**Are Gut Health, Vascular Health and Brain Health Related to Dementia and can OsteoStrong help?**

This blog might lead you to believe that unhealthy ageing is a foregone conclusion, but if you read to the end, there is light at the end of the tunnel for those who choose to be proactive and adopt a preventative health approach. It’s never to late to start and positive results can be achieved at almost any age.

I am fortunate that longevity runs in my genes, with both my parents living into their mid- nineties - long **lifespans** indeed!

The sad part is that their **healthspan** did not match their chronological age.

Unfortunately, they lived with multiple comorbidities for the last 20 years of their lives, slowly losing their mobility, freedom, independence, and dignity. Both ended up with vascular dementia, bedridden in healthcare.

This is not an uncommon experience for that generation, with older people in the UK and US typically spending the last 10-20 years of their lives with 3 or more comorbidities, related to cardiovascular, metabolic, cancer and neurological health problems.

However, scientific evidence now indicates that these diseases are primarily driven by epigenetic factors—lifestyle, nutrition, and environmental choices—rather than genetics. Current research suggests that only 5% to 20% of our health as we age is determined by our genetics, while 80% to 95% is influenced by epigenetic factors.

The early deteriorating health signs for my parents included high blood pressure, elevated very small LDL cholesterol levels, strokes, heart attacks, pre-diabetes, melanomas, and osteoporosis. We know today that all these conditions are largely associated with **poor metabolic and** **vascular health**.

My parents led active social lives and travelled extensively, rarely drank alcohol, and my father smoked for a decade during his time in the Navy, due to free cigarette rations. However, their poor nutritional and lifestyle choices, coupled with a lifetime absence of regular heavy weightlifting or cardiovascular exercise, ultimately led to both developing vascular dementia in their 80s.

Mum always said she did enough exercise raising 4 children and Dad played tennis in his 20’s and lawn bowls late in life. They believed that was good enough. But was it?

**Why Do We Get Old?**

Traditional thinking was that ageing is a genetic lottery. We now know that this is not correct, but our genetic heritage is still an important aspect. Let me explain!

Human genetics evolved over millennia, adapting to the harsh conditions our ancestors faced, including frequent infections, injuries, and predation. Historically, the average human lifespan was significantly shorter, with most individuals not living beyond their twenties. This was largely due to the high mortality rates from infectious diseases, injuries, and being eaten by dinosaurs and wild animals! The evolutionary pressures of these early environments shaped our genes, favouring traits that enhanced survival and reproduction at a young age, rather than promoting longevity.

As a result, our bodies developed robust repair mechanisms for acute damage and stress experienced in early life. However, these systems were not designed to function optimally beyond the early adult years. With the advent of modern medicine, better nutrition, improved sanitation, and technological advancements, human life expectancy has dramatically increased. This extended lifespan has revealed limitations in our genetic programming, as our biological repair systems begin to falter with age.

Conditions such as poor nutrition, lack of physical activity, chronic stress, environmental pollutants, and the use of multiple medications exacerbate the decline in our health as we age, and these are called epigenetic factors.

**Simply explained, humans were historically not expected to live much beyond the age of thirty.**

That’s when our bone and muscle mass and strength start to decline. However, technological, and medical advancements have significantly extended human lifespan, enabling many to live into their 80’s and beyond.

This correlates with our DNA replication and telomere length maintenance, which starts to show oxidative damage typically in the late 20s to 30s, with more pronounced effects becoming evident as individuals approach middle age.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Country** | **Longevity** |  **Males** |  | **Females** |  |
|  |  |  | **Years in**  |  | **Years in**  |
|  |  | **Years** | **poor health** | **Years** | **poor health** |
| **AU** | Lifespan | 81.3 |   | 85.4 |   |
|  | Healthspan | 74.1 | 7.2 | 71.6 | 13.8 |
| **USA** | Lifespan | 73.2 |   | 79.1 |   |
|  | Healthspan | 66 | 7.2 | 66 | 13.1 |
| **UK** | Lifespan | 79 |   | 82.9 |   |
|   | Healthspan | 61 | 18 | 62.3 | 20.6 |

And this is where Epigenetics come into play.

Poor lifestyle choices and environmental factors can accelerate ageing and reduce healthspan. Many people fail to get essential macro and micronutrients needed for optimal cellular repair and maintenance as they age. Factors such as diet quality, gut and oral microbiome health, and lifestyle choices, significantly impact nutrient intake and healthspan.

Poorly managed diets, whether vegetarian, vegan, or meat-based, can lead to nutrient deficiencies. Food quality is further compromised by soil degradation and practices like over cropping and use of fertilisers and pesticides, grain feeding beef, caged farming, and use of inflammatory vegetable oils and chemical additives in highly processed and fast foods.

In most supermarkets, many fruits and vegetables sourced in Australia and from overseas are harvested while still green to withstand longer transportation times. These products are then artificially ripened to minimize transport and storage damage, thereby maximising $ returns. However, this process significantly reduces the nutrient quality of the food. Additionally, these produce items are often more heavily fertilised and chemically treated to reduce spoilage and increase yield, which can potentially disrupt the balance of gut bacteria and negatively impact gut health.

Environmental factors, including damaged soil, pollutants, obesogen chemicals, and endocrine disruptors, reduce the nutritional value of food and introduce toxins.

Sedentary lifestyles, smoking and excessive alcohol consumption and overconsumption contribute to obesity and cardiovascular diseases, while chronic stress disrupts hormonal balance and weakens the immune system.

Long-term medication use can also introduce side effects and further compromise health.

Many pharmaceuticals and modern medical prescription practices often mask the symptoms of age-related diseases without addressing their root causes, resulting in suboptimal outcomes for both longevity and healthspan. Our society increasingly seeks quick-fix pills rather than taking long-term responsibility for their health outcomes.

However, advances in science have enhanced our understanding of genetic and epigenetic factors that affect healthspan, highlighting that quick-fix solutions do not exist, and that sustainable health requires a comprehensive and proactive approach focusing on proper nutrition, regular appropriate physical activity, stress management, and minimising exposure to environmental toxins and pharmaceutical interactions. By aligning our modern lifestyles more closely with our biological needs, we can enhance our healthspan and enjoy a better quality of life as we age.

**What is Vascular Dementia and How is it Related to Cardiovascular Health**

Vascular dementia is a common form of dementia associated with aging, making up to 30% of all dementia cases and ranking as the second most common type after Alzheimer's disease. This condition arises from damage to the brain's blood vessels, typically caused by blockages, inflammation, strokes, mini-strokes, or other issues that impede blood flow, resulting in cognitive decline.

The link between vascular dementia and cardiovascular health is significant. Atherosclerosis, which involves the buildup of plaques within blood vessels including the brain's blood vessels, plays a crucial role in this type of dementia. These plaques, composed of fats, LDL cholesterol, and other substances, can harden and narrow the arteries, restricting blood flow and potentially causing strokes or mini strokes. This vascular damage directly contributes to the cognitive decline characteristic of vascular dementia.

Managing cardiovascular risk factors is essential in preventing or slowing the progression of vascular dementia. Key risk factors include high blood pressure, diabetes, high cholesterol, particularly very small LDL cholesterol, and smoking. Chronic hypertension and poorly controlled blood sugar levels can damage blood vessels and lead to the formation of atherosclerotic plaques. Smoking further exacerbates these issues by damaging blood vessels and accelerating atherosclerosis.

The cognitive decline associated with vascular dementia include difficulties with memory, reasoning, planning, and judgment. Symptoms vary based on the extent and location of vascular damage in the brain. Addressing these risk factors through lifestyle changes, nutrition, and medical treatment where appropriate, can significantly impact the progression of the disease. By focusing on cardiovascular health, individuals can reduce their risk of developing vascular dementia and enhance their overall well-being and healthspan.

**How are Gut Health, Vascular Health and Brain Health Interrelated?**

The relationship between gut, heart, vascular, bone, muscle and brain health, and the health of the lymphatic and glymphatic systems is complex and deeply interconnected, playing a crucial role as we age in preventing metabolic diseases and vascular dementia.

Maintaining a healthy mouth and gut microbiome promotes optimum nutrient absorption and produces anti-inflammatory metabolites, essential for maintaining cardiovascular and vascular health by preventing atherosclerosis and supporting blood vessel integrity.

With over 100,000 kms of blood vessels in the body and 650 kms in the brain, vascular health is essential for overall well-being. Proper blood flow delivers oxygen and nutrients to our organs, muscles, bones, and the brain, thereby supporting cognitive function and physical strength. Maintaining vascular health through proper diet, exercise, and medical care helps prevent conditions like vascular dementia, ensuring overall health and structural integrity.

The gut-brain axis, a communication network linking the gut and brain through neural, hormonal, and immune pathways, is now widely recognized for its significant influence on cognitive function and mental well-being, as well as the importance of a healthy vascular system. This interconnected system highlights the direct impact of gut health on brain health and overall vascular health.

Most people understand how healthy muscles and bones contribute to overall physical wellbeing, but they are critical for our cardiovascular health and brain function, that synergistically supports our overall health.

**What is not widely known is the crucial role that healthy bones play in maintaining cardiovascular health. Specialized mesenchymal stem cells produced by bone marrow differentiate into mature endothelial cells, which then migrate to repair and maintain the integrity of the blood vessel lining, called the endothelium. This process ensures proper blood flow and helps prevent vascular diseases.1**

In simple terms, bone health is critical because cells produced by bone marrow maintain and repair the lining of blood vessels, keeping the walls smooth and preventing blockages and clots.

Think of the lining of blood vessels like an ice rink surface after it has been polished. It is smooth and very slippery. But after a game of ice hockey the surface is rough and pitted and is not smooth and slippery. This is what happens to the lining of blood vessels as we age due to poor vascular health – the lining becomes damaged and is more prone to blockages and inflammation, restricting blood flow which can damage your health.

Osteogenic loading at OsteoStrong stimulates bone turnover, enhancing bone density and strength, thereby supporting overall skeletal health. But this process also benefits the health of our bone marrow boosting and the production of mesenchymal stem cells which repair and maintain the lining of blood vessels.

In addition to our blood circulatory system, our cellular waste removal systems are also very important; these are our lymphatic and glymphatic systems.

**How Our Bodies Remove Cellular Waste**

Our blood supplies nutrients, oxygen, and water to our cells. Waste products are then removed from cells by both the blood vessels and our lymphatic and glymphatic systems. Here's how it works:

1. **Blood Vessels**: The blood circulatory system transports metabolic waste products from cells to the kidneys, liver, and lungs. For example, carbon dioxide, a byproduct of cellular respiration, is carried by the blood to the lungs for exhalation. Other waste products are transported to the kidneys for filtration and excretion in urine or to the liver for detoxification.

2. **Lymphatic System**: This system collects excess fluid and waste products from tissues through lymphatic vessels. Lymph nodes filter the lymph fluid to remove pathogens and debris before returning the cleaned fluid back to the bloodstream. This helps maintain fluid balance and supports immune function.

3. **Glymphatic System**: In the brain, the glymphatic system removes metabolic waste products. It facilitates the flow of cerebrospinal fluid through brain tissue, which helps clear away waste products such as beta-amyloid during sleep. This process is vital for preventing the accumulation of harmful substances that could impair brain function and contribute to neurodegenerative diseases over time.

Together, these systems ensure the efficient removal of waste products from the body, maintaining overall health and wellbeing.

Unhealthy blood circulatory, lymphatic, and glymphatic systems lead to a buildup of waste products in the body, which is detrimental to health by impairing cellular function, increasing inflammation, and contributing to the development of chronic diseases and dementia.

**Role Of Sleep in Glymphatic Health**

**Deep REM sleep is crucial to the glymphatic system in our brain** because it significantly enhances the system's ability to clear waste products and toxins from the brain.**2**

The glymphatic system is primarily active at night, especially during deep REM sleep, and is essentially inactive during the day. During deep REM sleep, the brain's interstitial spaces expand, allowing cerebrospinal fluid supplied by the glymphatic system to flow more freely through these spaces. This increased fluid flow facilitates the removal of harmful substances such as beta-amyloid and tau proteins, which are associated with neurodegenerative diseases like Dementia and Alzheimer's. Efficient waste removal during deep REM sleep helps maintain optimal brain function, reduces the risk of cognitive decline, and supports overall brain health.

Therefore, achieving sufficient deep REM sleep is vital for the effective functioning of the glymphatic system and the long-term health of the brain.

**There is Hope! We Can Improve Our Vascular Health**

Improving vascular health involves a combination of lifestyle changes, dietary adjustments, and stress management practices. Here are key strategies:

**1. Healthy Diet:**

**Today, many people are overfed but undernourished -** The convenience of supermarkets middle shelves and busy lifestyles make it easy to consume foods that are high in empty calories, simple carbohydrates, sugar, saturated fats, and chemical additives. These overprocessed foods stimulate hunger and contribute to various health problems like obesity, diabetes, and cardiovascular diseases.

Mindful eating involves consistently choosing whole foods that are nutrient-dense, in-season, locally sourced, and organic whenever possible. Fresh, locally sourced, and in-season produce typically contains a higher diversity of beneficial bacteria and fibres that support your gut microbiome when you need it.

This approach not only improves nutrition but also supports overall health and well-being.

**Consume a balanced diet** - the Mediterranean diet is a good starting place. Rich in fruits, vegetables, virgin olive oil, whole grains, lean proteins, and healthy fats. Foods high in antioxidants, fibre, and omega-3 fatty acids (like berries, nuts, seeds, and fatty fish) can reduce inflammation.

**Limit intake** of trans fats, chemically processed vegetable oils, processed and fast food, soft drinks, added sugar fruit juices, and sugar to prevent atherosclerosis and high blood pressure.

**2. Regular Exercise:**

 **Weight Training** - Engage in heavy lifting to stimulate bone and muscle growth and promote the development of fast-twitch muscles, crucial for balance and reaction time to reduce fall and fracture risk. Combining OsteoStrong and the X3 Bar provides an ideal regimen for these benefits. Additionally, weight training enhances vascular health, helps regulate blood pressure, and improves grip strength, all of which are important measures of longevity. Instead of lifting less as we get older, we should all be lifting as much as possible to retain our muscles – muscles really are the currency of ageing!

**Aerobic Activities -** Sitting is the new smoking when it comes to health risks. Movement is essential for good health, whether it’s walking, gardening, jogging, cycling, or swimming. Aim for at least 30 minutes of activity a day and try to stay as active as possible, avoiding prolonged sitting whenever you can. Simple choices like taking the stairs instead of the elevator, parking further away from your destination, and walking the extra distance can add up quickly.

While the ideal goal is 10,000 steps daily, recent studies show that even taking more than 4,000 steps per day substantially reduces all-cause and cardiovascular mortality. Incorporating regular aerobic activities into your daily routine can significantly improve your overall health and well-being.3

**3. Maintain a Healthy Weight:** Achieving and maintaining a healthy weight reduces the strain on your cardiovascular system and lowers the risk of vascular diseases. It also reduces the risk of developing Diabetes Type 2 which is now referred to as the gateway disease for most cancers, cardiovascular and neurological diseases.

**4. Avoid Smoking:** Quit smoking cigarettes and avoid exposure to second hand smoke and vapour, to prevent damage to blood vessels.

**5. Avoid Vapes:** Vapes are not a safe alternative to smoking cigarettes. Vapes are a significant health risk because they contain compounds including propylene glycol, glycerol, and flavourings which have been associated with clear airways impact, inflammation, impairment of cardiovascular function and toxicity. In addition, some of them are carcinogens or potential carcinogens.4

**6. Limit Alcohol Consumption:** While some recent studies suggest that low alcohol consumption may offer certain cardiovascular benefits, excessive drinking undeniably leads to hypertension, weight gain, and various cardiovascular and neurological problems. To maintain good cardiovascular health, it is best to avoid alcohol when possible and practice moderation if you do choose to drink.

**7. Manage Stress:** Practice stress-reducing techniques such as meditation, yoga, deep breathing exercises, journalling, and mindfulness to maintain hormonal balance and reduce the risk of vascular issues.

**8. Drink 2-3 Cups of Coffee Each Day:** A recent study in the UK found that drinking 2-3 cups of coffee (including instant and decaffeinated coffee) reduced the risk of cardiovascular disease including heart attacks by up to 25% most likely due to polyphenols, soluble fibre in coffee. The study found that Quinic acid is produced by special gut bacteria that feeds on caffeine called “Lawsonibacter” which lowers blood pressure and encourages release of insulin that may reduce blood sugar levels. However, drinking more than 2-3 cups may not be beneficial and for some people any caffeine may be overstimulating. To ensure good sleep quality, don’t drink coffee in the afternoon or evenings, because caffein can reduces adenosine production, the sleep-inducing hormone.

**9. Get Regular Health Screenings:**  Regular check-ups with your healthcare provider can help monitor blood pressure, very small LDL cholesterol levels, and blood sugar levels. Early detection and management of these conditions are crucial for vascular health. A coronary calcium scan is highly recommended for everyone. It is a specialised CT (computerised tomography) scan that detects calcium deposits in the heart's arteries, which can narrow the arteries and reduce blood flow. This scan can reveal coronary artery disease before symptoms appear. The results help assess the risk of heart attacks or strokes and guide treatment plans for coronary artery disease.

**10. Stay Hydrated:** Drink plenty of water (not soft drinks or alcohol) to maintain proper blood flow and support overall vascular function.

**11. Improve Sleep Quality:**  Ensure you get adequate sleep, as poor sleep quality can negatively impact cardiovascular and brain health. Aim for 7-9 hours of sleep per night. Strategies to improve sleep include;

* Maintain a Consistent Sleep Schedule to help regulate your circadian rhythm.
* No food coffee or alcohol for 2-4 hours before bed – digestion uses blood your brain needs to fall asleep.
* Limit exposure to blue light at least 1 hour before bed. Reduce screen time (phones, tablets, computers, TV’s) before bed. Bue light interferes with melatonin production which regulates sleep.
* Get red light at sunrise and sunset if possible. This increases melatonin production.
* Create a Sleep-Inducing Environment – cool dark and quiet and invest in a comfortable mattress and pillows.
* Establish a Relaxing Bedtime Routine, engage in calming activities such as reading, taking a warm bath, or practicing relaxation exercises (meditation, deep breathing, or gentle yoga) before bed.
* Get Regular Physical Activity, but not too close to bedtime. Physical activity can help you fall asleep faster and enjoy deeper sleep.
* Manage Stress and Anxiety by incorporating stress-reducing practices into your daily routine, such as mindfulness, journaling, or talking to a therapist. Managing stress can significantly improve sleep quality.
* Avoid Naps or Limit Them - if you must nap, keep it short (20-30 minutes) and not too late in the afternoon. Avoid falling asleep in front of the TV before bedtime!
* Increase exposure to natural light during the day to help maintain a healthy sleep-wake cycle.
* Consider Professional Help - consider seeing a sleep specialist if you continue to have trouble. Conditions such as sleep apnoea or insomnia may require professional treatment.

**Your Health Matters**

You are ultimately responsible for your health, as the medical system in Australia is primarily designed to address issues after they arise rather than prevent them.

Understanding that 80-95% of your health is influenced by life choices rather than genetics highlights the importance of education and being proactive.

By adopting integrative strategies early on, you can significantly improve your vascular and overall health, reducing the risk of cardiovascular diseases, including vascular dementia.

Remember, it’s never too early or too late to improve your health!

-------------------------------------------------------------------------------------------------------------

1. Bone Cell Biomechanics, Mechanobiology and Bone Diseases, Chapter 4 - Mechanobiology of bone marrow mesenchymal stem cells (BM-MSCs) Hua Liu, et al, Academic Press 2024.

(Research has illustrated the importance of mechanical stimuli in regulating the function of [bone marrow mesenchymal stem cells](https://www.sciencedirect.com/topics/medicine-and-dentistry/bone-marrow-mesenchymal-stem-cell) BM-MSC). Mechanical loading, such as compression, tension forces, substrate stiffness (SS), fluid shear stress (FSS), hydrostatic pressure (HP), and vibration, promotes osteogenic differentiation of BM-MSCs, while mechanical unloading, such as prolonged bed rest, random positioning machine (RPM), and space flight, inhibits osteogenic differentiation of BM-MSCs, promoting adipogenic or chondrogenic differentiation.)

1. Xie, L., et al. "Sleep drives metabolite clearance from the adult brain." Science 342.6156 (2013): 373-377.
2. The Association Between Daily Step Count and All-Cause and Cardiovascular Mortality: A Meta-Analysis Running title: Daily steps and mortality: A dose-response meta-analysis, European Journal of Preventive Cardiology 30(18) July 2023
3. Marques, P., Piqueras, L. & Sanz, MJ. An updated overview of *e-cigarette* impact on human health. *Respir Res* 22, 151 (2021). https://doi.org/10.1186/s12931-021-01737-5