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## As We SEE IT

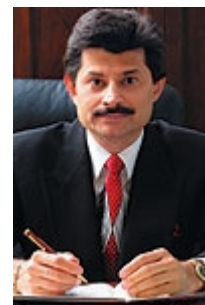
### Do Vegetarians Live Longer?

By William Faloon

Excess consumption of red meat increases the risk of heart disease, certain cancers, and other disorders. As a result, health-conscious people are eating more fruit, vegetables, and fish, and are staying away from beef. With all the benefits attributed to plant foods, one might think that vegetarians enjoy a huge life-span advantage over meat eaters.

We reviewed the published scientific literature and uncovered some surprising data relating to diet and longevity. As one would expect, most studies show that those who consume lots of red meat have higher disease rates.<sup>1-14</sup> Red meat not only predisposes people to lethal illness, but meat eaters also have increased risks of ailments such as appendicitis, chronic inflammation, and kidney disease.<sup>15-20</sup>

A huge volume of scientific data confirms the protective role of fruits and vegetables on human health.<sup>21-23</sup> So the question is, do people who eat only fruits and vegetables—and no meat—live significantly longer?



by William Faloon

#### UNEXPECTED FINDINGS

Vegetarians suffer fewer heart attacks than meat eaters.<sup>24-37</sup> Interestingly, this benefit dissipates as vegetarians age. For instance, one study showed that vegetarians under the age of 65 were 45% less likely to suffer a heart attack than were meat eaters. Once vegetarians reached the age of 80, however, their heart attack risk was only 8% lower than that of meat eaters.<sup>38</sup>

Longevity studies of vegetarians produce conflicting data. Some studies do not show that vegetarians live significantly longer.<sup>25,29</sup> Two studies of people who consumed very little meat showed an average life-span increase of 3.6 years.<sup>39</sup> A huge study of Seventh Day Adventists who ate little or no meat showed longevity increases of 7.28 years in men and 4.42 years in women.<sup>40</sup> These data are confounded by the fact that Seventh Day Adventists follow healthy lifestyles free of tobacco and alcohol.



Studies suggest that the longevity benefits conferred by a vegetarian diet dissipate as humans enter their ninth decade.<sup>39</sup> This implies that while vegetarian diets reduce disease risk, restricting one's diet to only plant foods does not completely protect against the effects of aging.

#### WHAT'S MISSING IN VEGETARIAN DIETS?

Vegetarians are often deficient in vitamin B12, and those who avoid meat have long been advised to supplement with B12. While vegetarians are slightly more likely to suffer anemia than are meat eaters, this does not by itself explain why they do not enjoy greater longevity in their later years.

A fascinating paper recently published in the journal *Mechanisms of Aging and Development* presents an entirely new theory to explain why vegetarians do not live longer.<sup>41</sup> It turns out that those who avoid eating beef suffer a deficiency of a nutrient (carnosine) that is critical to preventing lethal glycation reactions in the body.

For the benefit of new members, glycation can be defined as the toxic binding of glucose to the body's proteins. Glycation alters the body's proteins and renders them non-functional. While wrinkled skin is the first outward appearance of glycation, most degenerative diseases are affected in one way or another by pathological glycation reactions.

Diabetics suffer from accelerated glycation that contributes to the secondary diseases that result in premature death.<sup>42,43</sup> For instance, glycation's destructive effect on the arterial system results in a loss of elasticity, hypertension, and atherosclerosis.<sup>44-47</sup> Glycation is involved in disorders as diverse as cataract, cancer, and Alzheimer's disease.<sup>48-57</sup>

Unless aggressive steps are taken, many aging adults will suffer the devastating effects of glycation to proteins throughout their bodies. This fact was established recently when it was shown that even healthy people with slightly elevated glycation levels are at higher risk for heart attack.

Vegetarians have higher levels of advanced glycation end products (AGEs) in their blood compared to those who eat meat.<sup>58,59</sup> This is because an exclusively vegetarian diet would lack carnosine, nature's most potent anti-glycating agent.

For vegetarians who fastidiously adhere to a diet devoid of meat, their "Achilles' heel" may be lack of carnosine. This was confirmed in a paper published in October 2005 titled, "Glycation, ageing and carnosine: Are carnivorous diets beneficial?"<sup>41</sup>



### DOES BEEF SUPPLY ENOUGH CARNOSINE?

A recent study of 18 people sought to determine carnosine concentrations in blood plasma after eating beef.<sup>60</sup> Each 7.1-ounce serving of ground beef used in this study naturally contained 248 milligrams (mg) of carnosine.

In the study's first phase, meat foods were removed from the diet for 48 hours. When fasting blood levels were measured, no carnosine was present. After the subjects ate 7.1 ounces of ground beef, carnosine was detected in the blood within 15 minutes and continued to increase for several hours. After 5.5 hours, there was again no carnosine in the blood. This study clearly showed that 248 mg of carnosine does not provide the body with all-day protection against glycation reactions.

The reason carnosine disappears so quickly from the blood is the presence of an enzyme (carnosinase) that naturally degrades carnosine in the body. This new study on carnosine blood levels confirms what Life Extension published five years ago. Back in 2000, we advised members that at least 1000 mg a day of carnosine is needed to overwhelm the carnosinase enzyme and protect against toxic glycation reactions.<sup>61,62</sup>

Commercial supplement companies are still selling 50-mg carnosine capsules and claiming that this low dose is effective. Based on this recent study showing that the body degrades 248 mg of carnosine within 5.5 hours, consumers who take these 50-mg carnosine capsules are obtaining virtually no benefit.

### HOW DOES CARNOSINE WORK?

The proteins in our bodies are the substances most responsible for our ability to function and sustain life. Glycation causes the destruction of these proteins. Once too many proteins lose their ability to function, the body becomes prone to degenerative diseases and premature aging.<sup>63</sup> Carnosine has been shown to specifically protect against age-related degradation of protein.

Protein degradation occurs as a result of cross-linking and the formation of advanced glycation end products (AGEs). These changes figure prominently in the process of aging and in its typical manifestations, such as skin wrinkling and brain degeneration.<sup>62,64,65</sup> Carnosine is effective against cross-linking and the formation of AGEs.<sup>66,67</sup> Glycated proteins produce 50 times more free radicals than nonglycated proteins, and carnosine may be the most effective anti-glycating agent known.

An example of carnosine's defense against protein degradation can be seen when proteins are exposed to toxic malondialdehyde (MDA).<sup>68</sup> Similar to formaldehyde, MDA causes protein cross-linking and formation of AGEs. Carnosine has been shown to inhibit MDA-induced glycation in blood albumin and eye-lens protein.<sup>69,70</sup> Carnosine has also been shown to keep MDA from inducing protein cross-linking.<sup>71</sup> One study showed that carnosine actually decreased MDA levels in mice.<sup>72</sup>



### CARNOSINE'S EFFECTS ON THE BRAIN

Carnosine is highly concentrated in the brain, owing to the fact that the brain uses carnosine to protect against cross-linking, glycation, excitotoxicity, and oxidation. Animal studies show that carnosine provides broad protective effects in simulated ischemic stroke.<sup>73</sup>

Abnormal copper and zinc metabolism stimulates senile plaque formation in Alzheimer's disease.<sup>74,75</sup> Chelators of these metals dissolve plaques in the laboratory. Carnosine is a potent copper-zinc chelating agent that can inhibit the cross-linking of amyloid beta that leads to brain-cell plaque formation. A signature of Alzheimer's disease is impairment of the brain's arterial and capillary system. Carnosine has been shown to protect the cells that line the brain's blood vessels from damage by amyloid beta

as well as from damaging byproducts of lipid oxidation and alcohol metabolism.<sup>76</sup>

## **CARNOSINE EXTENDS CELLULAR LIFE SPAN**

Our bodies comprise cells that replace themselves by dividing. There is a genetic limit as to how many times our cells will continue to replicate themselves via healthy division processes. Once enough cells reach their genetic reproductive limit, the organism (the human body) is no longer able to sustain life functions and succumbs to disease or death. Carnosine appears to extend the period of time that cells will continue to divide in a youthful manner.

Laboratory research suggests that carnosine is able to rejuvenate cells approaching the end of the life cycle, restoring normal appearance and extending cellular life span.<sup>77,78</sup> When scientists transferred late-passage fibroblasts (a type of connective tissue cell) to a culture medium containing carnosine, the cells exhibited a rejuvenated appearance and often an enhanced capacity to divide.<sup>79</sup> The carnosine medium increased life span, even for old cells. Cells transferred to the carnosine medium attained a life span of 413 days, compared to 126-139 days for the control cells. This study showed that carnosine induced a remarkable 67% increase in cellular life span.

These aged cells also grew in the characteristic patterns of young cells, and resumed a uniform appearance in the presence of carnosine. However, when the aged cells were transferred back to a medium lacking carnosine, signs of senescence quickly reappeared. How does carnosine revitalize cells in culture? Some researchers propose that carnosine may rejuvenate cells by reducing the formation of abnormal proteins or by stimulating the removal of old proteins.<sup>69</sup>



## **WHY AGING ADULTS NEED CARNOSINE**

Life Extension members have long known that carnosine levels in the body decline with age. Muscle carnosine levels in our bodies decrease 63% from age 10 to age 70, which may account for the reduction in muscle mass and function seen in aging adults.<sup>80</sup> Carnosine acts not only as an antioxidant in muscle, but also as a pH buffer.<sup>81</sup> In this way, it keeps on protecting muscle cell membranes from oxidation under the acidic conditions of muscular exertion. Carnosine enables the heart muscle to contract more efficiently through enhancement of calcium response in heart cells.<sup>82</sup> Muscle levels of carnosine correlate with the maximum life span of animal species.

Carnosine has been shown to rejuvenate connective tissue cells,<sup>77,79</sup> which may explain its beneficial effects on wound healing. Damaged proteins accumulate and cross-link in the skin, causing wrinkles and loss of elasticity. Carnosine is the most promising broad-spectrum shield against protein degradation.

## Do Vegetarians Live Longer?

By William Faloon

### DON'T OVEREAT BEEF

Excess consumption of red meat is linked to a number of age-related disorders, especially atherosclerosis. The author of the recent study linking carnosine deficiency to higher glycation rates in vegetarians concedes that red meat's detrimental health effects may outweigh the anti-glycation benefits conferred by the carnosine that is naturally present in meat.

Health-conscious consumers often minimize their consumption of meat, thus depriving their bodies of carnosine. If carnosine is the missing link in explaining why vegetarians do not live that much longer than omnivores, then supplementation with 1000 mg a day of carnosine would appear to be at least as important as vitamin B12 for those on meat-restricted diets.

### HOW WE PROTECT YOU

The long-term goal of Life Extension research is to develop effective therapies to control aging, combat age-related disease, and eradicate death itself. A more immediate objective is to identify compounds that Foundation members can use today to live longer and healthier lives.

For instance, when our research showed that vegetarians were not living that much longer than meat eaters, we needed to find out why. After reviewing hundreds of scientific papers, we identified published research showing that vegetarians are lacking carnosine and that this deficiency could have lethal consequences.

Life Extension long ago identified carnosine's unique and critical anti-aging properties. So when we saw that vegetarians are devoid of carnosine and that low dietary intakes of carnosine provide virtually no benefit, it became clear that health-conscious individuals who avoid meat are unintentionally causing excess glycation to occur in their bodies, thereby accelerating age-related disease. No other organization on this planet goes to the extreme lengths that we do to identify and then neutralize the biological culprits that cause premature disease and death.

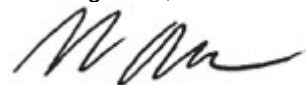
We currently support research at five separate laboratories employing 30 scientific personnel. We also conduct in-house human clinical studies in order to ascertain whether dietary supplements are as effective as their manufacturers claim them to be. Many of the supplements we test do not meet the efficacy claims made by their manufacturers. Supplements that fail our clinical studies are not offered or recommended to members.

In this month's issue, we describe scientific research funded this year by the Life Extension Foundation. One of our most significant findings was validating that resveratrol may indeed slow the aging process.

Back in August 2003, research from Harvard University showed that resveratrol extended the life span of yeast by 70%.<sup>83</sup> What caused so much excitement about this particular study was that resveratrol activated a "longevity gene" expressed during caloric restriction. Since caloric restriction dramatically extends maximum life span in mammals, scientists stated that humans might be able to derive some of the benefits of caloric restriction by taking a resveratrol pill.

Life Extension tested resveratrol and other nutrients used by members and found results that help corroborate the successful yeast studies. We used our proprietary gene-assay technology to demonstrate that resveratrol (and other nutrients) mimic many of the genetic changes seen in calorie-restricted mice. As a Life Extension member, you will find out information about resveratrol in this month's issue before it is published in a scientific journal.

For longer life,



William Faloon



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