NOURISHING VITALITY AND RESILIENCE IN NIGERIAN CUISINE AND HEALTH

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Abstract
Collagen, a prevalent layer of cells protein, has been discovered to have numerous medicinal, wellness, dietary, and ornamental uses. Over the last few decades, a better understanding of collagen sources, extraction procedures, structure, and qualities has been discovered, allowing the creation of more collagen-based goods and materials. Collagen products have been shown to improve human health, particularly among the elderly. In this paper, the effect of collagen on nourishing vitality and resilience in Nigerian cuisine and health, the local food sources rich in collagen, phytochemical stimulation on collagen production and food contributing to depletion of the body were discussed. Conclusively, collagen emerges as a foundational thread, woven through traditional practices, dietary choices, and modern understanding, with this knowledge, it possesses the means to improve vitality in human health.

Keywords: collagen, health, local cuisine, Nigerian cuisine, vitality

Introduction

In the intricate web of human physiology, one protein emerges as a foundational pillar, quietly upholding the strength, resilience, and vitality of diverse bodily tissues (Van Tonder, 2024). Collagen, a complex and vital protein, serves as the architectural framework that supports our skin, muscles, bones, and more. Comprising an impressive 25 to 35 per cent of the total protein content in mammals, collagen is not merely a structural component; it acts as a dynamic force that binds our physical form together (Guo et al., 2022). Abundant in connective tissues such as skin, bones, tendons, and ligaments, collagen bestows qualities of strength, flexibility, and resilience to these essential elements of our anatomy. Existing in various distinct forms, this protein performs specialized functions throughout the body, facilitating wound healing, maintaining bone density, and ensuring the smooth functioning of joints.

In examining the multifaceted role of collagen, its biological significance and practical applications emerge as critical areas of study. This will reveal the intricate process by which specialized cells synthesize this vital protein and highlight the essential contributions of key nutrients, such as vitamin C and amino acids, to this synthesis. Beyond its foundational structural importance, collagen has attracted significant attention in the beauty and wellness industries, leading to an influx of products designed to enhance its production and integrate it within the skin. However, as we navigate the potential of collagen, it is important to recognize the evolving nature of scientific understanding. While collagen-based treatments and supplements offer promise, the depth of our knowledge regarding their efficacy and mechanism of action remains a subject of ongoing research. This underscores the necessity for informed decision-making, guided by the expertise of healthcare professionals.

Nigeria, with its rich culinary heritage, provides a unique perspective on collagen. Traditional foods and dietary practices present a diverse array of collagen sources and supportive nutrients, from carefully simmered bone broth to the bounty of fish, chicken, eggs, and locally grown produce rich in collagen-boosting elements. These culinary treasures not only delight the taste buds but also establish a vital connection between cultural heritage and holistic well-being (Bok & Ododobari, 2024). This inquiry delves into the complex and multifaceted nature of collagen, exploring its structural, functional, and nutritional dimensions. We will unravel its functions and sources while recognizing the symbiotic relationship between mindful dietary choices, lifestyle practices, and the preservation of collagen's essential roles within the human body. The journey through the realm of collagen is one of interconnectedness, embodying a harmonious interplay of science, tradition, and the pursuit of holistic health.

Meaning of Collagen

Collagen is an essential protein that can be found throughout the body in various connective tissues such as skin, bones, tendons, and ligaments. It makes up between 25 and 35 per cent of a mammal's total body protein and is, therefore, the most abundant protein. Tissues that contain collagen have greater resilience to stretching and pressure because of these qualities. It's essential for skin health, aids in mending wounds, and keeps bones and joints in good shape. Distinct forms of collagen have distinct purposes and are distributed in unique ways throughout the body. Depending on the type of tissue, collagen is synthesized by specialized cells called fibroblasts and chondrocytes (Albert et. al., 2019). Vitamin C, which plays a crucial role in collagen synthesis, is required for the synthesis of collagen in addition to several amino acids, particularly glycine, proline, and hydroxyproline. Collagen has acquired popularity in the beauty and wellness industries due to its potential benefits for skin health, in addition to its structural function. Numerous skin care products claim to contain or foster collagen production to reduce the appearance of wrinkles and enhance skin elasticity. Experts disagree regarding the efficacy of topical collagen applications (Al-Atif, 2022).

Collagen-based treatments have been used for a variety of purposes, including wound healing, reconstructive surgery, and orthopaedic procedures. Matrixes and scaffolds composed of collagen can be used to promote tissue regeneration and repair. It is crucial to note that although collagen supplements and treatments may offer certain potential benefits, the scientific evidence supporting the majority of these claims is still evolving. The complex process by which the body absorbs ingested collagen and incorporates it into specific tissues is poorly understood (Al-Atif, 2022). Collagen is the major structural protein in all of the body's connective tissues, including skin, muscles, bones, tendons, and ligaments (Deshmukh, et. al; 2016). The organs in the body, the vascular system, and the gut lining all contain it. Amino acids are the building blocks of proteins. Proline, glycine, and hydroxyproline are the three essential amino acids for collagen synthesis. Proteins are fibrils made up of three strands of amino acids. The right amounts of vitamin C, zinc, copper, and manganese are also required for the body to construct the triple helix (Cleveland Clinic, 2022).

Functions of Collagen

Due to its special structural and chemical characteristics, collagen plays several crucial roles in the human body. A few of collagen's essential jobs include:

1. **Support from Collagen:** The body's various tissues are supported and kept structurally sound by collagen (Shoulders and Raines, 2009). It creates a web of fibres that supports blood vessels, bones, cartilage, tendons, and skin. The preservation of the form and functionality of these tissues depends on this support (Shoulders and Raines, 2009). Collagen is a crucial part of the extracellular matrix of the skin, which is good for the skin (Pfisterer et. al., 2021)
2. **Joint Function:** Cartilage, the tissue that cushions and protects joints, is made up in large part of collagen. It promotes overall joint health and mobility by preserving joint flexibility and reducing friction between bones (Fox et. al., 2009)
3. **Bone Strength:** Collagen serves as the foundation for the deposition of minerals like calcium and phosphorus, which strengthens and rigidifies bones. It aids in the prevention of fractures and contributes to bone mineralization (Tzaphlidou, 2008).
4. **Healing of wounds**: Collagen plays a role in the healing of wounds as well as the repair of damaged tissues. It helps with the regeneration of skin, blood vessels, and other connective tissues by acting as a scaffold for new tissue formation (Mathew-Steiner et. al., 2021). Collagen is a component of blood vessel walls, giving them structure and aiding in the maintenance of blood vessel integrity. It promotes good blood flow and cardiovascular wellbeing (Copes, et. al., 2019)
5. **Organ Function:** The liver, kidneys, and lungs are just a few of the organs that contain collagen. It supports the preservation of the form and functionality of these organs (Wang, 2021).
6. **Support for Muscles:** Tendons, which play a key role in movement by transferring force from muscles, are attached to bones through collagen. In dental health, collagen is a crucial component of the connective tissues that anchor teeth securely in the jawbone. Collagen also contributes to gut health by being part of the gut lining, helping maintain the integrity and proper function of the gastrointestinal tract. Additionally, collagen is found in hair and nails, enhancing their strength and durability (Bordoni & Varacallo, 2019).

Food Sources of Collagen

Collagen is mostly found in items made from animal sources in Nigeria, as it is in many other nations. A few typical Nigerian food items that contain collagen include:

1. **Bone Broth:** Collagen is abundant in bone broth. It is created by cooking connective tissues and animal bones, including chicken or cattle bones, for a long time. This procedure aids in the broth's nutritional and collagen release.

2. **Skin-on Poultry:** Collagen can be found in chicken and turkey skin. A natural source of collagen can be obtained by including skin-on poultry in your diet (Matinong et al., 2022).
3. **Fish:** Collagen is found in fish, particularly those with skin and bones. Fish that are frequently eaten in Nigeria include tilapia, catfish, and mackerel (Adeyeye et al., 2022; Yusuf et al., 2021). Collagen can also be found in organ meats such as the liver, heart, and kidneys. These meats can offer a considerable amount of collagen and are frequently used in Nigerian cooking (Odeyemi et al., 2020). Collagen is found in fish, particularly those with skin and bones. Fish that are frequently eaten in Nigeria include tilapia, catfish, and mackerel (Adeyeye, Adebayo, & Ogunlade, 2022; Yusuf et al., 2021). Collagen can also be found in organ meats such as the liver, heart, and kidneys. These meats can offer a considerable amount of collagen and are frequently used in Nigerian cooking (Odeyemi et al., 2020).
4. **Meat with bones:** When bones-in meats like beef or goat are cooked, collagen can be released into the surrounding tissues and bodily fluids (Matinong et al., 2022).
5. **Gelatin:** Gelatin is made from collagen and is used to make a variety of foods, including snacks and desserts. You can use it to create gummies, puddings, and jellies.
6. **Traditional meals:** Nigerian food uses collagen-rich materials in certain meals. For instance, fish, chicken, and bone-in meats are frequently used in soups and stews (Adeyeye, Adebayo, & Ogunlade, 2022; Odeyemi et al., 2020). Tocotrienols, found in palm oil, a common ingredient in Nigerian cuisine, may help collagen formation (Nwachukwu & Igbokwe, 2021).
7. **Eggs:** Egg whites do, to a lesser extent than collagen from other sources, contain some collagen (Zhao et al., 2018). The ability of dietary collagen to directly affect the levels of collagen in particular tissues is still a subject of active research, even though numerous foods contain collagen or encourage collagen formation (Bertoldi et al., 2021). A balanced diet full of vitamins, minerals, and other nutrients is also essential for collagen formation and overall health (Hernandez et al., 2020). Prior to making significant dietary changes, it is recommended to seek the advice of a healthcare provider or a trained dietitian (Cohen, 2019).

Phytochemicals that Stimulate Collagen Production

The ability to promote collagen formation in the skin has been investigated for a number of phytochemicals present in plants. These substances can encourage the production of collagen fibres and support the suppleness and structure of skin (Matsumoto et al., 2020). Despite not being a phytochemical, vitamin C (ascorbic acid) is a potent antioxidant found in a variety of fruits and vegetables. Given that it is crucial for stabilizing collagen molecules and fostering their cross-linking, it is necessary for collagen synthesis (Kim et al., 2021). Citrus fruits (oranges, lemons), strawberries, kiwi, bell peppers, broccoli, and kiwi are foods high in vitamin C (Pence et al., 2022). Flavonoids are a class of phytochemicals with anti-inflammatory and antioxidant effects. It has been demonstrated that certain flavonoids, including quercetin, genistein, and catechins, promote

the formation of collagen (Zhao et al., 2019). Berries (blueberries, cranberries), green tea, onions, and soy products are foods high in flavonoids (Sarkar et al., 2020). The following compounds are known to stimulate collagen:

1. **Proanthocyanidins:** This additional class of antioxidants is present in foods including grapes, berries, and some types of nuts. By preventing the enzymes that break down collagen fibres, they might aid in preventing collagen degradation (Li et al., 2020).
2. **Polyphenols:** Polyphenols are a group of different substances present in many plant-based foods. Resveratrol, a polyphenol found in red wine and grapes, has been investigated for its potential to boost collagen synthesis and deter the ageing process of the skin (Choi et al., 2018).
3. **Isoflavones** found in soy, such as genistein and daidzein, have been demonstrated to increase collagen formation and improve skin suppleness. Soybeans and soy-based products contain these chemicals (Sarkar et al., 2021).
4. **Anthocyanins:** Anthocyanins are antioxidants that give several fruits and vegetables, like blueberries, blackberries, and cherries, their vivid colours. These substances might boost collagen and improve skin health (Boehm et al., 2019).
5. **Ginsenosides:** Bioactive substances identified in ginseng include ginsenosides. According to some studies, ginsenosides may help promote collagen synthesis and improve skin suppleness (Kim et al., 2019).
6. **Aloe Vera:** Aloe vera contains ingredients such as acemannan that, when applied topically, have been found to improve collagen synthesis and wound healing (Rojas et al., 2020).
7. **Horsetail *(Equisetum arvense):*** Contains silica, a naturally occurring mineral that is not a phytochemical. By supplying vital nutrients for healthy skin, silica is thought to assist collagen formation.

It is crucial to note that while these phytochemicals may have the ability to stimulate the production of collagen, the results may differ based on a person's genetic makeup, general dietary habits, and way of life. Including a range of these phytochemical-rich foods in your diet can promote collagen formation and improve the skin's general health. Additionally, topical skincare products with these or other collagen-promoting components may improve the look and health of the skin. According to Dai et al. (2024), various dietary phytochemicals such as carotenoids, polyphenols, and flavonoids exhibit antioxidant and anti-inflammatory properties that contribute to enhanced collagen synthesis and skin health. These effects, however, are influenced by individual genetic and lifestyle factors.

Local Food Sources of Collagen

There are a number of traditional foods and products in Nigeria that can help with collagen formation and overall skin health. While collagen-rich diets are often associated with animal sources, certain plant-based foods also play a crucial role in collagen synthesis by providing essential nutrients such as vitamin C, zinc, and amino acids. In the Nigerian context, several indigenous foods support the body’s natural collagen production.

1. **Bone Broth** is a staple in many Nigerian households. It is prepared by simmering animal bones and connective tissues such as cow leg (bokoto), goat head (isi ewu), or assorted meat for several hours. This slow-cooking process extracts collagen, gelatin, and amino acids such as glycine and proline, which are critical for collagen biosynthesis. Bone broth is commonly used as a nutrient-dense base for soups like pepper soup, egusi, and ogbono, contributing to both flavour and skin health benefits. According to Dai et al. (2024), nutrients from both animal and plant-based sources can stimulate collagen production and alleviate premature skin ageing, especially when consumed as part of a diverse and balanced diet. These findings support the value of incorporating traditional foods like bone broth into skincare and wellness routines.
2. **Fish**: Fish, particularly those consumed with their skin and bones, are excellent sources of collagen. In Nigeria, commonly eaten varieties such as mackerel, catfish, and tilapia provide not only collagen but also essential omega-3 fatty acids, both of which are beneficial for maintaining skin elasticity and hydration. Consuming these fish whole, including the skin and bones, maximizes nutrient intake, particularly collagen-rich connective tissues. According to Ritchason (2022), collagen derived from fish sources can significantly improve skin hydration and elasticity, supporting youthful skin appearance.
3. **Chicken Feet**: Chicken feet are widely used in Nigerian cuisine and are a traditional delicacy that's both affordable and nutrient-dense. Rich in collagen due to their high content of tendons, cartilage, and skin, they are often incorporated into pepper soup, stews, okra soup or simply boiled and spiced as a snack in some regions. In dishes such as *ofe nsala* (white soup) or spicy tomato-based stews, chicken feet absorb rich flavours while contributing their gelatinous texture, which is highly prized in many households. Beyond their culinary appeal, chicken feet are nutritionally beneficial. Research has shown that collagen extracted from chicken feet can improve skin texture, elasticity, and joint health (Healthline, 2020). Their use in traditional Nigerian cooking offers a culturally embedded and effective means of enhancing natural collagen intake.
4. **Eggs:** Eggs include proline and lysine, two amino acids necessary for the formation of collagen. The amino acids required for collagen synthesis are present in egg white (albumin).
5. **Oranges, tangerines, and grapefruits** are examples of citrus fruits that are high in vitamin C, which is necessary for the production of collagen. Consuming these fruits regularly can boost collagen synthesis.
6. **Bell peppers:** Bell peppers, particularly the red and green varieties, are rich in ascorbic acid (vitamin C), which plays a critical role in the enzymatic hydroxylation of proline and lysine, two amino acids essential for collagen fibril formation (Pullar, Carr, & Vissers, 2017). In Nigeria, bell peppers are used extensively in traditional stews and sauces, making them valuable dietary contributors to collagen health.

- **Ayamase Sauce (Ofada Stew):** Ayamase, a Yoruba speciality commonly served with Ofada rice, is a pepper-based stew primarily made from green bell peppers, locust beans (iru), onions, and assorted meats. Although red bell peppers are known for their higher vitamin C content, green bell peppers still provide substantial antioxidant support and are used in large quantities in this dish. The inclusion of onions, which contain quercetin and sulfur compounds, may further support collagen formation by reducing inflammation and supporting connective tissue health (Oboh & Rocha, 2008). Ayamase stands out nutritionally not only for its pepper content but also for the traditional cooking method that preserves much of the vegetable base, especially when minimally processed. The locust beans (fermented African oil bean seeds) also add prebiotic and protein benefits, which indirectly support skin and gut health, both of which are linked to collagen stability (Akande, Oduyoye, & Oladapo, 2019).
- **Obe Ata (Nigerian Red Stew) and Jollof Rice:** In addition to Ayamase, Obe Ata, the base for a variety of tomato and pepper stews, and Jollof rice, also incorporate red bell peppers in their sauce bases. These dishes are widely consumed across Nigeria and serve as major dietary sources of vitamin C and carotenoids, particularly beta-carotene, a precursor to vitamin A that also protects skin structure.

7. **Dark Leafy Greens in Nigerian Soups:** Nigerian soups are typically vegetable-rich, making them important vehicles for micronutrient delivery. Traditional greens such as fluted pumpkin (ugwu), waterleaf, and spinach are rich in vitamin C, beta-carotene, iron, and polyphenols, all of which have been associated with enhanced collagen formation and protection from oxidative degradation (Akinlua, 2017; Oboh & Rocha, 2008).
    - **Edikang Ikong Soup:** Native to the Efik and Ibibio people, Edikang Ikong soup combines waterleaf and fluted pumpkin leaves in generous amounts, cooked with assorted meats and seafood. The polyphenol and vitamin C content in this combination supports both antioxidant defence and collagen synthesis, particularly when prepared with minimal overcooking.
    - **Efo Riro and Afang Soup:** Efo Riro, a Yoruba leafy vegetable stew made with spinach or other local greens, often includes bell peppers, tomatoes, and onions, creating a multi-nutrient profile conducive to collagen health. Likewise, Afang soup, made with okazi leaves and waterleaf, is fibre-rich and contains anti-inflammatory compounds that can prevent collagen breakdown from chronic stress and ageing.
8. **Lycopene**, an antioxidant found in tomatoes, may help shield collagen from UV-induced deterioration.
9. **Palm Oil and Red Palm Fruit**: Palm oil, a widely used cooking fat in Nigeria, is derived from the red palm fruit (Elaeis guineensis) and is especially rich in tocotrienols, a form of

vitamin E with potent antioxidant properties. These compounds help protect the skin from oxidative stress, which is a known contributor to collagen breakdown and premature ageing (Sen, Khanna, & Roy, 2000). The red palm fruit itself is abundant in carotenoids, including beta-carotene and lycopene, which not only give the oil its characteristic reddish hue but also offer photoprotective effects, helping to shield skin from UV damage and reduce oxidative degradation of collagen (Tan et al., 2011). Traditional dishes such as:

- Banga soup (from the Niger Delta)
- Ofe Akwu (Igbo-style palm fruit stew)

10. **Ekpang Nkukwo (Efik dish made with cocoyam and palm oil) Nuts and Seeds**: Amino Acids and Healthy Fats for Collagen Structure: Groundnuts (peanuts) and sesame seeds (beniseed) are commonly consumed in various forms in Nigeria, from snacks and sauces to groundnut soups and seed-based condiments. These are excellent sources of plant-based proteins and essential fatty acids, which contribute the amino acids glycine, proline, and arginine, critical building blocks of collagen (Proksch et al., 2014).

    - **Groundnut soup**, a staple in many northern Nigerian homes, combines protein-rich groundnuts with meats and sometimes leafy vegetables, supporting both dietary protein needs and micronutrient intake.
    - **Sesame seed paste or beniseed soup** is common in Middle Belt cuisine and is often eaten with swallow meals like pounded yam or tuwo.

11. **Coconut and Coconut Derivatives**: Coconut, in its various forms, coconut oil**,** coconut milk**,** and coconut water, is another traditional food with substantial benefits for the skin. Coconut oil, for instance, is rich in medium-chain triglycerides (MCTs) and lauric acid, which possess antimicrobial and anti-inflammatory properties (Verallo-Rowell et al., 2008). When consumed or applied topically, coconut oil can improve skin hydration and lipid barrier function, indirectly supporting collagen maintenance.

    Coconut rice (a southern Nigerian dish) incorporates fresh coconut milk, often combined with spices and bell peppers.

    Coconut snacks and coconut candy, popular street foods, also serve as minor sources of beneficial lipids. Coconut water, rich in electrolytes and cytokinins, may support cell hydration and regeneration, further contributing to overall skin vitality (Yong et al., 2009).

While these nutrient-rich foods provide essential building blocks and protective compounds for collagen, it is important to recognize that collagen production is multifactorial. Factors such as genetic predisposition, lifestyle behaviours (e.g., smoking, sun exposure), and overall diet quality significantly influence collagen dynamics (Moskowitz, 2000). Thus, a balanced and diverse diet that includes traditional Nigerian foods rich in vitamin C, amino acids, healthy fats, and antioxidants is optimal for maintaining skin integrity and promoting endogenous collagen formation.

Factors Contributing to Collagen Depletion in the Body

Collagen, the most abundant protein in the human body, is essential for the structure and elasticity of skin, joints, and connective tissues. It provides strength and flexibility, contributing to the overall health of tissues and organs. However, collagen levels naturally decline with age, and their depletion is influenced by a range of internal and external factors. The following outlines the primary contributors to collagen depletion:

1. **Ageing:** Ageing is one of the most significant natural causes of collagen depletion. As the body ages, its ability to produce collagen decreases, which can affect the elasticity of the skin, the flexibility of joints, and the overall health of tissues. The decline in collagen production begins as early as the mid-20s, and the decrease becomes more pronounced with each passing decade. This reduction in collagen synthesis contributes to the visible signs of ageing, such as wrinkles, sagging skin, and joint stiffness (Proksch et al., 2014).
2. **UV Radiation:** Ultraviolet (UV) radiation from the sun is a well-known external factor that accelerates collagen breakdown. Prolonged exposure to UV rays leads to the formation of free radicals, which damage collagen fibres in the skin. This damage triggers the production of enzymes that break down collagen, contributing to the process known as photoaging. Over time, UV radiation weakens the skin's structure, resulting in premature ageing, wrinkles, and loss of firmness (Cascella et al., 2012).
3. **Smoking:** Smoking has been shown to significantly reduce collagen production. The chemicals in tobacco smoke damage the skin by breaking down collagen and inhibiting the production of new collagen. Additionally, smoking narrows the blood vessels, which reduces the flow of oxygen and nutrients to the skin and other tissues, thus impairing collagen synthesis. These effects lead to a loss of skin elasticity, wrinkling, and increased susceptibility to skin damage (Montero et al., 2004).
4. **Unhealthy Diet:** An unhealthy diet can severely impact collagen synthesis. Diets that lack essential nutrients such as vitamin C, zinc, and copper hinder the body's ability to produce collagen. Additionally, diets high in sugar and processed foods can lead to glycation, a process in which sugar molecules bind to collagen fibres, forming harmful molecules called advanced glycation end products (AGEs). AGEs weaken collagen and reduce its ability to regenerate, leading to faster breakdown and loss of skin elasticity (Vasilenko et al., 2017).
5. **Poor Lifestyle Choices:** Several lifestyle choices can negatively affect collagen levels. A lack of regular physical activity, insufficient sleep, and chronic stress can all contribute to collagen depletion. Exercise helps improve circulation and nutrient delivery to tissues, promoting collagen production. Poor sleep, on the other hand, reduces the body's ability to repair and regenerate tissues. Chronic stress increases the release of cortisol, a hormone that can inhibit collagen production and weaken the skin's structure (Schaal et al., 2017).
6. **Genetics:** Genetics plays a role in determining the rate of collagen degradation and the general health of connective tissues. Some individuals may have genetic variations that affect collagen production or influence the enzymes responsible for collagen breakdown.

These genetic factors can lead to variations in the skin's ageing process and the body's ability to maintain collagen levels, contributing to earlier signs of ageing or connective tissue disorders (Rachakonda et al., 2014).

7. **Hormonal Changes:** Hormonal fluctuations, particularly during menopause, can also lead to a reduction in collagen levels. Estrogen, a hormone that plays a significant role in maintaining collagen production, declines during menopause, which can lead to thinning skin, decreased elasticity, and joint discomfort. As a result, the skin becomes more prone to wrinkles, sagging, and a loss of firmness (Takahashi et al., 2007).
8. **Environmental Factors:** Environmental pollutants and toxins contribute to collagen breakdown and skin ageing. Air pollution, for example, releases free radicals that can damage skin cells and accelerate the degradation of collagen fibres. Additionally, exposure to other environmental stresses, such as harsh chemicals or extreme weather conditions, can lead to skin inflammation and an increased rate of collagen loss (Finkelstein et al., 2013).
9. **Chronic Disease and Inflammation:** Chronic diseases, particularly those that involve systemic inflammation, can have a profound impact on collagen synthesis and overall tissue health. Conditions such as rheumatoid arthritis, autoimmune diseases, and inflammatory bowel disease can interfere with collagen production, leading to weakened connective tissues. Inflammation can promote the activity of enzymes that break down collagen, resulting in further tissue damage and increased collagen depletion (Caufield et al., 2010).
10. **Drugs and Lifestyle Decisions:** Certain medications, such as corticosteroids and some acne medications, can hinder collagen synthesis and contribute to collagen depletion. These drugs may interfere with the body's ability to produce or maintain collagen, leading to thinning skin and increased fragility. Additionally, excessive alcohol consumption and drug abuse can decrease collagen production and impair skin health (Prakash et al., 2012).
11. **Rapid Weight Loss:** Rapid weight loss, particularly when coupled with poor nutrition, can cause the skin to lose its elasticity, leading to sagging and the breakdown of collagen. When weight loss occurs too quickly, the skin may not have enough time to adjust to the new shape, resulting in a loss of collagen and a decrease in skin firmness (Kaliyadan & Zawar, 2012).

While collagen depletion is a natural part of ageing, it is clear that environmental, lifestyle, and dietary factors can significantly influence the rate at which collagen is lost in the body. Factors such as UV radiation, smoking, poor diet, and chronic diseases all contribute to the breakdown of collagen, while genetics and hormonal changes may accelerate this process. However, living a healthy lifestyle, including regular exercise, a balanced diet, sun protection, and avoiding smoking, can help slow collagen depletion and promote overall skin and tissue health. By making informed choices, individuals can mitigate the effects of collagen loss and support the maintenance of youthful, healthy skin.

Symptoms of Collagen Depletion in the Body

The skin, joints, and other connective tissues are the main areas of the body where collagen deficiency can be seen. Although some collagen loss is a normal feature of ageing, severe depletion can cause obvious symptoms. The following are some typical signs of collagen depletion:

1. **Wrinkles and Sagging Skin**: The appearance of wrinkles, fine lines, and sagging skin is a prominent indication of collagen depletion. Collagen provides the skin with flexibility and structural support; thus, its reduction can lead to diminished firmness and an aged appearance. Recent studies have demonstrated that oral supplementation with low-molecular-weight collagen peptides can significantly improve skin hydration, elasticity, and reduce wrinkle depth. For instance, a six-week randomized, double-blind, placebo-controlled trial found that participants who consumed collagen peptides experienced notable enhancements in skin smoothness and radiance (Carrillo-Norte et al., 2024). Additionally, a systematic review highlighted that fish-derived collagen supplements effectively increased skin moisture and elasticity, reinforcing collagen's role in maintaining youthful skin (Cao et al., 2023).
2. **Joint Pain and Stiffness**: A significant portion of cartilage, which cushions and shields joints, contains collagen. Joints may face increased wear and tear as collagen levels drop, resulting in discomfort, stiffness, and a loss of range of motion. Joint problems connected to collagen can result in conditions like osteoarthritis (Henrotin et al., 2014).
3. **Reduced Skin Hydration**: Collagen plays a crucial role in promoting water retention in the dermis, which helps maintain skin hydration. When collagen levels decline, the skin can become drier, less elastic, and more susceptible to flakiness and dullness (Heinz et al., 2016; Bolke et al., 2019).
4. **Brittle Hair and Nails**: Collagen is important for preserving the strength and health of hair and nails. Lack of collagen can result in hair that is lifeless and brittle with easily broken nails (Proksch et al., 2014).
5. **Loss of Muscle Mass**: The collagen found in muscle tissues contributes to the structure and functionality of those tissues. Collagen depletion may lead to muscle weakness and a gradual loss of muscle mass (Laurent, German, & Boulanger, 2019)
6. **Bone Fragility:** Collagen is a critical component of bone structure, providing strength and flexibility. Reduced collagen levels can contribute to bone fragility and an increased risk of fractures. Recent studies have shown that collagen supplementation can enhance bone mineral density and improve joint function, particularly in ageing populations and athletes experiencing bone stress (Alemán-Mateo et al., 2023). Additionally, new findings suggest that age-related impairments in osteocyte function reduce the quality of collagen in bone tissue, impacting overall bone integrity and increasing the risk of fragility fractures (Schurman et al., 2024).

7. **Gastrointestinal Issues**: Collagen is found in the lining of the gastrointestinal tract and can help maintain its integrity. Collagen depletion may contribute to digestive issues and a compromised gut lining (Zhao, Li, Zhang, & Elson, 2019).
8. **Cellulite Formation**: Collagen depletion can lead to changes in the skin's texture, potentially contributing to the appearance of cellulite. Lifestyle and Prevention: While collagen depletion is a natural part of ageing, certain lifestyle factors can accelerate the process. Protecting your skin from excessive sun exposure, maintaining a healthy diet rich in nutrients that support collagen production, staying hydrated, getting regular exercise, and avoiding tobacco and excessive alcohol consumption can help mitigate the effects of collagen depletion (Sibilla et al., 2015).

Conclusion

Collagen stands as a pivotal protein that plays an essential role in maintaining the structural integrity and health of various tissues throughout the body. Its significance extends beyond mere structural support, encompassing functions crucial for skin health, joint mobility, bone strength, wound healing, and overall tissue vitality. In the Nigerian context, traditional foods and local dietary practices offer a rich array of collagen sources and collagen-supporting nutrients. From bone broth, fish with skin and bones, and chicken feet, to eggs, citrus fruits rich in vitamin C, and an assortment of vegetables and nuts, these offerings not only contribute to collagen synthesis but also underline the deep interconnection between local cuisine and health.

Nonetheless, as collagen depletion is an inevitable aspect of the natural ageing process, understanding the factors contributing to its decline is equally imperative. Factors such as UV radiation, smoking, an unhealthy diet, and poor lifestyle choices can hasten collagen loss, resulting in visible symptoms such as wrinkles, joint pain, and brittle hair and nails. Environmental influences, genetics, and chronic diseases further impact collagen levels, emphasizing the need for a holistic approach to maintaining optimal collagen production. By remaining conscious of these facets, individuals can make informed decisions to protect and promote collagen health. Embracing a well-rounded lifestyle, inclusive of sun protection, balanced nutrition, regular exercise, and adequate hydration, can effectively counteract collagen depletion and its associated symptoms. While dietary choices can certainly play a role, it is prudent to seek guidance from healthcare professionals to ensure tailored strategies that safeguard not only collagen health but also overall well-being.

Recommendations

Based on the elaborate findings, the following recommendations are as follows:

1. Embracing a well-rounded lifestyle should be encouraged by healthcare professionals, policy makers, organizations and government.
2. Increased awareness of collagen-based products applications as important supplements in Nigerian health systems.

3. There should be increased promotion of community sensitization and mobilization for local collagen fortification as part of collagen-based therapies, including knowledge empowerment.

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