant-based food with exclusion of animal meat [Tonstad et al., 2009]. Meanwhile, a green diet also Concentrates on the need to eat well by consuming less salt in the clinical course. consumption of plant-based food. It is also of interest that there is an attractiveness of a green diet that is it all about the pluses. Food sources of origin for environmentally sound [Chiu et al., 2021]. Further insights on healthy This includes not only aging itself, but also hints and suggestions about a green diet, salt reduction, and so on intake will also be discussed. Even someone who eats mostly plant-based foods might consume far more salt each day than is advised for optimal health. Due to their diminished sensitivity to salty, the issue gets worse for older people [Chau et al., 2017]. Consequently, it is believed that two crucial elements of a healthy diet for the elderly are reducing salt intake and implementing plant-based meals.

Food Safety Controls

The Four Steps to Food Safety

If you are 65 or older, or prepare food for someone who is, always follow the four steps to food safety

1. Clean: Periodically wash and sanitize your hands, utensils, and surfaces. Bacteria may live and spread in most places.
2. Store apart: Keep raw meat, poultry, fish, and eggs apart since they can contaminate goods that are ready to eat.
3. Cook: To ensure that any dangerous bacteria are eliminated, use a food thermometer to determine whether a meal has reached a safe internal temperature.
4. Chill: Store food that will spoil in two hours. If it's exposed to more than 90 F (e.g., a car left running or picnic), cool it within an hour.

We advise committing yourself to safe food handling for life to reduce your risk of foodborne illness. Remember that the older you are, the weakened your resistance to infection.
(https://www.fsis.usda.gov/news-events/news-press-releases/adults-65-and-older-risk-population-why)

Risk Factors For Low Nutrient Intake In The Elderly

1.A change in flavor and aroma (a reduction in the enjoyment of eating)
2.Initial satiety.
3.Medication (nausea, malabsorption, appetite loss)
4.Emotional state shifts (loneliness, sadness, and grief)

5. A change in mental state, such as dementia, mania, or paranoia
6. Digestive disorders (oral dryness, hypo- and achlorhydria, difficulties swallowing, gastrointestinal disorders, malabsorption, and dental issues)
7. Long-term conditions (diabetes, respiratory conditions, cardiovascular conditions, cancer)
8. Physical impairment (difficulty preparing and shopping for food)
9. The state of poverty
10. Social isolation and living alone
11. Abuse of alcohol and cigarette smoking

Nutritional And Aging

Malnutrition is caused by lack of control over food and privacy, unsuitable food times, the wrong temperatures of food, the need for assistance when eating, and the presence of people who are boisterous or psychotic and unsatisfactory conditions for eating can be responsible for a decrease in the dietary consumption of older adults (62) Certain nutritional issues, including protein-energy undernutrition, vitamin and trace mineral deficiencies, and even nutrient malabsorption, can occasionally affect older persons (Chandra 1997). There are a number of risk factors that can lead to malnutrition are identified, along with multiple explanations for why a certain percentage of the aged population suffers from malnutrition.

Malnutrition: at any age leads to more infections and delayed wound healing and clinical results (Black et al., 1995). The correlation between healing and nutrition and immunity, because malnutrition negatively affects a number of immunological functions.

Nutritionally acquired immunodeficiency syndrome (NAIDS) is a term applied to malnutrition-induced immunological dysfunction (Beisel 1995, Beisel 1996). As the elderly experience age-related immunodeficiencies NAIDS places an added burden on the aging immune system with consequential enhanced risk of infection. Diets of about one third of the elderly have been estimated to be lacking in vitamins and trace elements (Chandran 1997.). It has been discovered that giving older people vitamin and/or mineral supplements improves a number of immune markers. For example, adding vitamin E to the diet of a group of healthy individuals who were independent at the age of 265 shown an increase in a number of cell-mediated immunological functions (Meydani et al., 1997).

Increased production of antibodies to the T-cell-dependent antigens for hepatitis B and tetanus toxoid, as well as an increase in delayed-type hypersensitivity responses, were observed. T- and B-cell counts were unaffected by vitamin E administration, nor did nonspecific IgG, IgA, or IgM levels (Meydani et al., 1997). For the vast majority of Americans, especially the elderly, iron supplements do not appear to be necessary in their diet. (Conner et al., 1997). The aging subjects do not lose iron so easily as in young subjects; hence, the storage of iron increases in the elderly (Conner et al., 1997, Johnson et al.,1997).

Therefore, iron supplements for the elderly cannot be recommended, even in the absence of clinical indications like anemia due to deficiency of iron. Senior Citizens people over 65 who live freely and are said to be in good health,showed enhanced immunity when given the best possible supplements,amounts of minerals and vitamins. After using supplements for a full year, Increases in CD4 + T cell counts and improvements in lymphocyte increase in IL-2 and IL-2 receptor concentrations in response to mitogen stimulation, and increase in the activity of natural killer cells.

Additionally, Chandra (Chandra 1992) showed that individuals who received vitamin supplements experienced less illnesses than those who received a placebo. Similarly, Bogden et al. (Bogden et al., 1994) found that daily micronutrient (mineral and vitamin) supplementation over a 12-month period significantly increased delayed hypersensitivity skin test reactions compared to a group taking a placebo. The study compared seemingly healthy, single individuals aged 59 to 85.

If an older population that is obviously malnourished receives enough supplements to their diet, it's feasible that their immune condition will improve. While studies by Bogden et al. (1994), Chandra (1997), and Meydani et al. (1997) demonstrated that nutritional supplementation improved immunological status in ostensibly healthy elderly patients, it is unclear if these subjects actually had NAIDS. (Henderson et al., 1988 Nicolle et al., 1997.).

Exercise, Immunity And Aging:

A bout of exercise of acute onset is immunosuppressive in youth and old. The impact of chronic (chronic) exercise on immune competency, however, is not very clear since clinical studies in man have yielded differing results (Mazzeo et al.,1996). Nevertheless, moderate habitual exercise has been thought to be a very significant factor with respect to long-term good health and immune response in the elderly. Seniors' skeletal, muscular, cardiovascular, respiratory, endocrine, and neurological systems all benefit from exercise. (Christiansen et al.,1993).

Frequent exercise also improves several immune function indicators in the elderly. In older participants in a fitness program, there is a significant increase in cutaneous delayed hypersensitivity reactions, natural killer cell activity, and lymphocyte proliferation in response to mitogen stimulation. Furthermore, the combination of the exercise regimen and nutritional supplements had an even more detrimental effect on immunological responses (Chandra 1989). In comparison to sedentary old age controls (mean age 66), recreational male runners of advanced age (mean age 64) showed increased cytokine production (IL-2, IL-4, and IFN--y) and lymphocyte proliferative responses to mitogen (Shinkai et al., 1995). However, there was little difference in other immunological markers between the two groups. Regular, long-term exercise seems to counteract age-related loss in some Tcell immunological functions and is likely essential for older adults' immune systems to function at their best. In 1994, Nieman et al, Recently, a great review was published that examined the connection between exercise and immunity in older people. (Venkatraman et al., 1997).

Challenges In Ageing

Aging enhances challenges in the physical aspects of eating. Elderly persons report anorexia and do not take enough energy and nutrients. Aging comes with tooth loss, and alteration of muscle function both of which lower masticatory efficiency. This is to describe challenges like loss of appetite and formulate remedies to enhance nutritional status in the elderly. Malnutrition among the elderly is partly caused by declining muscle strength resulting in suboptimal intakes.Additionally, food texture design may influence the oral processing and perceived difficulty.[Laguna et al., 2016]

Chemosensory Functions And Aging:

Aging-related changes in chemosensory function. While it is well established that aging results in losses in sensory acuity, the extent to which various senses are impacted, and its effects on liking and consumption are poorly understood. Chemosensory function affects food selection and consumption. The senses of smell and taste are essential for identifying possible dangers, identifying food, and enjoying meals. Disturbances in chemosensory function have been linked to decreased appetite, food-consumption, malnutrition and even quality of life [Fluitman et al.,2021] Knowledge of how aging alters perception of food is a critical question since it is fueling the growing demand for food drinks catering for older consumers. Elderly nutrition. Body weight and muscle mass reduces in elderly individuals and this is related to frailty and greater morbidity. There is a serious need for health promoting foods assuring proper nutritional intake, and the recognition of feeding interventions that can be used at societal level. [Giacalone et al., 2016]

II. Conclusion:

Growing insight into certain food-related behavioral drivers among the elderly. Physical (e.g., fatigue.) and socio-psychological (e.g., isolation) aging-related factors influence the manner in which individuals prepare and consume meals. Insight into food consumption behavioral drivers among the elderly is thus essential to create not only quality products, but also public health policy and innovative services that effectively encourage food consumption and healthy aging.

While there is no way to go back in time, older adults should experience fewer foodborne and other infections if they adopt a healthy lifestyle that includes regular exercise, a balanced diet, routine medical care, maintaining personal hygiene, and keeping an eye on food preparation and handling.

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