Cardiovascular Disease in the Western World – an Overlooked Risk Factor
Raymond A. Schep, D.Sc.

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Abstract

The author observes that high rates of cardiovascular disease occur in western civilized countries while the disease is almost absent in non-industrialized locations such as Sri-Lankan and Vietnamese villages embracing a traditional life style. Investigations were conducted to determine what it is in these lifestyles that account for this difference. From interviews, it was found that these communities embrace a natural form of agriculture using traditional means that have persisted for thousands of years, whereas in industrialized countries much agriculture is highly dependent on artificial fertilizers, and much of the food so harvested is processed in a way that removes various vitamins and trace elements. This is not so with traditional agriculture, where 100% of nutrients are recycled back to the ground. One of these trace elements, copper, was then identified in hundreds of scientific publications to have a critical effect on the cardiovascular system. From among these several hundred publications, a sample of about 40 were selected and discussed here. As indicated in these papers, it was found that when copper is lowered or removed from the diet of animals and humans, the possible disorders include defective cardiovascular tissue, irregular heartbeat, elevated cholesterol, hypertension, diabetes, and increased blood clotting leading to strokes. These disorders, in turn, can lead to sudden death, aortic fissures and ruptures, coronary artery thrombosis, myocardial infarction, abnormal cardiograms, and congestive heart failure.

The prevalent medical approach is to call these "risk factors" and proceed to treat these risk factors by means of cholesterol lowering drugs and anti-hypertension drugs, lowering of salt intake, and surgery, etc. It is clear that this approach has resulted essentially in the lowering of the heart death rate. As discussed herein, Government scientists of the United States Department of Agriculture (USDA) have confirmed these experiments, warning in their publications that a copper intake of below 1 mg of copper a day causes severe cardiovascular symptoms and death in animals and that these symptoms can be reversed by repletion of copper intake. These government scientists have also conducted human trials in which copper intake was lowered to 1 mg per day or lower, and the trials had to be discontinued when the subjects developed cardiovascular symptoms. A review of these hundreds of papers indicates that a supplement of 6 mg of copper a day will result in almost full protection from these symptoms, and the author tested this hypotheses between the ages of 55 and 67 by participating in severe anaerobic fitness training and championship sports such as rugby, competing successfully with young men 20-30 years of age.

Maladies cardiovasculaires dans le monde occidental – un facteur de risque souvent négligé.
Raymond A. Schep, D.Sc., F.R.C.

Résumé

L'auteur fait remarquer que des taux élevés de maladies cardiovasculaires se produisent dans les pays développés occidentaux, alors que cette pathologie est quasiment absente dans des endroits non industrialisés, par exemple des villages sri-lankais et vietnamiens embrassant un style de vie traditionnel. Des études ont été entreprises pour déterminer ce qui, dans ces modes de vie traditionnels, cause cette différence. A partir d'entrevues, il a été constaté que ces communautés emploient une forme naturelle d'agriculture, à l'aide de moyens ancestraux qui sont utilisés depuis des milliers d'années, alors que dans les pays industrialisés, l'agriculture est fortement tributaire d'engrais artificiels, et une grande partie de la nourriture ainsi récoltée est traitée d'une manière qui élimine de nombreuses vitamines et oligo-éléments. Il n'en est pas ainsi avec l'agriculture traditionnelle, où 100 % des éléments nutritifs sont recyclés en direction du sol. Un de ces oligo-éléments, le cuivre, a été ultérieurement reconnu, dans des centaines de publications scientifiques, pour avoir un effet d'importance cruciale sur le système cardiovasculaire. À partir de cette centaine de publications, un échantillon d'environ quarante a été sélectionné et examiné dans cet ouvrage. Conformément à ces publications, il a été constaté que, lorsque le cuivre est réduit ou supprimé de l'alimentation des animaux et des humains, les troubles qui peuvent en résulter comprennent : tissus cardiovasculaires défectueux, arythmie cardiaque, augmentation du taux de cholestérol, hypertension, diabète et risque d'augmentation de coagulation sanguine, pouvant causer un infarctus. Ces troubles, à leur tour, peuvent conduire : à la mort subite, à des fissures et ruptures de l'aorte, à une thrombose de l'artère coronaire, à un infarctus du myocarde, à des cardiogrammes anormaux et à une insuffisance cardiaque.

La méthode médicale de prévention plus répandue, consiste à appeler ces troubles, des « facteurs de risque » et à procéder à des traitements au moyen de médicaments abaissant le cholestérol, l'hypertension, à la baisse de la consommation de sel, à la chirurgie, etc.. Bien entendu, cette prévention a entraîné en grande partie la diminution de la fréquence de décès causés par attaque cardiaque. Ainsi qu'il est expliqué dans l'ouvrage, des scientifiques du Ministère de l'Agriculture des États-Unis (USDA) ont confirmé ces expériences, tout en prévenant, dans leurs publications, qu'un apport de cuivre inférieur à 1 mg / jour provoque des symptômes cardiovasculaires graves et des décès chez les animaux, tandis que ces symptômes peuvent être renversés en augmentant l'apport de cuivre. Ces scientifiques ont également effectué des essais sur l'homme, au cours desquels l'apport en cuivre a été abaissé à 1 mg par jour ou moins, ces processus ayant été interrompus dès que les sujets ont développé des symptômes cardiovasculaires. La lecture approfondie de ces nombreux rapports d'étude démontre qu'un supplément de 6 mg de cuivre / jour se traduit par une protection quasi totale de ces symptômes. L'auteur a testé cette hypothèse sur soi-même, de 55 à 67 ans, tout en participant à un entrainement physique anaérobique, et à des tournois sportifs de rugby, réussissant des jeunes âgés de 20 à 30 ans.

Enfermedades Cardiovasculares en el Mundo Occidental – Examinando el Factor de Riesgo

Raymond A. Schep, D.Sc., F.R.C.

Resumen

El autor examina la existencia de altos grados de enfermedades cardiovasculares que ocurren en países civilizados del mundo occidental, mientras que esta enfermedad es casi nula en los países no industrializados, tal es el caso de Sri-Lankan y aldeas Vietnamitas que llevan estilos de vida tradicionales. Se llevaron a cabo investigaciones para determinar qué es lo que existe en estos estilos de vida, lo cual contribuye a esta diferencia, así que por medio de entrevistas, se descubrió que estas comunidades han adoptado métodos agrícolas naturales los cuales han persistido por miles de años, mientras que en los países industrializados la mayoría de la agricultura depende mucho de fertilizantes artificiales, y gran cantidad de la comida es procesada de tal manera que muchos de los nutrientes y elementos esenciales son eliminados. Esto no es lo que sucede en el caso del empleo de métodos tradicionales de agricultura, en donde 100% de los nutrientes son reciclados de nuevo a la tierra. Uno de estos elementos esenciales, el Cobre, fue identificado en cientos de publicaciones científicas el tener un efecto crítico en el sistema cardiovascular. Entre varias de estos cientos de publicaciones, un ejemplo de 40 de ellas fue seleccionado y discutidas aquí. Tal como se indica en este escrito, fue descubierto que cando el nivel del cobre es bajo o se anula de la dieta de los animales y los humanos, los posibles efectos incluyen, defectos en los tejido cardiovasculares, latido irregular del corazón, alto colesterol , hipertensión, diabetes e incremento de coágulos sanguíneos causando ataques cardiacos. Estos desordenes, sucesivamente, pueden causar una muerte instantánea, rupturas y fisuras de la aorta, trombosis de las arterias coronarias, infarto del miocardio, cardiogramas anormales, e insuficiencia cardiaca.

El actual aproche medico es el de mencionar estos “factores de riesgo” y proceder a tratarlos por medio de drogas para bajar el colesterol y para la hipertensión, bajo consumo de sal, cirugía, etc. Es muy claro que este enfoque ha dado resultados esenciales en la baja mortalidad cardiaca. Tal como se menciona aquí, Científicos del gobierno del departamento de agricultura de los Estados Unidos de América (USDA) han confirmado estos experimentos, advirtiendo en sus publicaciones que el consumo menor de 1 mg de cobre al dia causa severos síntomas cardiovasculares e inclusive muerte en los animales y que estos síntomas pueden ser invertidos al cubrir esa necesidad de consumo de cobre. Estos científicos del gobierno también han conducido ensayos con humanos en los cuales el consumo de cobre fue menos de 1 md por dia o inclusive más bajo, y los ensayos tuvieron que ser eliminados al descubrir que los participantes desarrollaron problemas cardiovasculares. Una revisión de estos cientos de documentos, indica que un suplemento de 6 mg de cobre al dia, resultaría en casi la completa protección para estos síntomas, y el autor comprobó estas hipótesis entre participantes de edades entre 55 y 67, estos individuos participaron en severos entrenamientos físicos y campeonatos deportivos tales como rugby, competiendo con éxito en contra de jóvenes de 20 a 30 años de edad.

Doênça Cardiovascular do mundo Ocidental – um fator de risco negligenciado
Raymond A. Schep, D.Sc., F.R.C.

Resumo

O autor observa que taxas elevadas da doença cardiovascular ocorrem em países civilizados ocidentais, quanto que a doença é quase inexistente em locais não-industrializados como nas vilas do Sri Lanka e do Vietnã, que abraçam um estilo de vida tradicional. As investigações foram conduzidas para determinar o que é nestes estilos de vida que esclarecem esta diferença. Através de entrevistas, encontrou-se que estas comunidades utilizam uma forma natural de agricultura usando meios tradicionais que persistem por milhares de anos, visto que em países industrializados muito da agricultura é altamente dependente dos adubos artificiais, e muito do alimento colhido é processado de uma maneira que remove várias vitaminas e oligoelementos. O mesmo não ocorre na agricultura tradicional, onde 100% dos nutrientes são reciclados de volta à terra. Um destes oligoelementos, o cobre, foi identificado em centenas de publicações científicas por ter um efeito crítico no sistema cardiovascular. Entre várias centenas de publicações, uma amostra de aproximadamente 40 foram selecionadas e discutidas aqui. Como indicado nestes jornais, encontrou-se que quando o cobre é reduzido ou removido da dieta dos animais e dos seres humanos, possiveis desordens ocorrem, incluindo o tecido cardiovascular defeituoso, a batida do coração irregular, o colesterol elevado, a hipertensão, o diabetes, e o aumento da coagulação do sangue conduzindo ao derrame. Estas desordens, por sua vez, podem conduzir à morte súbita, fissura e rupturas aórticas, trombose da artéria coronária, enfarte do miocárdio, cardiogramas anormais, e insuficiência cardíaca congestiva.

A maneira médica predominante é de chamar estas casualidades como “fatores de risco” e continuam a tratar estes fatores de risco por meio do uso de drogas para abaixar o colesterol, as drogas de anti-hipertensão, redução do uso do sal, cirurgia, etc. É claro que esta prática conduziu essencialmente à redução da taxa de mortalidade por doenças do coração. Como revisto aqui, os cientistas do governo do Ministério da Agricultura dos Estados Unidos (USDA), confirmaram estas experiências, advertindo em suas publicações que o consumo de cobre abaixo de 1 mg ao dia, causa sintomas severos cardiovasculares e a morte em animais e que estes sintomas podem ser invertidos pela suplementação do cobre. Estes cientistas do governo igualmente, conduziram experimentações humanas em que o consumo do cobre foi de 1mg ou menos ao dia, e as experimentações tiveram que ser interrompidas quando os indivíduos desenvolveram sintomas cardiovasculares. Uma revisão destas centenas de jornais indicam que um suplemento de 6mg de cobre ao dia conduzirá à proteção quase completa destes sintomas, e o autor testou estas hipóteses em individuos entre as idades de 55 a 67anos, que participam em vários esportes intensos anaeróbicos e de campetição de aptidão tais como o rugby, competido com sucesso, por rapazes de idade entre 20-30 anos.

Kardiovaskuläre Krankheiten in der westlichen Welt – ein übersehener Risikofaktor
Raymond A. Schep, D.Sc., F.R.C.

Zusammenfassung

Der Autor beobachtet, dass kardiovaskuläre Krankheiten in der westlichen Welt sehr geläufig sind und in den nicht industrialisierten Ländern wie z.B. Sri Lanka oder in vielen Dörfern in Vietnam, die eine traditionelle Lebensweise vorweisen, kaum vorkommen. Um feststellen zu können, welche Unterschiede in den Lebensgewohnheiten dies begünstigen, wurden verschiedene Untersuchungen durchgeführt. Während der Interviews stellte man fest, dass diese Menschen eine naturbelassene Landwirtschaft pflegen, die auf einer jahrtausendalten Tradition beruht, im Gegensatz zu den Industrieländern, deren Landwirtschaft in hohem Maße belastet ist mit künstlichen Düngemitteln und die Nahrungsmittel zudem nach der Ernte auch noch so behandelt werden, dass sämtliche Vitamine und Spurenelemente nicht mehr vorhanden sind. Dies geschieht nicht in der traditionellen Landwirtschaft, denn 100% der Nährstoffe werden dem Boden wieder zugefügt und auf natürliche Weise recycelt. Was die Spurenelemente betrifft, kann man in hunderten wissenschaftlichen Berichten nachlesen, dass eines von denen, nämlich das Kupfer, für das kardiovaskuläre System entscheidend ist. Wir haben deshalb aus den vielen hunderten Berichten 40 ausgewählt und hier besprochen. Man fand heraus, wie auch in diesen Berichten angedeutet, dass, wenn der Bestandteil des Kupfers in der menschlichen und in der tierischen Nahrung gemindert oder gänzlich weggelassen wurde, dies potentielle Gesundheitsstörungen wie u.a. Beschädigungen des kardiovaskulären Gewebes, Herzrhythmusstörungen, erhöhtes Cholesterin, Bluthochdruck, Diabetes, und erhöhtes Risiko auf Blutgerinnung bis zum Infarkt hervorrufen könnte. Diese Funktionsstörungen wiederum können Anlass geben zum plötzlichen Tod, Risse in der Aorta bis zur Aorten Ruptur, Thrombose im Herzkranzgefäß, Herzinfarkt, abweichende Kardiogramme und kongestive Herzinsuffizienz verursachen.

Die gängige Medizin bezeichnet dies als Risikofaktoren und behandelt diese Risikofaktoren generell mit cholesterin- und blutdrucksenkenden Mitteln, Reduzierung des Salzgebrauchs, und durch Operationen. Diese Vorgehensweise hat hauptsächlich nur eine Senkung der Herztod Sterberate bewirkt. Wir haben hier auch besprochen, dass die Regierungswissenschaftler vom Ministerium für Landwirtschaft (USDA) diese Experimente bestätigt haben und in ihren Veröffentlichungen davor gewarnt haben weniger als 1 mg Kuper am Tag einzunehmen, denn dies würde bei Tieren zu ernsthaften Herz-Kreislaufsymptomen und zum Tod führen, wobei diese Symptome durch Zugabe von Kupfer reversibel gemacht werden können. Diese Regierungswissenschaftler haben auch Versuche bei Menschen durchgeführt, wobei die tägliche Einnahme von Kupfer gesenkt wurde bis 1mg oder weniger. Im Falle von Herz-Kreislauf Symptomen sollten die Versuche jedoch unterbrochen werden. Viele hunderte Berichte wurden bewertet; hieraus ergab sich, dass 6 mg Kupfer pro Tag die erwähnten Symptome nahezu verhindern können. Der Autor hat diese Hypothese bei einer Testgruppe von 55- bis 67-Jährigen getestet, wobei die Probanden ein hartes anaerobisches Fitness Training und Hochleistungssportarten ähnlich wie Rugby im Wettbewerb mit 20- bis 30-jährigen jungen Männern erfolgreich absolvierten.

Introduction

In millions of years of evolution of both the animal and human body, a system has evolved whereby nature provides all the nutrients needed for a long and healthy life. The problem is that modern industrial society has interfered with the natural and perfect production of nutritious food, so that food no longer supplies all of the nutrition required by the body. This has been found to result in a substantial increase in disease, with cardiovascular disease being the pre-eminent disease now shortening life spans. In the USA, more than one death every minute results from cardiovascular disease. Mortality is 0.6 million, and a staggering 83 million suffer from heart disease.[1] This is 1 in 4 persons in a population of 318 million.

The findings in this study are consistent with the teachings of various esoteric and philosophic traditions including the Rosicrucian Order, which recognize the connection between physical health, spiritual development, and living in harmony with nature. For example, an article by Dr. H. Spencer Lewis[2] observes that Nature supplies everything that is needed to keep every physical body in a normal condition provided that the body is not abused or neglected.

This paper explores copper deficiency as a typically overlooked risk factor for cardiovascular disease.

Early Indications – Falling Disease in Cattle

An Australian animal nutritionist, E.J Underwood, relates that in the 1930's when cattle in certain areas of Australia were chased by horseback some of the cattle would collapse and die.[3] Some herds experienced an annual mortality of 5–40%. Although sudden death had been reported in bulls, it was most frequently observed when cows were being brought in for milking or were being driven out to paddock. Some cows had fallen on the milker after a bellow and a toss of the head. Death frequently appeared to be instantaneous.[4] Autopsies ruled out causes such as parasites and poisonous plants. The soils and pastures of this region of the country were analyzed and found to have a low copper content. Strangely enough the deaths did not occur in pastures around vineyards, where Bordeaux mixture (copper sulfate and slaked lime) was sprayed on the vines to combat fungus and mildew. It was thought that the trace mineral copper had something to do with the prevention of the falling disease but the mechanism was unknown. However the role of copper soon became apparent as a result of nutrition studies on the trace element.

Experimental Studies

Copper, Elastin Tissue, and Hypertension

In their research on the effects of copper deficiencies in the diets of chickens, rats, and pigs, B.L. O'Dell et. al.[5 6] found that the aortas of the animals became diseased and malformed. For example, chicks that had been fed a copper deficient diet had only 26% elastin in their aortas as

compared to controls that had 47% elastin in their aortas. Elastin is a protein necessary to supply elasticity and strength to arteries and veins including the aorta, the main artery coming from the heart. They found that offspring of copper deficient rats were unable to hold blood in their veins and arteries, resulting in bleeding into the surrounding tissues. Other trace mineral deficiencies such that of iron, manganese, and iodine did not have this effect. In these studies, arterial degeneration generally occurred when copper intakes were less than one part per million (ppm), or one mg of copper per kg of the diet.

A defining study was that of Hill et al.[7] Aware of the fact that the arteries of copper deficient animals had too much lysine in them, they determined that an enzyme in the arteries, called lysyl oxidase, was instrumental in using the amino acid and nutrient, lysine, to make elastin tissue. Lysine is one of the building blocks for protein, including elastin tissue protein. It was established that this enzyme contained copper. The truth became apparent: without copper there was not enough lysyl oxidase to incorporate the lysine into elastin tissue, and only defective tissue could be manufactured, accompanied by excess lysine build up. Arteries or veins containing defective elastin tissue showed many different kinds of symptoms. They would leak (edema), balloon out (aneurysm), or rupture and break. Harris, et al.[8] found that chicks fed copper deficient diets suffered severe decline of lysyl oxidase activity. Returning copper to the diet restored complete enzymatic function.

Studies by Alarcon[9] and Lukasaki[10] found that hypertension, a cardiovascular risk factor, increases when the dietary intake of copper is lowered. Alarcon found the statistical relationship R, between copper intake and blood pressure lowering, to be 0.963 to 0.981 with the value of 1.00 being perfect correlation. It appears that loss of elasticity in veins and arteries causes higher pressure during heartbeats.

Copper and Atherosclerosis

In order to metabolize glucose, which we get from starch or sugar in our food, the body must convert glucose into heat and energy with the by-product of carbon dioxide and water. It does this by converting oxygen into a highly reactive superoxide molecule which combusts the glucose. This superoxide radical, if not controlled, can damage the cells and tissue in arterial walls, signaling white blood cells to deposit plaque in arteries to repair the damage with resultant inflammation and disruption of circulation.[11] This is known as atherosclerosis and can cause stroke and heart muscle death due to lack of oxygen from insufficient blood supply. The enzyme that neutralizes the superoxide is called superoxide dismutase (SOD). This is also a copper-containing enzyme. As in the case of lysyl oxidase, the higher the copper intake the more superoxide dismutase is present in the body. Conversely, the less the copper intake the less SOD is present.[12] Wester[13] also found that atherosclerotic arteries had a low copper content. Studies by Q Liu[14] and S. Didion[15] showed that the superoxide radical can actually cause arteries to constrict, and that SOD counteracts this.

Considering the huge volume of literature showing severe effects of copper deprivation in animals, it would seem unwise to do human trials with copper deprivation. Nevertheless S. Reiser et. al.[16] of the US Department of Agriculture (USDA), published a study to determine if fructose, a component of the now ubiquitous high fructose corn syrup in most market foods, lowered copper levels more than just starch. He stated that the trial followed ethical guidelines. His subjects ranged from 21 to 57 and were fed a diet containing 1 milligram of copper and 2850 (k)calories per day. The study had to be terminated three weeks early because 4 of the 24 subjects had cardiovascular incidents, including a heart attack. The author remarked that in years of human trials he had never encountered anything like this. He still was able to determine that the fructose diet did lower SOD activity but starch did not do so. Repletion of the subjects with 3 mg of copper a day did increase SOD levels in the fructose group.

Recent Findings

Klevay[17] of the USDA, in 2000 affirmed the deficiency of copper in animal experiments to be associated with aortic fissure and rupture, cardiac enlargement and rupture, coronary artery thrombosis and myocardial infarction, decreased lysyl oxidase activity, the latter of which results in failure of collagen and elastin cross-linking, low superoxide dismutase activity with resultant weakened arteries and heart, abnormal electrocardiograms, even glucose intolerance and hypertension. Copper depletion experiments in humans resulted in abnormalities in lipid metabolism, blood pressure control, and abnormal cardiograms. It also resulted in impaired glucose tolerance. He affirmed that the western diet, found to be low in copper, has proven insufficient for these people.

Recent studies [18] [19] [20] circa 2000-2013 have continued the numerous findings of the past century. It was found that dietary copper deficiency caused cardiac hypertrophy and a transition to heart failure in mice. Curing the deficiency caused a rapid restoration of the heart and prevention of heart failure. In essence they found out that heart muscle atrophied when the mice were fed a diet containing 0.3 mg/kg of copper in the feed, and when it was replaced by a diet of 6 mg/kg of copper it then normalized the size and number of heart muscle cells (cardiomyocytes).

Other Theories About Heart Disease

C-reactive protein

One theory presently under discussion[21] holds that high concentrations of compounds called "C reactive proteins" in the blood of persons are a causative factor for heart disease. However in this same paper it is pointed out that C Reactive proteins are primarily a response to inflammation in the body due to tissue injury, infection, and damage. This damage is stimulated by phagocytes (white blood cells) attacking damaged inflamed cells, and signaling C reactive protein to come to the damaged cell and attach themselves to facilitate the removal and destruction of the damaged cell.[22] [23] Now it is clear from numerous animal experiments that severe tissue damage is caused in the cardiovascular system due to copper deficiency resulting in malformed elastin tissue and

free radical damage to arteries due to insufficient SOD protection. This suggests that increased C reactive protein blood concentrations are a symptom of copper deficiency induced injury, not a fundamental cause of injury to the cardiovascular system.

No reports were found of any work studying the effect of copper levels on blood clotting. However consider the following. Coagulation is the process by which factors circulating in the blood form clots when they encounter damage to the vessel walls. It an important mechanism to prevent blood loss from a damaged vessel, where the damage is covered by a platelet and fibrin-containing clot to stop bleeding and begin repair. A lysyl oxidase deficiency and thus a copper deficiency are implicated in vein and artery damage, which would trigger excessive clotting. Nevertheless at least one study, that of Leslie Klevay,[24] did report deaths in copper restricted mice due to atrial thrombosis while conducting copper nutrition studies. He acknowledged that the thrombosis was due to copper deficiency. This finding would argue against the use of anti-coagulants as the first line of defense against strokes.

Homocysteine Levels and Cardiovascular Disease

Elevated homocysteine levels in the body are involved in congestive heart failure. Homocysteine chelates copper and impairs copper-dependent enzymes. It is an intermediary in the synthesis of cysteine, an amino acid needed for the synthesis of glutathione, a most important anti-oxidant for the body. Vitamin B_6 is needed for this synthesis, and a deficiency can elevate homocysteine levels.[25] It has been shown that attempts to lower homocysteine levels in the body will not overcome or negate the effects of a copper deficiency. In one experiment, Brown[26] fed some rats adequate copper (14 mg/kg in the feed, according to him) and some he fed inadequate levels (1.3 mg/kg), which were nevertheless a level higher than the typical American diet. He also fed half of them 10g/kg of homocysteine. He found homocysteine and the copper deficient diet lowered glutathione and copper dependent enzymes including superoxide dismutase enzyme, resulting in increased lipid peroxidation (free radical damage) in the heart. He concluded that homocysteine can markedly decrease copper status in rats. Rimm[27] found 33% reduction in coronary heart disease in 80,082 women from the lowest to the highest quintile of vitamin B_6 intake. Renzhe[28] found 21% reduction of heart failure and mortality in the same B_6 intake quintiles in 58730 Japanese. He claimed the effect was due to a reduction in homocysteine levels. His study may be confounded because the intake of the anti-inflammatory factor omega-3 fatty acid increased from 0.9 to 2.6 g/d in those quintiles. The results indicated that cardiovascular damage done by homocysteine is by lowering copper availability. The strategy to increase vitamin B_6 intake to obtain modest benefit would not succeed in a copper deficient diet, and a likely cause of any heart disease due to elevated homocysteine level is copper deficiency. Thus, overcoming a copper deficient state is superior to increasing B_6 intake. Higher levels of homocysteine in the body would indicate a need for increased or adequate dietary copper.

Hypertension, Sodium levels and ACE Inhibitors

One of the present theories concerning hypertension is that it is related to increased sodium intake. In an extensive and comprehensive study[29] the sodium intake of 2415 patients was reduced by 33 - 44 mmol/24 hr over a 36 to 48 month period according to questionnaires. Follow-up by phone found 200 persons reporting cardiovascular events and the authors claimed 25 to 33% reduced risk of a cardiovascular event in that time period in the intervention group. However, the authors mentioned that 67 people died during this time. This is one out of every 46 persons in the study, a high mortality rate, and undermines the author's claim of benefit due to sodium reduction. They claimed 20% reduction in mortality in the intervention group; a less than impressive mortality reduction.

This study suggests that the mechanism of copper lowering the blood pressure by increasing the elasticity of veins and arteries is a much more sound finding, based on solid biochemical principles, than sodium reduction. It is therefore concluded that although high sodium intake may increase arterial pressure due to osmotic pressure, ultimate protection is strong and flexible arteries and veins due to healthy elastin content, induced by adequate lysyl oxidase activity supported by adequate copper intake, not attempting to reduce sodium, a necessary electrolyte. Sodium contributes nothing to arterial structure and strength, either by the presence or lack thereof. Besides, sodium chloride is required by the body to manufacture hydrochloric acid, necessary for the digestion of protein. Other findings also suggest that correction of a copper deficiency, not sodium restriction, is the proper treatment for hypertension. Kedzierska et. al.[30] states the following: Hypertension is associated with a deficiency of trace elements such as copper and zinc and their imbalance can be associated with hypertension. This hypertension is associated with increased activity of sodium transport systems. They determined the ATP driven sodium/potassium transport in the red blood cells to have an average value of 2232 units for 15 hypertensive patients compared to 1751 units for 11 non-hypertensive patients. They concluded that copper supplementation (overcoming a deficiency) could be expected to provide therapeutic benefits for hypertensive patients.

The most frequently prescribed drug for hypertension is the ACE inhibitor.[31] This works by inhibiting a substance called angiotensin, which causes vasoconstriction (narrowing or tightening of the arteries). At least two papers, QiangLi[32] and Lawson,[33] report that SOD counteracts vasoconstriction in arteries. This vasoconstriction is caused by the superoxide radical, which SOD destroys. Adequate SOD requires adequate copper supply. However ACE inhibitors have adverse drug reactions, some of these severe, hypotension, dry cough, hyperkalemia, headache, dizziness, fatigue, nausea and renal impairment. The adverse effect of hyperkalemia (high potassium in blood) is a particularly severe side effect because it causes heart arrhythmia and palpitations. The US Food and Nutrition Board has set the tolerable upper intake level (UL) for copper at 10 mg/day from food and supplements.[34] Also, Wang[35] in a 2013 paper found that copper induced vasorelaxation in rat arteries. They induced vasoconstricion by injection of noradrenaline and found that copper in a dose dependent manner blunted the induced vasoconstriction. These three studies suggest that copper, a natural requirement,[36] may be

superior and have much none of the adverse side effects of ACE inhibitors in the amelioration of hypertension. Any treatment containing both sodium reduction and ACE inhibitors may be inadvisable because lower sodium intake would increase hyperkalemia, a side effect of ACE inhibitors.

The cholesterol theory

The Tecumseh study, conducted from 1959 to 1979, showed that saturated fat intake has no effect on cholesterol levels.[37] Dr L.M. Klevay[38] of the USDA, a government agency, located the original publication that first claimed that high fat diets raised cholesterol and caused arteriosclerosis. He found that the animals had been fed a sugar and lard diet. No minerals or vitamins had been added to this diet, so in essence it was deficient in copper. He repeated the same experiments, but added copper to their drinking water. The mice did not get atherosclerosis. From this, he concluded that elevated cholesterol was not the cause of heart disease.

The American diet – a copper deficiency?

It is shown that the answer is a definite yes. There are three causes for a very inadequate copper intake in the American diet. One is that high copper containing foodstuffs are simply not consumed anymore. Typical examples are the replacing of whole rice and whole wheat with white rice and white flour and less consumption of copper-containing foods such as liver. The second cause is that food processing removes copper from our food. Our diet has become almost solely dependent on processed foods. The third cause is that agricultural processes have stripped copper from the soil by not replacing it, and even natural vegetables and fruit now do not have the copper content that they had eighty or ninety years ago, as is discussed below.

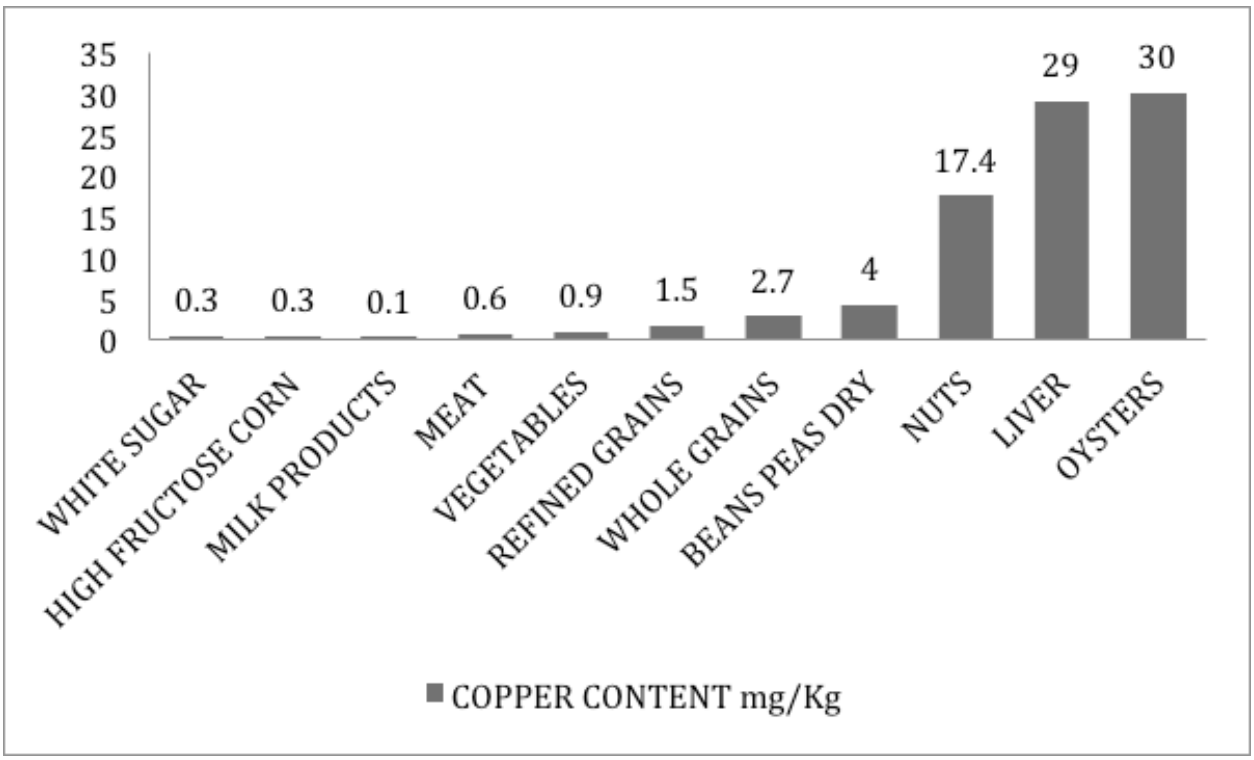

Figure 1. Copper Content Of Foodstuffs and Food Groups

Fig. 1 illustrates the copper content of all food groups. The values are the average of three different published sources.[39 40 41] In the copper deprivation experiments, disease resulted when animals were fed copper diets of less than 1 mg per kilogram (2.2 lbs) of food. It was usually achieved in animal copper deprivation experiments by mixing dried milk powder and dextrose (glucose). This table illustrates that the foods that have the highest copper content are foods that are just not consumed or are rarely consumed by the population. The table also illustrates how food processing removes copper from our foods, notably refined grains, mostly white rice and white flour, contain only about half as much copper as whole grains. The addition of high fructose corn syrup to foods reduces the amount of copper as it has very low copper content. Therefore the normal human diet of pancakes with corn syrup, white toast with margarine, milk, apple juice, corn flakes, beef, pork, chicken, white rice, vegetables, fruit, broccoli, orange juice, spaghetti, French fries, sodas, candy, doughnuts, without any significant amount of nuts, brown rice, beans, shellfish, or liver would contain only about 0.7 to 0.9 mg of copper a day, an number that has been linked to severe heart disease in animals. Note the copper content of corn syrup, white sugar and milk products.

In 2013 Pang[42] reported that the average copper intake for 68 Americans measured daily for a year was 0.9 mg/day. This is at a level causing cardiovascular symptoms in animal feeding experiments. Mills[43] found severe cardiovascular symptoms in chickens, mice and rats with a

copper intake of 0.7 to 0.9 mg/Kg of feed within 20 weeks. This would be a human intake of 0.7 to 0.9 mg if the human consumed 2.2 lbs of this feed.

Klevay and Forbush[44]compared the copper content of foodstuffs in 1942 and 1966 using statistical and sampling procedures. Bananas had dropped from 2.1 to 0.66 mg/Kg, egg yolks from 4 to 2.4 mg per Kg and white bread from 4 to 2.4 mg/Kg. Using their procedures, they found on average a downward movement in copper content between these dates. During this time, they reported a 44% increase in arteriosclerotic disease, and intake of animal fat actually decreased. A likely contributing factor is that copper removed from soils during farming is not being replaced, thereby depleting the soils of copper. Pratt and Blair[45] confirm that copper is depleted from irrigated soils. The harvesting of one tonne per acre of the following crops results in the following annual removal of copper from the soil: Cereals, 3-5 g, legumes 5-10 g, oilseeds 4-14g. [46] In the following paragraph it is shown that centuries old traditional pre-industrial agriculture removes no copper from the soil.

Traditional Agriculture Recycles Copper

For purposes of this study the author interviewed two persons, Thylina Balasuira and Trudi Du, both of Los Angeles. One grew up in a Sri Lankan village, and the other in a Vietnamese village. They both stated cardiovascular disease was nonexistent in their village and surrounding villages. They testified that complete recycle of all material took place from the rice paddies. The rice hulls and husks were used for heating and the ashes relegated to an ash pile. Any rice straw fed to animals resulted in their dung being added to this pile. Even human waste was added to this pile. Nothing was lost. Prior to flooding and planting the paddies with rice, all this material was scattered on the rice paddy returning all minerals and nutrients to the paddy. These paddies have been producing for thousands of years and never had to be abandoned due to mineral depletion. This is not the case with western agriculture after artificial fertilizers were developed.

Obtaining Adequate Copper in Industrialized Western Civilization

Although it is best to get copper naturally and from food, this may be difficult in the modern day environment of highly processed and sugar-laden foods. One approach is supplementation of bioabsorbable copper. The author resorted to taking copper amino acid chelated pills of 2 mg each, 3 times daily for a total of 6 mg of copper intake. This must be taken on a full stomach. While doing this, he was able to carry out extreme fitness training for championship rugby, which requires a fitness level substantially higher than football, between ages 55 and 67. A typical training regime was 15 one hundred yard dashes at full speed in rapid succession with ten minute breaks in between. His alternative regimen consisted of ten full tracks runs at full speed with only 20 seconds for recovery between runs. He was able to do this even with his family history of atherosclerosis, which claimed his father at age 54.

Conclusions

Animal experiments have linked copper deficiency with aortic fissure and rupture, cardiac enlargement and rupture, edema, coronary artery thrombosis and myocardial infarction, and decreased activities of lysyl oxidase and SOD resulting in failure of collagen and elastin cross-linking and resultant weakened arteries and heart, abnormal electrocardiograms, and even glucose intolerance and hypertension. Copper depletion experiments in humans resulted in abnormalities in lipid metabolism, blood pressure control, abnormal cardiograms, and impaired glucose tolerance. In turn, these symptoms have been linked to weakened or defective elastin tissue. Copper is an essential nutrient to the enzyme lysyl oxidase, critical to the formation of elastin tissue needed for a healthy strong heart, arteries and veins.

Various studies have called into question earlier findings on causes of heart disease, for example, elevated cholesterol. The original study consisting of feeding animals a fatty diet resulting in atherosclerosis was refuted when the diet was shown to be lacking in copper, and addition of the copper removed the atherosclerosis. Elevated homocysteine levels were shown to reduce the availability of copper and were reversed by repletion of copper. In one study, reduction of sodium intake failed to reduce cardiovascular disease by more than 20%, and furthermore, sodium restriction may make it more difficult for the body to combat hyperkalemia. Copper repletion was found to be superior to ACE inhibitors, which have many side effects, some of them severe and dangerous such as hyperkalemia. Evidence was presented that copper deficiency may underlie various other mechanisms that have been implicated in cardiovascular disease. The second mechanism of copper is through the presence of SOD, of which it is a constituent. SOD protects the veins arteries and heart due to its ability to neutralize the superoxide radical. Superoxide radicals in arteries have been shown to cause vasoconstriction leading to heart attack and stroke. In the study cited, it was indicated that even mere injection of copper solution stopped vasoconstriction, thereby providing an immediate and quick result.

Homocysteine's effect on heart disease has been reported to be due to the chelation of copper, in turn resulting in copper deficiency-related damage to the cardiovascular system. Overcoming this by B_6 supplementation had only limited success in very large studies. Low copper intake would make the cardiovascular system more susceptible to damage by elevation of homocysteine levels, but adequate copper intake may counteract this and provide a remedy that may be more comprehensive than lowering homocysteine and with fewer or no side effects. It has been found that the copper intake of Americans at 0.9 mg per day is marginal and at a level causing severe cardiovascular problems in animals. Various studies indicate that copper and other minerals are removed from the soil during modern day agriculture. In addition, it has been observed that in traditional non-industrial agriculture, as in villages where persons grow their own food with total recycle of all materials back to the soil, there is no cardiovascular disease. This may be due to the system never becoming copper depleted, which may reflect differences between industrial agriculture and traditional rural agriculture. The person living in an industrial environment may therefore need to resort to copper supplementation.

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