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Examining the Synergistic Effects of Dietary Patterns and Lifestyle Habits on Aging: A Review of Their Combined Impact on the Aging Process and Prevention

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ABSTRACT:

Aging is a multidimensional process that involves decline in body's systems and functions, and if happens in abnormal pre-mature way, will lead to more chances of chronic diseases and mortality rate. Aging has two forms where chronological is naturally determined by passage of time while biological shows actual alternations of cellular and molecular processes. Aging typically involves epigenetic changes involving DNA and cellular senescence, followed by the complex interplay between dietary patterns and lifestyle changes thus, all influences it in a different way. Depending upon habits and determinants, quality of life is different in different cultures and so is the life expectancy rate. Dietary factors impact aging by including nutrients That ultimately acts on cellular level and thus, quality determines outcomes, that can be either good like improved longevity (majorly due to anti-oxidant or anti-inflammatory nature), or bad like causing chronic disorders and poor aging. Lifestyle factors like physical activity, sleep, stress, alcohol, toxins as well as hydration also impacts aging by either improving the health or by causing severe complications and pre-mature aging. Longevity results in improved health quality and increased life expectancy while poor aging process impacts all

internal and external bodily processes. This review covers the gap of correlation between dietary patterns and lifestyle determinants, and their combined impact on aging process along with its early prevention, all summarized in one frame.
Keywords: Aging, longevity, life expectancy, diet, lifestyle, anti-aging, nutrients

INTRODUCTION

Aging is a complex inevitable progressive decline of physiological health, biological, functional, genetic, immunological, environmental, psychological, behavioral, and social processes including increased chances of chronic human diseases and ultimately increased vulnerability to death. Aging has two forms; biological and chronological. Biological maturation refers to how old a person's cells and tissues [1] alter with major change to a number of physiological and morphological processes throughout childhood and particularly in adolescence [2] and it is more precise assessment of disease-related risk, as compared to chronological aging [3]. While, chronological age is the time period from birth to death as it is the natural process that can never be changed.

Every species has different lifespan, determined by its origin and dependent on diverse factors, like biological mechanisms. Epidemiologic studies indicate that 11% of the global population is over the age of 60 years; which is expected to increase to 22% of the population by 2050 (4). Recent death stats for the group of seven (G7) countries (Canada, France, Germany, Italy, Japan, United Kingdom (UK), and United States (US) in alphabetical order) from a World Health Organization (WHO) database showed, life expectancy rate and healthy life expectancy are both greatest in Japan, in both men and women; however, longevity is particularly high in women. Recently, Pakistan's 6% of population (7.3 million people) is above 60 years of age, and is estimated to double up by 2050 to 12.4% (42.8 million) older adults, average life expectancy is 67.7 years (male: 65.8 years/female: 69.8 years) and is estimated to reach 76.7 years by 2050 and it all depends upon healthy aging (5).

Aging involves complex mechanism having different determinants and processes. In humans, mainly the gradual deterioration of cellular functioning and extensive DNA damage [4] like genome instability, senescence, shortening of telomere, mitochondrial malfunction, stem cell exhaustion, loss of protests, altered nutrient and cellular relation affects aging process before chronological time (6). More aging-linked epigenetic changes include DNA methylation, histone modification, chromatin remodeling, non-coding RNA (ncRNA) regulation, and RNA modification, all of which play a role in the

regulation of the multifaceted aging process, and hence contribute to aging-related disorders (7,8).

Actually, the processes are complex as genomic instability involves DNA mutation which leads to cancer etc., while in senescence, cells release pro-inflammatory stressors. Furthermore, telomere shortening also causes senescence as telomeres are chromosomal caps that when shorten up, leads to aging. Mitochondrial malfunctioning causes decline in energy release, stem cells rejuvenation decreases, also loss of proteostasis causes poor folding of proteins which causes damage. Epigenetic factors are significant and causes many outcomes like fatal alterations to cells, tissues, and organs due to the deterioration of biomolecules (including DNA, lipids, and proteins etc.). While genetic predispositions are dominant for biological features, but environmental elements also impact gene expression and morbidity via mechanisms like epigenetic modifications, oxidative stress, and inflammation. These connections highlight the part of lifestyle factors and environmental management in longevity rate (9).

Other determinants of aging are life choices. Exercise and PA play a significant role in aging process and act as preventable approaches for geriatric syndromes. Sedentary or no activity can lead to negative outcomes and frailty especially in mid-aged to older individuals. Physical inactivity is associated with mortality and morbidity as well. Exercise improves mitochondrial function, immune responses, and inflammatory pathways, thereby reducing aging through the regulation of exercises that are secreted by various tissues and organs. These bioactive molecules, which include hepatocytes, cytokines, adipocytes, osteokines, and neurokinesis, function to provide protective effects against the negative impacts of aging (10).

Poor sleeping patterns, such as having trouble falling asleep, waking repeatedly during the night, unable to fall back to sleep after waking, and waking up too early in the morning, occurs due to increasing frequency with age, particularly among elderly. Also, many older adults experience fewer sleeping hours per night as compared to earlier decades. Poor sleeping patterns reflect underlying disorder mostly related to aging which further leads to complications. Stress and mental health also determine aging (11).

So, all outcomes, whether good or bad, influence individual's life survival, expectancy, and how that person will grow old and the major determinants are ultimately controlled by dietary patterns and person's nutrition status. In short, longevity and healthy aging and long-life expectancy are all characteristics that are determined mainly by dietary patterns, lifestyle

changes, and epigenetics. This review collectively summarizes all the currently discovered determinants of poor aging process and their impact on body, biological aging, along with healthy patterns for increasing life expectancy majorly focusing on synergistic combined effects of dietary patterns and lifestyle habits on delaying and preventing aging process.

LITERATURE REVIEW:

The aging process is a significant and essential life phenomenon. It is a multifactorial process and dynamic in nature. Aging slowly decreases physical health, increases chances of diseases and risk of mortality, but chronological aging is just going to happen as it's the basic frailty process that occurs with age. Individuals who have equal chronological and biological age, have ideal aging process but those having biological age more than the chronological age, looks elder than their age while people who have less biological age, looks younger than their actual age. Aging is indeed a lifelong process that affects everyone, regardless of age. Different processes occur at proper development time in life like peak bone mass occurs by age 20, muscle mass also goes on peak till 25 age and remains stable approximately till 50, while cognitive functions like intelligence, wisdom etc. develops as the person ages more in life but declines in older age if not maintained properly. So, aging is not just about the elderly, but about the cumulative effects of our choices and experiences throughout life and healthy aging is basically by preventing chronic diseases and maintaining life (12).

Understanding all these determinants is necessary to develop helpful strategies to prevent and delay aging side-effects and remain healthy even in older age too. Healthy aging has a lot of benefits and is shaped majorly by a well-balanced diet, focusing on managing lifestyle and control cellular mechanisms by dietary modifications and interventions. Longevity and prolonged life expectancy prevent chronic diseases risk. Different cultures, ethnicities have different life expectancy rate just because of following different habits, dietary patterns, lifestyle etc. Nutrition, genetics, aging are dynamically linked together (13).

DASH diet and healthy aging:

Hypertension, is the persistent elevation of high-pressure blood within the vessels, and it's increasing prevalence is mainly in elderly people, due to poor food options (diets high in sodium and low in potassium), smoking and the lack of exercise. WHO reports that around 1·3 billion persons, aged 30–79 years, are hypertensive and it is a main promotor for CVD and premature death so, its prevention and management are vital for which diet plays an

important role? In 1997, the National Heart, Lung, and Blood Institute (NHLBI) of USA introduced the DASH diet that stands for Dietary Approaches to Stop Hypertension and it is a well-rounded eating plan and was mainly designed to lower blood pressure thus supports overall health and wellbeing. It focuses on incorporating whole foods, in a moderate amount, without major restrictions yet it differs from other diet types by its major emphasis on lowering amount of sodium and high lean proteins. It has eight nutritional components: excessive intake of fruits, vegetables, low-fat dairy, nuts and legumes, and whole grains, reduced consumption of sodium, sweetened beverages, red and processed meats. Sodium ingestion is suggested to be limited to (⩽2300 mg or 1500 mg) for the DASH diet so facilitates in managing blood pressure, specifically in elderly, who typically eat more salt due to reduced taste sensitivity (14,15).

Plant-based vegetarian diet and prevention of aging process:

A healthy plant-based diet (PBD) is characterized by high consumption of nutrient- dense foods like whole grains, legumes, vegetables, and fruits, and low intake of salt, saturated fats, and added sugars. Plant-based diet differs from other diet types like Mediterranean and DASH diets as it excludes all animal products, while Mediterranean and DASH diets allow moderate amounts of dairy, eggs, and lean meats. There are various types of PBDs, including vegetarian and vegan diets, which exclude animal products to varying degrees. Vegetarian diets can be further divided into sub-groups, such as peso-vegetarian (includes fish and honey), ova-lacto-vegetarian (includes eggs, dairy, and honey), and vegan (excludes all animal- foods). Overall, PBDs offer different health and environmental benefits, making them an increasingly popular choice for healthy aging. Consequently, the health benefits of plant- based diets may be partial due to their impact on trim ethylamine N-oxide (TMAO), an end product produced by the gut micro biome that's linked to an increased risk of chronic diseases like cardiometabolic diseases and cancer and TMAO can increase the oxidative stress inflammation metabolism disturbance which is directly associated with aging [64]. TMAO is basically found in fish and can be produced from amino acids in animal and plant products, such as choline and cantina in eggs and beef, and betadine in beets, spinach, and whole grains and the level of TMAO in the blood depends on the interaction between diet and micro biome, but previous researches showed that an index of a healthy plant-based diet was positively related to TMAO, while an unhealthy plant-based diet index is negatively related with TMAO, so manages aging (16,17).

Caloric-restriction and longevity:

Diet and lifestyle are linked to about 50% premature deaths as a diet can be of quantitative nature like calorie content, or qualitative nature like macro- and micronutrient content and actually the daily calorie intake changes with age. Calorie restriction (CR) is the reduction of energy intake without any risk of malnutrition, and is a dietary manipulation that can increase health and longevity and attenuate the age-related increase in chronic disease risk, while maintaining adequate intake of essential nutrients. A previous two-year interventional study was done, covering 218 non-obese persons, 21 to 51 years old, having BMI range of 22.0 to <28 kg/m2 and the volunteers were randomly appointed to either a 25% calorie restriction group followed by intermittent fasting and compared with an ad libitum (no-restriction) diet group and thus enhancements in body composition, as proved by a decrease in body mass index (BMI) of more than 1 kg/m2 were seen along with improved measures of cardiovascular status, having systolic and diastolic blood pressure, heart rate, arterial and pulse pressure, and pulse wave velocity, hence proving the benefits of caloric-restriction with longevity (19,20).

Okinawan diet and longevity:

Okinawan diet is particular Japanese diet and is connected to high densities of centenarians (people living to 100+) on the island of Okinawa. Okinawa is out of the five "Blue Zones," areas, a theory given by Buettner while the other Blue Zones include Sardinia in Italy, Nicoya Peninsula in Costa Rica, Ikaria in Greece, and Loma Linda in California, USA and is mainly known for their local's longevity and numerous centenarians. Along with unique food composition, another exceptional quality of the Okinawan diet is the habit of discontinuing eating when one is 80% full, known as Hara Hachi Bu and this phenomenon is pointed to mild caloric restriction naturally. As the name suggests, Okinawan diet, is well known for promoting longevity, and differs from other diets by emphasizing nutrient-dense, whole-plant foods like sweet potatoes, vegetables, and soy products, while limiting meat, dairy, and processed foods, and practicing portion control. Basically, all diets of the Blue Zones play an important role in the exceptional longevity rate and characters, such as plant-based intake, balance in consumption, being physically active, and strong familial and social relations (21,22)

Anti-inflammatory diet impact on healthy aging:

Inflammation is a tissue immune response to infectious agents like pathogens and toxins and chronic inflammatory markers include inflammatory cytokines such as interleukin (IL)-6, IL-1, and tumor necrosis factor (TNF)-α, chemokines like monocyte chemo attractant protein (MCP)-1, cell adhesion molecules such as vascular cell adhesion molecules (VCAM)- 1 and intercellular adhesion molecules (ICAM)-1, and acute phase proteins such as C-reactive protein (CRP) [76]. As individuals age, the levels of inflammatory markers rise, and this age-related increase in baseline systemic inflammation is referred to as inflammageing where TNF- α, IL-1, and IL-6 are recognized as inflammation producing biomarkers, whereas IL-4, IL-10, IL-13, and transforming growth factor (TGF)-β are recognized as anti-inflammatory biomarkers. Research on inflammation and dietary patterns has suggested that foods and food components can act as potential anti-inflammatory agents; fiber, flavonoids, carotenoids, and ω-3 fatty acids are the food components known for their anti-inflammatory properties thus, foods like some whole grains, fruits, vegetables, and nuts having more anti-inflammatory components can be categorized as anti-inflammatory foods also, a diet abundant in anti-inflammatory foods can be regarded as an anti-inflammatory diet (23,24).

Intermittent fasting effects on healthy aging:

Intermittent fasting (IF) diets consist of eating habits where people experience long fasting (e. g 16 to 48 hour) with less or zero energy intake, followed by duration of normal food consumption and fasting, repeatedly. A study was done in which 60 healthy individuals (without a background in fasting) 48 to 52 years old, having a BMI ranging from 25.37 to 25.66, got split into 2 groups: 30 participated in alternate-day fasting (ADF) for four weeks, while the remaining individuals maintained an ad libitum (no restriction) diet meanwhile, another group of 30 individuals (who practiced ADF for more than 6 months) also participated and results showed ADF which was comprised 36 h intervals without food intake (fast days) won by 12 h periods of ad libitum food intake (feast days), leading to an average calorie deficit of 37.40% in the ADF group and ADF also showed enhancements in body composition, reduction in body mass index (BMI) of over 1 kg/m2, improvement of Cardiovascular health, such as systolic and diastolic blood pressure, heart rate, arterial and pulse pressure, and pulse wave velocity, hence, improving aging (25,26).

Unhealthy dietary patterns and poor aging process:

As like healthy dietary patterns influence healthy aging, similarly, unhealthy diet types also lead to negative impacts and causes poor aging, chronic diseases and ultimately pre- mature death. Basically diet, lifestyle are the main

determinants that influence body physiology, cell morphology, and genetics and thus control aging process. Unhealthy diet types majorly include refined foods, processed items, high-sugary foods, high-sodium items, junk food, fast-food etc. Usually, this type of diet is followed by western culture. Moreover, poor eating habits, timings and portion sizes also influence this as like followed by Asian countries like Pakistan, where there is more ratio of mortalities and comorbidities (27,28).

Western diet and unhealthy aging process:

People in this modern era relies mostly on packaged and quick foods irrespective of considering the fact that these are unhealthy options. The Western diet (WD) represents an poor eating pattern defined by consumption of ready-made foods, refined grains, high-fat dairy items, high-sugar beverages, candy, sweets, artificial sweeteners, high-salt items, fried items, conventionally elevated animal products, high-fat dairy items, decreased ω-6 polyunsaturated fatty acids, high-fructose products, added sugars like high fructose corn syrup, table sugar in baked items, elevated utilization of red and processed meats, high consumption of saturated (animal products such as meat, butter, and cheese) and trans fats (processed foods like baked goods and fried foods), along with low consumption of fruits, vegetables, whole grains, fish and nuts, ω-3 polyunsaturated fatty acids, fiber, and is taken as, habitual snacking, time between meals etc and causes overeating. The Western diet (WD) gets discussed in the field of nutrition as it has been linked to various No communicable chronic disorders (NCDs), including visceral obesity, type 2 diabetes, cardiovascular disease, low-level inflammation, imbalance in gut micro biota and specific cancers etc. and NCDs are primarily getting common worldwide and studies clearly indicates WD causes NCDs and increases risk of mortality and morbidity and decreases life expectancy (29,30).

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