# Promoting Healthy Aging through Lifestyle Changes: The Plausibility and Evidence-based Recommendations

Abiodun Bamidele Adelowo
*Department of Public health, Texila American University, Guyana*

## Abstract

*Through the advances in public health, most humans on earth are now assured to live to at least 60 years, regardless of their geographical location and socioeconomic status. Between 2015 and 2050, the proportion of the world's population 60 years and above will be expected to increase from 900 million to 2.1 billion, while the average global life expectancy will be expected to increase by additional 10 years. Experts have ascribed this development as the most significant social transformation of the 21st century. However, although the world may have successfully learned how to live longer, it has not necessarily learned how to live healthier. In most situations, old age is associated with significant loss of physical and mental functionalities, increased risk of developing multiple diseases (including COVID-19), and reduced quality of life. This association has been described as the most important global public health challenge of the 21st century. The objective of this article is to investigate the scientific plausibility of slowing down the aging process and to identify evidence-based strategies of achieving healthy aging. A review of related online free-full articles written in the English language published from 2000 to 2021 was done. It was noticed that the pace and quality of aging can be significantly influenced by controlling the lifestyle determinants of aging. Although the science of healthy aging is still evolving, there is enough evidence for healthcare professionals to recommend evidence-based strategies for achieving healthy aging to the public and policymakers.*

*Keywords: Aging, Healthy aging, No-communicable diseases, Free radicals, Systemic chronic inflammation, Lifestyle choices.*

## Introduction

From time immemorial, understanding the aging process, and preserving youth and vitality have always been a subject of immense concern and discussion in many medical and non-medical fora [1]. Aside from the fact that aging is viewed as a lifelong process that begins from fertilization and is terminated by death, for many years, little is known about the process, and very little is known on how to possibly control it. However, recent advances in the science of aging have changed this narrative. Although all the various interplaying specific cellular and molecular mechanisms of the aging process are not yet fully understood, great scientific strides have been made already, especially on how to possibly mitigate some of the factors that may accelerate the process [2].

## Methods

The review was based on the available English literature from electronic databases in Google search engine, Academia, ResearchGate, and MEDLINE database. The websites of reputable public health organizations and institutions, such as the United Nations (UN), World Health Organization (WHO), European Commission, American College of Lifestyle Medicine, Blue zone project, American Heart Association, American Association for the Advancement of Science (AAAS), etc., were

also visited for relevant and current information. Some of the keywords that were searched include aging, global aging, aging and chronic non-communicable diseases (NCDs), aging and COVID-19, healthy aging, theories of aging, the plausibility of healthy aging, determinants of aging, blue zones, etc. The inclusion criteria were – topics relating to aging and the plausibility of healthy aging; article type from reviews, case reports, and original researches; articles published between 2000 and 2021; and articles written in English language only. While editorials, letters to the editor, and commentary articles were excluded from the review. A total number of 5, 018 articles were retrieved. They were visualized, profiled, cleansed, prepared, analyzed, and summarized, out of which 37 most relevant articles were utilized for the review.

## Defining Aging and its Attributes

Many definitions of aging exist. It may be defined as the process of deterioration of the time-dependent functions of an organism, leading to homeostenosis (inability to maintain equilibrium) of key physiological systems, which progresses from robustness to frailty, illness, disability, and terminates in death [2, 3]. It may also mean a progressive decline in the functions and performances of the body with advancing years, resulting in the failure of the cells to function normally or to reproduce and replace those cells that are dead or malfunctioning [4]. Aging also refers to the regular change that occurs in mature genetically representative organisms living under representative environmental conditions as they advance in chronological age [4]. Finally, it can also mean the outcome that results from the progressive accumulation of time-dependent changes in the body of an individual which lead to the increase in the probability of disease and death [5].

Regardless of the adopted definition, most scientists agreed that aging must be characterized by four basic concepts: it must be universal, intrinsic, progressive, and deleterious.

As a universal concept, all living beings or species must participate in the aging process [5, 6]. As an intrinsic process, the primary factors or processes that interplay in aging must be endogenous, which may or may not be enhanced by extrinsic factors. As a progressive process, the changes that lead to aging must be gradual and cumulative, usually throughout the lifespan. Finally, as a deleterious process, the changes in aging are usually destructive and should terminate in death for the organism [5]. Thus, the distinct characteristics of aging include an inevitable gradual deterioration in physical, mental, and reproductive capacities, which progress to loss of functions, loss of integrity across multiple organ systems, increased susceptibility to diseases and environmental stressors, and ultimately terminates in death [7-10].

## The Global Aging Phenomenon and its Implications

The global population is presently increasing both in number and in years of living [11]. Between the years 2015 and 2050, the proportion of the world's population 60 years and above will be expected to increase from 12% to 22%. Precisely, the world's population aged 60 years and above is expected to nearly double from 900 million in 2015 to around 1.4 billion by 2030, and triple to around 2.1 billion by 2050 [12-14]. While the average life expectancy all over the world is expected to increase by additional 10 years by the year 2050 [15]. Also, by 2050, 80% of the world population that are 60 years and above are expected to be older than 80 years, and most will likely be living in the low- and middle-income countries (LMICs) [14]. Moreover, between 2010 and 2050, the number of people who are 100 years and above will likely increase by 10-fold [11]. For the first time in human history, most people presently alive globally, are expected to live into their 60s and above, irrespective of their socio-economic status and geographical locations [11, 12, 14].

The observed increase in global life expectancy has been ranked by the WHO and the United Nations as one of the greatest achievements of the 20th century, and the most significant social transformations of the 21st century, respectively [11, 12]. However, the global changing demographic profile is a source of concerns and worries to public health professionals. The world may have successfully learned how to live longer, it has not necessarily learned how to live better or healthier. Over the past 30 years, advances in public health and medical sciences have led to a significant reduction in the rates of developing severe morbidities, disabilities, and mortality in many countries (especially in the high-income countries), however, these advances have not resulted in a significant change in the rates of developing mild to moderate morbidities and disabilities over the same period [14]. Thus, many people are presently living to old age, but often with multiple chronic diseases and disabilities.

Aging is not a disease condition, it, however, correlates positively with loss of physical and mental functionalities, which increases the risk of developing many chronic NCDs (such as cardiovascular diseases, diabetes mellitus, dementia, etc.) and communicable diseases (such as tuberculosis, COVID-19, etc.) [3, 16]. The chronic NCDs in particular, which usually disproportionately affect older adults, tend to contribute significantly to higher frailty and disability rates, diminish the quality of life, increase the demands on social services, and increase healthcare costs in old age [15]. Furthermore, the general declines in physical and mental functionalities in a large number of people around the same period will almost always result in a significant socio-economic downturn and burden in their family, community, and country at large [14, 15]. Considering multifaceted health and socio-economic challenges that confront the world as a result of rising global aging, the phenomenon has been regarded by some as probably the most important global public health challenge of the 21st century [17].

The global efforts to significantly improve life expectancy may not be worthwhile, or may even be counterproductive, if it will almost always result in significant compromise of the health, autonomy, and quality of life of the majority of the people in the microeconomy of a nation, and negatively affects the macroeconomic development of most nations of the world [12]. A world full of old and unhealthy people is not in the best interest of any person or government. The ripple effects of such possible occurrence may be too grave for the sanity of affected people, and socio-economic and security stabilities of the world, especially in the developing countries. Ensuring the best possible health and optimal functionalities in older age among the global citizens is therefore a compulsory project for the global stakeholders if the world is to achieve sustainable development and growth [18, 19].

Since the global population dynamics will continue to shift, and more people that are 60 years and above will likely to be living in the world by the year 2050, this calls for action now. All countries in the world, but more importantly the LMICs, must respond appropriately and timely, by ensuring that their health and social systems are prepared to reduce the consequences of the phenomenon of a global aging population, increase the possibility of healthy aging, and optimize the possible benefits of increased healthy life expectancy [12, 14].

**Understanding the Determinants of Aging**

Some of the aging theories that have stood the test of rigorous scientific scrutiny, and gained broad acceptance among scientists, have proposed that various internal and external mechanisms interplay in the aging process. The general principle behind most of these widely accepted theories is that aging results primarily from the accumulation of pro-inflammatory free radicals and cytokines in the body, which

eventually results in systemic chronic inflammation, and damages at the genetic, cellular, and organ levels [5, 20]. These processes in aging are most often influenced by prolonged exposure to certain unhealthy external factors, which can be environmental (such as pollutants and toxins) and unhealthy behavioral/lifestyle practices. In the presence of favorable genetic predisposition, the presence or absence of these external factors may accelerate or slow down the aging process and may increase or reduce the risk of developing age-related frailty, disabilities, and many chronic NCDs [4].

Aside from the ageing theories, multiple studies have also implicated the effects of unhealthy behavioral/lifestyle choices as the most significant or most important determinant of aging and premature death, exceeding the effects of other important determinants of aging, such as genetic, environmental, and sociodemographic factors [21]. Consequently, avoiding or controlling the unhealthy behavioral/lifestyle determinants of aging may be critical in reducing not only the aging process, but also the prevalence and severity of many age-related diseases, and increase people's general quality of life. Thus, appropriate policies and programs that emphasize healthy lifestyles from a young age may result in sustained good health, retention of most functional capacities, and ensure that most people remain independent well into older age [11].

Evidence from the 'Blue Zones' (the regions of the world where more than average people live comfortably into their century age with no or minimal disease burden) and other similar studies have also suggested that genetics may not be the greatest influence on the aging process, rather the lifestyles or behaviors of the people. According to these studies, compared to other age determining factors, lifestyle factors, such as diet, physical activity, stress management, sleep, social connectedness, etc., may be much more important in determining

how long and how well most individuals will live [22-24].

## The Plausibility of Achieving Healthy Aging

Healthy aging (also called active aging, graceful aging, successful aging, positive aging, productive aging, and resilient aging) has no universal definition [25]. It can however be defined as the process of developing and maintaining people's physical and mental functional capacities and enabling wellbeing (including good health, happiness, satisfaction, and fulfilments) even till older age [26, 27]. Healthy aging also refers to the process of optimizing opportunities for good health, social participation, and security to realize peoples' full physical and mental potentials and wellbeing throughout their lifespan [17, 26]. The process of healthy aging usually starts from birth, where genetic predispositions are influenced by favorable maternal and fetal experiences during pregnancy, and after birth by diverse supportive environmental exposures, sociodemographic factors, or personal characteristics (such as gender, ethnicity, occupation, social status, educational attainment, etc.), lifestyle choices, and disease conditions [18, 19].

As further informed by the WHO, healthy aging is plausible and attainable if there is an effective and healthy relationship between three basic factors in people: optimal functional capacity, optimal intrinsic capacity, and a supportive environment [20]. Functional capacity in people consists of all the health-related qualities that enable them to be and to do what they want or value at the time they what [27]. It also means the capacity to meet ones' basic needs (be it physical, psychological, sexual, etc.); to build and maintain healthy social relationships; to learn, grow and make appropriate decisions; to be physically mobile, and to contribute positively to the society [27]. Optimal functional capacity is achieved basically through the effective interaction and optimization of the intrinsic capacity of a person

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with consistent supportive environmental exposures [20, 27].

The intrinsic capacity of an individual refers to the total aggregate of all their physical and mental capacities at a given period [27]. Examples of common intrinsic capacities in people are the mental and physical resilience in the face of stress, the capacity to endure extreme temperatures and infections, glomerular filtration of the kidneys, maintenance of glycemia after a glycemic surge, pulmonary ventilation, efficacy of blood flow round the body, maintenance of homeostasis, blood pressure control, etc. [5]. The efficacy of different intrinsic capacities is determined primarily by the age of the person, and the presence or absence of certain health risks or determinants of aging in the person, namely – behavioral/lifestyle risk factors (such as unhealthy diet, physical inactivity, poor sleep, etc.), physiological and psychological intermediate risk factors (such as obesity, high blood pressure, high blood cholesterol, social isolation/loneliness, etc.), chronic diseases (such as cardiovascular diseases, type 2 diabetes mellitus, cancers, Alzheimer's disease, etc.), disabilities and injuries, and other broader geriatric syndromes [18, 19].

The intrinsic capacity of most people increases with age, peaks in early adulthood, after which it usually starts to decline from around 40 to 65 years. Specifically, after age 30 to 40 years, the intrinsic capacity of most internal systems (like the cardiovascular, endocrine, respiratory, renal, etc.) decline at a predictable rate of about 1% a year [28]. However, these trajectories are not always constant, some components of the intrinsic capacity (such as emotional capacity) may remain unchanged or even improved with increasing age [18]. Moreover, the effective interaction or interplay between the various determinants of aging will ultimately determine the pace of decline or pattern of presentation of the intrinsic capacities of most individuals [20].

In addition, exposure to certain environmental factors also has a vital role to play in the plausibility of healthy aging. The environment means all the external factors in the world that are part of and can influence the person's life. Such environmental factors can either be the physical environment (such as housing and road systems), or the social environment (such as friends and family). The environmental factors influence the plausibility of healthy aging at different levels of influence. They may include micro-level influencers (such as attitudes and values, relationships, family structures, social connectedness, etc.), meso-level influencers (such as community structures, cultures, etc.), and macro-level influencers (such as health and social policies, services, and systems in the country) [27]. Thus, a supportive environment often assists people to attain optimal functional and intrinsic capacities, which may ultimately translate to healthy aging (see figure 1) [20].

The figure 1 demonstrates that healthy biological aging is better achieved with the optimal functional ability (which results from the effective collaboration between optimal intrinsic capacity and supportive environment), than with optimal intrinsic capacity alone.
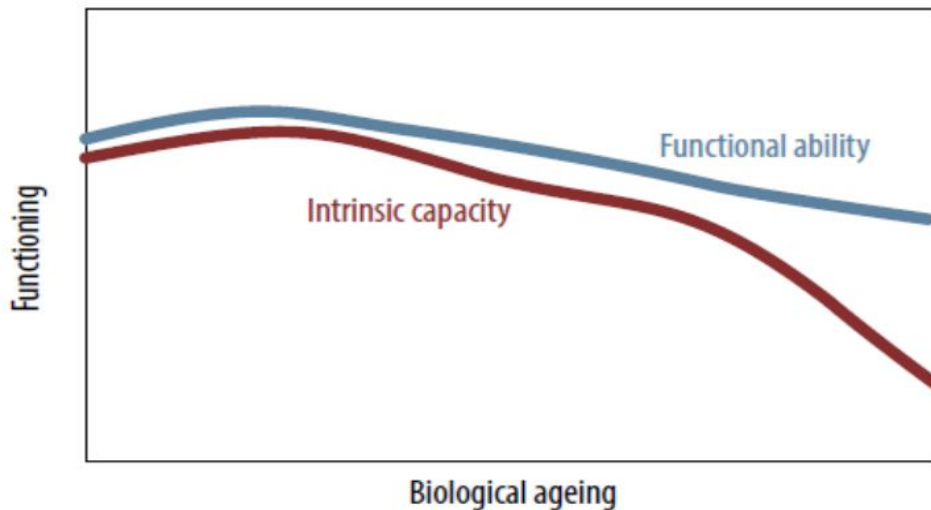
**Figure 1.** Trajectories of functional and intrinsic capacities in relation to healthy aging

Source: World Health Organization [20]

Even in people with suboptimal intrinsic capacity, a supportive environment will still allow for some degree of improved functional capacity and healthy aging. Thus, people, especially the older population, will most likely achieve their optimal functional capacity and a greater degree of independence if they are exposed to an appropriate supportive environment, and vice versa. For instance, a married person whose partner constantly smokes cigarettes at home may have second-hand or third-hand exposure to the toxic substances from the cigarette, which may result in the development of reduced respiratory fitness, even though he/she did not take the tobacco product directly. Also, without good road systems, effective security, and adequate support from loved ones, many people may have difficulty in sustaining healthy eating or exercising, Therefore, any attempt to optimize the functional ability of an individual or a group of people by improving their intrinsic capacity and ensuring supportive environment will most likely translate to healthy aging, especially when started from a young age, and when done consistently.

Moreover, healthy lifestyles, if practiced consistently, will cause an individual not only to have strong functional and intrinsic capacities, it will also increase his/her reserve functional capacities. Reserve functional capacities are the physical and mental capacities that are not needed at the moment but are kept by the body for future use. Reserve functional capacity can be compared to saving extra incomes in a bank for the days of needs or retirement days. These reserve functional capacities are needed to achieve better physiological and psychological resilience and adaptation when the need arises, especially in older age. The reserve functional capacities may be physiological reserves – this will allow the individual's blood pressure, for instance, to quickly return to normal after a frightening situation; physical reserves – this will allow the individual, for instance, to quickly maintain balance if tripped or after a fall; psychological reserves – this will allow the individual, for instance, to quickly reason-out appropriate solution to a challenging situation; or environmental reserve – this provides strong social connections and supports that will be available to deliver quality social care, especially in older age [20].

For example, it has been observed that the decline in learning ability that is usually experienced with increasing age, is modulated by the $\varepsilon 4$ allele of the APOE gene which is located in chromosome 19 of the human genes.

However, there is evidence that the efficiency of this allele is significantly influenced by life events, lifestyle choices, and environmental exposures [29]. Consistent practice of healthy lifestyles with exposure to a supportive and healthy environment, especially from a young age, may help to improve the efficacy of the reserve functional capacities of the $\varepsilon4$ allele of APOE overtime, and consequently improve mental resilience, and prevent a significant decline in learning ability later in life [29].

Hence, healthy aging is a scientifically plausible phenomenon and will be achieved through effective and healthy interaction and relationship between an individuals' functional ability, intrinsic capacity, and supportive environmental exposures, in which appropriate resilience and reserves functional capacities are available for the body to effectively mitigate the possible biological, physical, psychological, or environmental assaults that the aging process might present. For these reasons, the ultimate goal of any healthy aging policy or program is to promote optimal functional capacity and optimal health span (the years of life lived free of disease and disability) among the target population [7]. Such policies and programs should also aim to control the steady decline in biological age (in relation to increasing chronological age) by ensuring people's rate of intrinsic capacity decline is maintained below 1% every year [28, 30].

## Essential Lifestyle Choices that influence Healthy Aging

Based on the available knowledge of the theories, processes, determinants of aging, and examples of people that lived long and healthy lives into their century age, it is now possible to implement appropriate evidence-based health promotion intervention programs that focus primarily on lifestyle changes to slow down the aging process [31]. If done consistently, those lifestyle changes have the potential to optimize the functional and intrinsic capacities of people, and ultimately ensure healthy aging and better

quality of life. Thus, although the science of healthy aging is still in its early stages and still evolving, it has reached an advanced level enough for individuals, communities, and government to take appropriate and decisive actions [32].

Furthermore, since accelerated aging and most of its associated chronic conditions and diseases are related primarily to the accumulation of free radicals and proinflammatory cytokines, which results in the development and progression of systemic chronic inflammation (SCI) and decline in functional and intrinsic capacities in the body; it is possible to prevent or delay the onset of most chronic NCDs, and increase health span by truncating the SCI process. This can be done by advocating and ensuring that people of all age groups significantly reduce their age-accelerating lifestyle practices and consistently engage in evidence-based anti-inflammatory healthy lifestyle practices in a supportive environment, starting from their young age [33]. Such measures will also most likely assist people to achieve optimal functional and intrinsic capacities, which are the indicators of healthy aging.

Growing evidence strongly suggests that the key lifestyle determinants of healthy aging, like engaging in adequate physical activity, consumption of healthy diets, avoidance of tobacco products and alcohol, and prudent use of medications, may significantly prevent a decline in functional capacity, improve and maintain the various intrinsic capacities, improve the overall quality of life of an individual, and can assist to positively modify the direction of most of the intrinsic capacities in later life [26]. Also, regular exercise alone has been shown to reduce not only physical capacity decline but also cognitive and psychological capacity decline by as much as 50% in some cases [28]. However, to get the best possible results, health promotion and lifestyle interventions should start from a young age and should continue throughout a life span [18]. Such lifestyle interventions can

remain effective in improving functional reserves and in promoting healthy aging even in advanced years. Healthy lifestyle choices can particularly assist to improve some indicators of healthy aging, such as more efficient cardiometabolic health, better blood pressure control, optimal mental health, and better overall quality of life [20].

## Recommendations on how achieve Healthy Aging

There is no known single action that people can engage in to guarantee optimal functional capacity, healthy aging, and healthy life expectance; rather there are numbers of action that if done regularly seems to work synergistically to increase the likelihood of slowing down the biological aging process and improve overall health outcomes. Some evidence-based recommendations that may work synergistically to ensure healthy aging if done regularly have been highlighted in Table 1 [26, 28-32, 34-37].

**Table 1.** Common Evidence-based recommendations to Achieve Healthy Aging

| Categories | Recommendations |
|---|---|
| Diet | Daily diet should be high in fiber but low calorie, fat, and salt. This is achieved primarily through the regular consumption of whole vegetable, fruits, lentil/legumes, spices, and seeds; and the minimal intake or avoidance of high-caloric and poor nutrient-dense foods such as sugar-sweetened beverages, and processed foods. |
| Calorie Restriction | Regular practice of calorie intake restriction is advised. This can be done for example through intermittent fasting. |
| Good Hydration | Water should be taken frequently; about 6-8 cups or 2 – 3 liters daily. |
| Alcohol Consumption | Alcohol should be avoided or taken in moderation. Wine is preferred above other forms of alcohol. |
| Tobacco Use | All forms of tobacco products should be avoided. |
| Weight Management | Obesity (especially truncal obesity) should be avoided. |
| Physical Activity | There should be regular moderate-intense aerobic physical activity 5-7 days a week; while resistance physical activity should be about 3 times (alternate days) a week. |
| Sleep Quality | Sleep duration should be about 7-8 hours every night with no or minimal interruption. |
| Stress Management | Evidence-based measures should be implemented to prevent or minimize stressful events. |
| Social Network | Healthy relationships and quality social connectedness should be encouraged. |
| Environmental Exposures | Exposure to sunlight is desirable but it should not be more than 30 minutes daily. Contact with all environmental pollutants, toxins, and radiations, should be avoided, or minimized to the barest limit. |
| Medication Use | The use of any medication, including dietary supplements, should be supervised by certified healthcare professionals. |

## Public Health Promotion Strategies to achieve Healthy Aging

Public health professionals should and must be the first responder to the possible imminent global aging crisis, and the first to proffer evidence-based health promotion intervention on healthy aging to the apparently healthy individual and the general population whose functional and intrinsic capacities are still relatively optimal. The clinicians may then co-manage at the point in which the intrinsic capacities of the patients have dropped significantly, or risk factors/chronic diseases have developed. The most appropriate public health promotion strategies should be the combination of policies and programs that target the modifiable lifestyle determinants of aging while encouraging a supportive environment.

The health promotional strategies to achieve healthy aging should be primarily to increase the public awareness and education about the concept of global aging, and the plausibility of healthy aging through lifestyle changes; identify the modifiable age-accelerating determinants in a group of people; introduce measures that will gradually reduce the identified modifiable determinants of aging; increase the availability, accessibility, and affordability to the lifestyle factors that promote healthy aging; institute sustainable behavioral/lifestyle changes that will turn healthy lifestyle choices into a habit for most people in the community, and provide a supportive environment for the people. The more of these lifestyle practices that can be turned into a habit, the higher the possibility of slowing down the aging process, increasing healthy life expectancy, reducing dependency in old age, and improving the general quality of life [35].

## Conclusion

The increasing global aging phenomenon is not sustainable and counterproductive to the socio-economic development of the world. One of the best strategies to control the global aging phenomenon is to ensure healthy aging among global citizens. Healthy aging is a plausible phenomenon if emphasis and priorities are given to healthy lifestyle practices and a supportive environment from a young age. Through appropriate advocacy and health literacy, public health professionals need to "reinvent" the concept of 'aging' to 'healthy aging [17]. Here, peoples' attitudes, understandings, and practices as regard aging must be changed.

The old stereotype way of viewing healthy aging and healthy life expectancy as only the domain of chance and genetics must be further interrogated and changed. Furthermore, for the public health strategies to achieve healthy aging among a target population to be achievable and sustainable, it must be innovative, practicable, specific, and culturally sensitive, with due considerations for changing technology, urbanization, and globalization. All these strategies should be translated into policies and programs, and communicated to all stakeholders, including policymakers, clinicians, and most importantly, the general population.

## Conflict of Interest

The author declares no conflict of interest.

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