Wild-Type Food in Health Promotion and Disease Prevention

WILD-TYPE FOOD IN HEALTH PROMOTION AND DISEASE PREVENTION

THE COLUMBUS CONCEPT

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Preface

For most of us, it requires some effort to dare realize how wrong we were: Blood cholesterol was never a problem. Blood vessels were the issue; this fact is scientifically, clinically, and epidemiologically established. *Wild-Type Food in Health Promotion and Disease Prevention: The Columbus Concept* will bring this evidence into the public domain. It is essential to make a "U-turn" in the way contemporary medicine approaches ill-health diseases. Early prevention of primary risk factors is a far more promising approach compared with late-acute treatment of secondary risk factors in reducing the cost burden of public health, not to mention the expected benefits of the former versus the latter regarding quality of life.

The leading market concept behind the rehabilitation of dietary/blood cholesterol is called "Columbus." Obviously, it borrows the significance of the name from the time when the earth was proven round rather than flat, and a dramatic leap was made in the way people understood the world they lived in. However, facts are not enough to catalyze change. There must be a will, fueled by the hope of an opportunity or the fear of a threat for those involved. As far as the cholesterol–health relationship is concerned, the opportunity in terms of economic development and the threat in terms of civil responsibilities become more sensible every day that science, industry, and legislation progress.

Wild-Type Food in Health Promotion and Disease Prevention: The Columbus Concept is divided into five major parts of equal importance. Part I identifies the missing essential ratio/proportion of competing essential fatty acids in the human diet and relates them to the upsurge of modern chronic diseases and associated health care costs, with special emphasis on coronary heart disease. Fabien De Meester explains the scientific basis of the Columbus Concept and the evidence supporting the rehabilitation of dietary/blood cholesterol. Tomohito Hamazaki and Harumi Okuyama show that blood cholesterol is a necessity for a population to maintain healthy blood vessels (Japan), while Gal Dubnov-Raz and Elliot M. Berry identify the medical consequences of a high proportion of omega-6 HUFAs in blood vessels and peripheral tissues in a population (Israel) whose dietary pattern has been characterized by high to extremely high omega-6:omega-3 ratios. Jing Xuan Kang reports on the ratio and proportion of omega-6 to omega-3 fatty acids naturally found in genetically modified organisms that are allowed to desaturate the former to the latter and, so doing, validate the wild-type hypothesis at the molecular level. William E. Lands describes the biochemical and mathematical relationships that have been established between dietary and tissue essential fatty acid ratio/proportion to conclude that our health is closely associated with our dietary choices in terms of lipid (essential fatty acid) make-up. Jonathan D. Belsey takes these conclusions and reviews the results of major prospective clinical studies to estimate the potential public health savings that would result from the implementation of the Columbus Concept in high-risk cardiovascular populations only. Finally, S. Boyd Eaton closes the Part I with a discussion on the world perspective of wild-type diet in health promotion.

Part II concentrates on the 10% (in terms of their contribution to the daily energy intake) essential ingredients (amino acids, fatty acids, vitamins, and minerals) in our daily diet that make our blood vessels healthy and resistant. The first seven chapters of Part II use eggs as a model. Fabien De Meester describes the wild-type egg as an ideal candidate for the future establishment of a WHO reference pattern for dietary fatty acids in humans. Basant K. Puri and Jonathan P. Stannard report on the essentiality of eicosapentenoic acid (once disputed because it competes against AA) in human milk and the efficiency of the wild-type egg in supplying this essential omega-3 fatty acid to breast milk through the mother's diet. Peter F. Surai and Brian K. Speake emphasize the changes that have occurred in the composition of eggs as a result of the domestication of the birds. With their collaborators, Tigran T. Papazyan and Nick H. C. Sparks, they explain how we can, and why we should, return modern eggs to their standard in the wild. Niva Shapira describes a lipid endothelial and inflammatory hypothesis that explains how egg composition can affect cardiovascular disease risk. Finally, Gita Cherian and Ricardo Ayerza (h) illustrate ways to produce and characterize eggs with increased levels of omega-3 fatty acids obtained by feeding layers of flax and chia seeds, respectively. The remaining eight chapters relate to the physiological/metabolic properties of omega-3 HUFAs, taking fish oil as the complementary source to wild land-based plant and animal omega-3 sources. Adrian S. Dobs and Daniel Edelstein start with an overview of fish oil and health promotion and introduce the basis for a series of leading articles on the established relationship between dietary omega-3 fatty acids and the occurrence of ill-health diseases. Michel de Lorgeril and Patricia Salen present the extended amount of accumulated evidence on the involvement of omega-3 fatty acids in regulating cardiovascular health and, in turn, their potential use in primary prevention of coronary heart disease. Vijaya Juturu and James J. Gormley take the discussion forward to describe how the absence/imbalance of essential omega-3 fatty acids modulates insulin resistance, while Ram B. Singh et al. extend that discussion to involve the brain, and propose a modern dietary therapy for the metabolic syndrome based on an appropriate balance of dietary essential fats. Erin M. O'Connell, Patricia D. Schley, and Catherine J. Field show how, interestingly, omega-3 fatty acids are mediating immunomodulation and cancer resistance. Mental health and diseases associated with imbalance in dietary essential fatty acids are reviewed by Abolghassem Djazayery and Shima Jazayery, while Sheila Sedig and Ronald Ross Watson review the role of omega-3 fatty acids in prevention of aged-related macular degeneration. The last two chapters of Part II introduce two non-lipid essential ingredients of the diet that contribute synergistically with omega-3 fatty acids to the maintenance of healthy blood vessels and peripheral tissues, including bones. Brandon Lewis reviews the essentiality of the natural carotenoid lutein in promoting eye and skin health, and Rainy Dawn Warf and Ronald Ross Watson presents evidence for calcium in protecting teeth against degenerative dental caries.

Part III introduces the functional part of the diet that can bring about health benefits in terms of maintaining healthy blood vessels. Dietary functional components include dietary ingredients (phytochemicals, pro-, pre-, synbiotics) and other lifestyle factors (physical activity, spiritualism). They usually do not contribute to an appreciable extent to the daily energy intake. It will become obvious to the reader that some chapters treat both essential and functional aspects of the human diet and lifestyle. Because the authors were not consigned to limit themselves to the description of the one (essential) or the other (functional) aspect independently, those chapters treating the two aspects simultaneously were collected in Part III.

Peter F. Surai, Ambrose J. Spinnler Benadé, and Brian K. Speake review the distribution of natural antioxidants in land- and marine-based food, and explain how such distribution is important to maintain in modern food, especially if the latter are rebalanced in wild essential fatty acids. Ricardo Ayerza (h) and Wayne E. Coates introduce the tale of an ancient crop of Latin America that came back to life thanks to the reviving interest towards wild food rich in omega-3 fatty acids and essential/functional antioxidants. Chia seed (*Salvia hispanica*) is presented as an ideal vector of land-based omega-3 fatty acids to modern human's diet. Other phytochemicals and their influence on ill-health diseases are reviewed by Madhuri Vemuri, Darshan S. Kelley, and Kent L. Erickson in their article on foods rich in polyphenols; by Tirang R. Neyestani in his report on evidence of a relationship between the presence of polyphenols in the diet and the possible modulation of immunity; by Sherma Zibadi, Douglas F. Larson, and Ronald Ross Watson in a review on the influence of flavonoids on heart failure; and by Simin Bolourch-Vaghefi and Paula Inserra in chapters on the functional properties of natural carotenoids—lycopene—in preventing modern diseases in general (Vaghefi), and prostate cancer in particular (Inserra). Reading through Part III, it appears that functional ingredients of the diet need not be absorbed to a significant level to be active. Their action at the food/blood interface (intestine) may well be their primary site of action.

Part IV presents the health benefits of wild-type foods as found naturally in different cultures around the globe, starting with Francesco Visioli, Franca Marangoni, and Claudio Galli with their review on local wild foods in the Mediterranean countries, and Manuel J. Castilló Garzón on the effects on plasma lipids as a result of the recent changes observed in the Spanish-Mediterranean diet. Nahla Hwalla and Dalia Tannous Dit El Khoury give us an introduction to the Middle East with the traditional Lebanese diet and its recognized health effects, while Abolghassem Djazayery and Shima Jazayery collect information for us on the health status of Iranian people relative to their choice in terms of nutritional lipids and fatty acids. Finally, Buncha Ooraikul, Anchalee Sirichote, and Sunisa Siripongvuthikorn report on the traditional and modern diet/health relationship in South East Asia, taking Thailand as their native target country. This part supports the theory that each region around the world has the potential to maintain wild dietary standards compatible with human genome, long-term homeostatis, and health, extended to blood vessels and peripheral tissues.

The fifth and final part is an essay toward bringing the Columbus Concept to the market in a world driven by economic and financial factors that provides little, if any, support to all kinds of preventive approaches to health and medicine. Luc Coucke starts by describing how different modern wild-type agriculture will have to be compared to today's modern standards. Alfredo Nasiff-Hadad and Jiménez-Acosta Santa Magaly describe a way to definitively test and prove the wild-type diet and lifestyle hypothesis in a country (Cuba) where wild-type standards could still be established without the burden of fighting *per se* against economic and financial pressure. Finally, Ambrose J.

Spinnler Benadé concludes with his proposal to test for the Columbus Paleolithic hypothesis on plasma lipoprotein composition, metabolism, and atherosclerosis in a species closely genetically related to man, the vervet monkey.

It is obvious that the Columbus Concept is in its early stages of market development. Given the general public confusion with the cholesterol myth, it is evident that only a step-by-step reconstruction and the rehabilitation of a Dietary Food Guide based on Paleolithic lipid standards can be thought of as a leading pattern to true public health and quality of life. Knowing what is at stake, there is no doubt that it is a good investment.

Fabien De Meester
Ronald Ross Watson

Acknowledgments

Wild-Type Food in Health Promotion and Disease Prevention: The Columbus Concept is the result of 10 years of teamwork by a team whose members are establishing a value chain organized to take a sound scientific concept to a market reality. Those members are not part of a single company or institution; rather, they are independent members taking part in the shaping and building up of a science-led business concept, i.e., the Dietary Food Guide based on Paleolithic Lipid Standards, which, among other things, advocates the normal functioning of diet/blood ingredients and the rehabilitation of dietary/blood cholesterol. On the market, the concept is branded as "Columbus."*

The members belong to a large web of public and private organizations, with expertise extending from science and technology to marketing, legal matters, economics, and finance. The organization of the Consortium has been described in the Common Statement of the First International Congress on the Columbus Concept (ICCC) that took place in Washington, D.C., in October 2002. Each year, an ICCC is organized to review progress in bringing the science of the Columbus Concept to the market. In 2006, the event coincided with ISSFAL in Cairns, Australia, where a concurrent session on dietary PUFAs and cholesterol was organized and sponsored by Columbus (see www.columbus-concept.com for regularly updated information).

To all contributors, Dr. De Meester wishes to extend his most sincere gratitude for achieving such progress as a team, and promises to do what it takes for this concept to establish itself as the reference in human nutrition and preventive medicine throughout the industry.

Dr. Watson acknowledges the research support for the past few decades from Wallace Research Foundation, led by H. B. and Joceyln Wallace supporting studies using dietary supplements, eggs, foods, and bioactive extracts in health promotion by preventing heart disease and immune dysfunction. This led to his role as a coeditor of this book.

A special appreciation is due to Bethany L. Stevens, who worked on this book from the beginning as the editorial assistant. She diligently supported the editors, publisher, and especially the authors in making their contributions the excellent chapters found in this volume. Her many hours of day-to-day communication are therefore much appreciated by the editors.

* In the United States, Columbus products appear under the brand "Christopher."

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I

The Columbus Concept: Scope and Limitation

1 Wild-Type Land-Based Food in Health Promotion and Disease Prevention

The LDL-CC:HDL-CC Model

Fabien De Meester

Abstract

The Columbus Concept (CC) stands for a return of α-linolenic acid—herein referred to as wild- or game-type, land-based fatty acid—into the feed ration of land-based, bred animals to such an extent that their body fat (white adipose tissue) and triglycerides (TGs) exhibit a balanced ratio of essential fatty acids (EFAs) (i.e., ω6:ω3-EFAs/TGs = 1:1), characteristic of body fat in wild animals or game. This return to the standard in the wild translates into a substantial reduction in highly unsaturated omega-6 fatty acids and a moderate and variable increase in highly unsaturated omega-3 fatty acids in the peripheral tissues of these domesticated, land-based animals or livestock. In other words, their meat total lipids (TLs) exhibit a proportion (%) of conditionally-essential highly unsaturated fatty acids (HUFAs) in favor of the omega-3 species (i.e. ω6/(ω6 + ω3)-HUFAs/TLs = 25%), characteristic of meat lipids in wild, land-based animals and game. The ω6:ω3-EFAs/TGs = 1:1 ratio is also a reference for the design of composite, plant-derived table oils and fats, as these represent other important sources of energy in the modern human diet.

Particular attention is given to the antioxidant content (vegetables, fruits) of such foods.

Finally, a new and simple mathematical equation is proposed that provides a basis for accurate prediction of individual risk for CHD based on the measurement of two blood parameters: total blood cholesterol level (TC) and proportion of omega-6 HUFAs in blood total HUFAs (i.e., ω6/(ω6 + ω3)-HUFAs/TLs), the former being phenotype-driven, the latter in direct relationship with peripheral-tissue HUFAs-composition.

Key Words: Wild- or game-type land-based food; omega-6 and omega-3 fatty acids; LDL-CC:HDL-CC; degenerative diseases.

1. INTRODUCTION

The theory that dietary cholesterol and dietary saturated fats are causal factors for elevated blood cholesterol and cardiovascular disease has successfully influenced our dietary habits—giving eggs, milk, and meat questionable nutritional status. It is now known that blood cholesterol is not a primary risk factor for coronary heart disease and that the diet–heart hypothesis holds true greatly to the extent that our dietary lipids in general, the essential fatty acids in particular, have deviated from their original make-up. Even more significant is that high blood cholesterol might be a sign of health and longevity.

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Table 1
Essential Fatty Acids (as % of Total Fatty Acids) in Adipose Fats of Wild Pig and Antelope

Adipose fat	*Pig*	*Antelope*
ω6-linoleic	17	4.5
ω3-linolenic	17	4.0
Total	34	8.5
ω6:ω3	±1	±1

It is time to re-establish the land-based "Golden Game Standards," defined *(1)* as LA:ALA = 1:1 in the TGs of body fat in livestock and *(2)* as ω6/(ω6 + ω3)-HUFAs/TLs = 25% in the TLs of their meat, and to test them in large retrospective and prospective epidemiological studies.

2. FATS IN THE PALEOLITHIC LAND-BASED DIET

Wild animals, plants, and fruits were the major food sources available to our hunter-gatherer, unhumanized Paleolithic ancestors. Hunting is still practiced as a sport in some parts of the world, and contemporary scientists have measured the ω6:ω3-EFAs/TGs ratio that persists in untamed land environments such as the African Savannah. They discovered that adipose fats, which account for ±95% of total fat in land-based animals, differ from species to species by their respective content in essential fatty acids (*see* Table 1; 34% in monogastric pig vs 8.5% in ruminant antelope), but that their essential ω6:ω3-EFAs/TGs ratio consistently nears equilibrium *(1,2)*. More recent studies on wild animals confirmed original observations by Crawford and Sinclair *(3)*.

During human evolution, modern cereals and grains were scarce, and the food available to preagricultural humans was essentially wild and lean (e.g., meat, fish, leafy greens and plants, fruits, nuts, berries) and loaded with antioxidant vitamins and minerals. Under such Paleolithic-type, environmental conditions, it is generally estimated that the white adipose tissue of wild animals and game accounted for the major source of land-based dietary lipids and that the average ω6:ω3-EFAs/TGs ratio in that land-based diet was therefore close to 1:1 *(3,4)*.

3. FATS IN THE MODERN LAND-BASED DIET

It is obvious that agribusiness (grain and cereal production) and food technology (fat and oil extraction) have dramatically changed the pattern of nutrients and lifestyles in the human regimen. Energy-dense, fat-rich foods and sedentary lifestyles have become standard. However, all things remaining equal in terms of essential principles *(5)* (i.e., energy intake = energy expenditure, proportionality, variety and moderation) modernization has induced a single dramatic change in the human regimen which is the way essential nutrients are distributed. Basically, modern foods are loaded with omega-6 fats and are moderately to largely deficient in omega-3 fats, antioxidant vitamins, and minerals. This shift in paradigm is a logical or induced consequence of the modern turn from the wild, versatile diet, based on greens and game, to the modern, easy-to-access diet, based on grains and livestock.

It has been estimated that the modern Western diet is largely deficient in omega-3 essential fatty acids with a ratio of omega-6 to omega-3 ranging from 20:1 to 10:1, instead of 1:1 as in the Paleolithic diet *(3)*.

4. FATS IN THE COLUMBUS DIET

Since the Paleolithic era, and because the time period under consideration is only a few thousand years, humanity as a phenotype has evolved thanks to environmental and developmental changes rather than genetic modification. The evolving human phenotype, therefore, interacts with the same genome as did the hunter-gatherer phenotype. Over the last 150 to 50 yr of industrial revolution and modernization, however, a major change has occurred in the human diet: essential fats and antioxidant vitamins and minerals have been manipulated. Essential fats are those that cannot be produced or exchanged within the human body; they must be extracted from food and are involved in human gene expression and overall homeostasis. There are two types: the omega-6 (ω6) and the omega-3 (ω3); these two types compete against each other in human, fatty-acid, biological pathways. It is therefore interesting to evaluate and test the most probable dietary ratios that existed between the two types of essential and conditionally-essential fatty acids at the inception of our ancestor's genome, for there is no obvious reason for a necessary change since then.

The Columbus Concept recognizes that it is both essential and urgent to test for a return to wild-type, balanced essential fatty acid ratios (ω6:ω3-EFAs/TGs = 1:1 ⇒ ω6/(ω6 + ω3)-HUFAs/TLs = 25%) in the human diet associated with the delivery of appropriate amounts of essential and functional antioxidants (e.g, vitamins C and E, selenium, xanthophylls, phytochemicals) from grains, cereals, fruits, legumes, vegetables, meat, milk, and eggs. From an industrial perspective, the Columbus Concept stands for a "return to wild-type, land-based foods based on modern economically viable agribusiness standards," which involves a second agribusiness revolution (*see* Fig.1). This revolution encompasses large-scale production of naturally-occurring, omega-3 rich seeds (e.g., colza, flax, chia, perilla), low-fat cereals (e.g., wheat, rice), and genetically selected and/or modified omega-3 versions of naturally-occurring omega-6 rich grains (e.g., sunflower, corn, cotton, soy) to the extent that *(1)* modern intensive animal husbandry can be maintained on feed lipid patterns reminiscent to those of grass and greens and *(2)* the human diet can be maintained on Golden Game Standards similar to that of our Paleolithic ancestors. The end result could eventually be an unchanged food supply in terms of quantity, variety, and stability but with improved or more human-gene-compliant essential-fatty-acid, antioxidant-vitamin, and mineral patterns.

5. CHOLESTEROL IN THE COLUMBUS DIET

Dietary cholesterol, dietary saturated fats, and blood cholesterol have been hot issues over the last 40 to 50 yr and still are. Terms such as "bad" and "good" cholesterols are deeply imprinted in the subconscious of the general population. HCPs are used to describe the apparent atherogenicity of high- vs low-LDL-C:HDL-C ratios, respectively. Most if not all means associated with the human health regimen—nutritional, medical, environmental, spiritual—tested so far for the treatment and/or the prevention of cardiovascular disease have targeted the LDL-C:HDL-C ratio. As shown in Fig. 2,

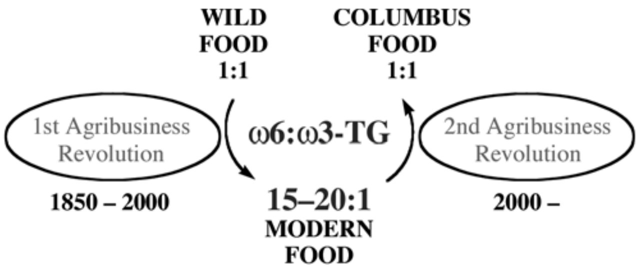

Fig. 1. The Columbus Concept and its vision.Wild food to Modern food to Columbus® food as led by the 1st and 2nd agribusiness revolutions respectively. Modern crop production and processing have supported, in terms of energy supply, an outgrowth of the world population, but they have concomitantly induced drastic changes in the essential dietary fatty acids and associated antioxidant supplies in the human diet. Besides its obvious blessing, one dramatic drawback of the paradigm shift in food supplies—from wild to modern—are the so-called modern degenerative diseases becoming ever more endemic in most developed and developing countries. Scientific, clinical, and epidemiological data support the view that this drawback is in large part induced by the moderate to high ω6:ω3-EFAs/TGs ratios in modern foods from plant and animal origins and therefore in human tissues. The Columbus Concept describes a second possible agribusiness revolution that sustains a return to wild-type food (ω6:ω3-EFAs/TGs = 1:1 ⇒ ω6/(ω6 + ω3)-HUFAs/TLs = 25%) based on modern, economically viable agribusiness standards.

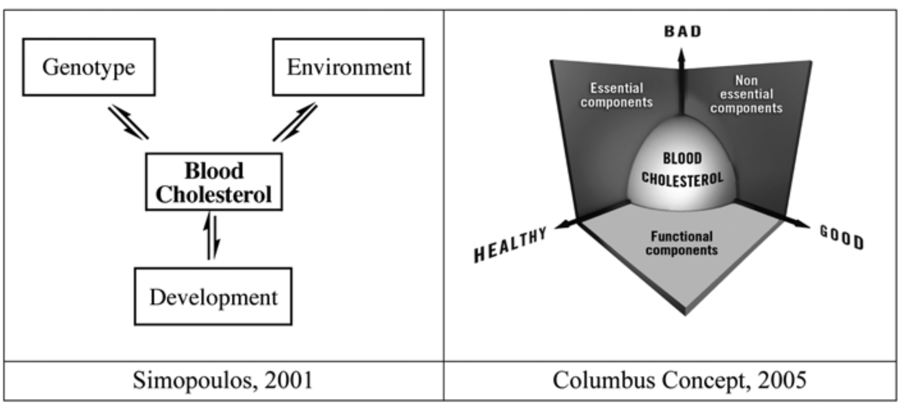

Fig. 2. The Columbus Concept and its 3D representation of blood lipoprotein behaviors. "Bad" LDL-C, "good" HDL-C, and "healthy" LDL-CC:HDL-CC ratios. Blood cholesterol depends on genetic factors, health regimen, and development. As any other phenotype-driven parameter, it varies with circumstances and age. As such, in no case can it be declared as an independent risk factor for cardiovascular or any other degenerative diseases. Actually, it can be a good thing provided it is associated with appropriate and balanced amounts of essential nutrients (fatty acids and antioxidants). The 3D representation of blood cholesterol in the Columbus Diet allows one to immediately identify the components (nonessential, functional, and essential) of the human regimen that may influence blood lipoprotein behavior in the vascular systems of the human body.

however, blood-cholesterol level (TC) and distribution (LDL:HDL ratio) are phenotype-driven and susceptible to various components of the human health regimen (i.e., nonessential, functional, and essential). Induced changes in blood-cholesterol-related parameters have in fact seldom rather than always shown positive results in the prevention and treatment of cardiovascular disease (*see* ref. *6*, for a thorough review and critique of past, major clinical and epidemiological studies on the controversial dogmatic subject, the multitude of misleading interpretations and myths created, and the consequent developments thereof). Also, some more recent large epidemiological studies have clearly demonstrated that blood cholesterol is not an independent risk factor in the development of cardiovascular disease and that high blood cholesterol might in fact be a marker for longevity in the elderly *(7,8)*. Within this framework of maintained confusion—itself seeded largely by the spread of misunderstanding and sometimes conflicting interests—the Columbus Concept works toward a truly scientific rehabilitation of the long-term health benefits of blood lipoprotein patterns associated with, or characterized by, appropriate and balanced amounts of essential dietary nutrients (essential fatty acids and antioxidant vitamins and minerals). Hereafter, this ideal individual blood lipoprotein pattern is referred to as LDL-CC:HDL-CC, where CC stands for Columbus Concept (i.e., the individual phenotype-driven LDL-C:HDL-C ratio associated with ideal wild-type, diet-sensitive, essential-fatty-acid and antioxidant patterns [*see* Fig.2]).

The introduction of this concept of LDL-CC:HDL-CC ratio is important because it automatically leads to a need for re-interpreting past clinical and epidemiological studies in terms of dietary compliance with RDIs for essential nutrients, including omega-3 fatty acids and antioxidant vitamins and minerals.

Compared with the traditional 2D representation of "bad" and "good" LDL-C:HDL-C ratios that globalizes the influence of all components of the human regimen, it is seen that the proposed 3D representation allows one to refine the analysis to the three classes of components: the nonessential nutrients that represent ±90% of the DEI, the functional components that do not substantially contribute to the DEI, and the essential nutrients that account for ±10% of the DEI. It then becomes clear that a supposedly good LDL-C:HDL-C ratio can be atherogenic if some essential components of the regimen are not present, and, vice versa, a supposedly bad LDL-C:HDL-C ratio can be nonatherogenic if all the necessary essential components of the regimen are present. In the same representation, functional components appear potentially beneficial to human health, especially in the case of bodily deficiencies and/or higher sudden requirements in essential nutrients. Functional components can be anything from dietary (e.g., phytochemicals, pre- and probiotics) to behavioral (e.g., sport, relaxation, resting, chronobioethics), environmental (e.g., altitude, electromagnetism, weather conditions), spiritual (e.g., mind, ethic, soul), and other kinds.

Epidemiological studies tend to show that the innovative healthy cholesterol or LDL-CC:HDL-CC avenue is a more promising healthcare investment on the long term because higher blood cholesterol now tends to be recognized as an indicator of longevity in the elderly.

But what are these new species, LDL-CC and HDL-CC?

6. DEFINITION OF LDL-CC:HDL-CC

Lands has demonstrated that CHD-mortality in various populations around the world accurately reflects their blood-relative concentrations of long-chain omega-6 fatty acids (%Omega-6 HUFAs in total HUFAs or (ω6/(ω6 + ω3))-HUFAs/TLs) (*see* Fig. 3).

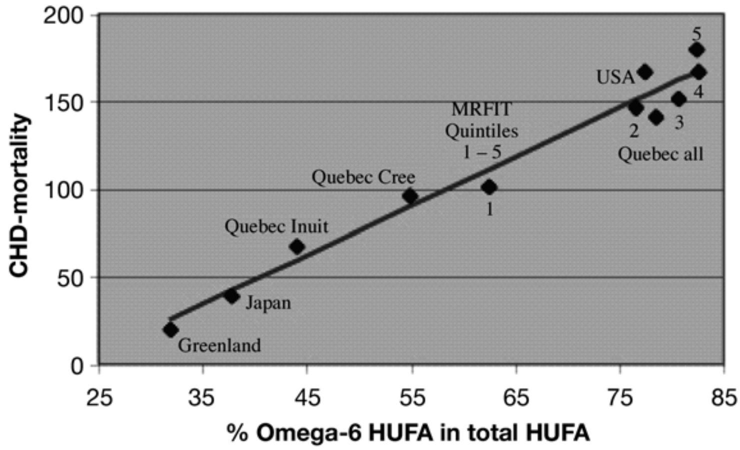

Fig. 3. Lands has demonstrated that there is an almost perfect correlation between the death toll per CHD (#/100,000/yr) in various populations around the world and their blood proportion of highly unsaturated omega-6 fatty acids relative to their blood-total concentration of highly unsaturated fatty acids (HUFAs): Greenlanders, Japanese, and Inuits have lower blood-relative concentrations of omega-6 HUFAs and present substantially lower rates of CHD-mortality than western populations characterized by high blood-relative concentrations of omega-6 HUFAs. The apparent absence of the influence of blood cholesterol on this (linear) relationship may result from the small (0–0.2%) contemplated scale of CHD-mortality recorded in a limited time period (1 yr.).

Linear extrapolation of the data shown in Fig. 3 leads to a 25% tissue-relative concentration of omega-6 HUFAs (as compared with 75–85% in western populations) as a blood-cholesterol-independent, immediate, potentially ideal protection against death from CHD, such as

$$\%\text{CHD Mortality} = 3 \times (\%\omega6/(\omega6 + \omega3)\text{-HUFAs/TLs} - 25)$$

The Lands diagram therefore tells us that the human tissue and therefore dietary essential-fatty-acid compositions quite accurately predict how likely humans will die from CHD. Clinical trials led in Britain, France, Italy, and India over the last 20 yr (1985–2002) have confirmed the wild-diet, cause-effect relationship—the reproducibility of the *immediate* health (cardiac) benefits related to the dietary intake of wild lipids (green-type ω3-EFA [ALA] and game-type ω3-HUFAs [EPA, DPA, DHA]) in high-risk patients (secondary prevention) traditionally fed omega-6-rich grain- and livestock-based modern, domesticated foods Table 2).

A meta-analysis of these clinical trials *(9)* has confirmed that a wild-type diet enriched in omega-3 fatty acids characteristic of greens and game does protect, complementarily and synergistically, against cardiovascular diseases to an extent where the risk of dying from a cardiovascular disease becomes a question of personal choice (*see* Fig. 4).

Based on such strong scientific evidence, we define LDL-CC and HDL-CC as the LDL-C and HDL-C species that coexist in a vascular environment defined by a blood total lipid composition that complies with the standard in the wild: ω6/(ω6 + ω3) – HUFAs/TLs = 25%.

Table 2
Results of Randomized Clinical Trials

Trial	*Length*	*No. of patients*	*Lipid source*	*Total death rate*	*Cardian death rate*	*Nonfatal cardiac events*
IHT	1 yr	500	GREENS (ω3-EFA)	–35%*	–45%**	–50%
LDHS	5 yr	605	GREENS (ω3-EFA)	–50%	–50%	–50%
DART	2 yr	2033	GAME (ω3-HUFAs)	–30%	–30%	–
GISSI	1 yr	11324	GAME (ω3-HUFAs)	–20%	–30%	–

Abbr: IHT: Indian Heart Trial *(10,11)*; LDHS: Lyon Diet Heart Study *(12,13)*; DART: The Diet and Reinfarction Trial *(14)*; GISSI: *(15,16)*.

Notes: *Borderline, non-significant; **Not provided, calculated by de Lorgeril.

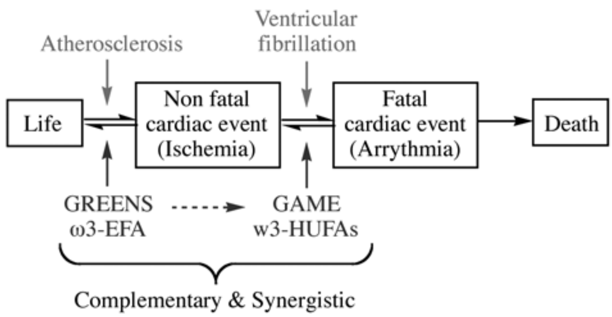

Fig. 4. Complementary and synergistic heart benefits of green-type (ALA) and game-type (EPA, DPA, DHA) fatty acids in the diet. Clinical trials tend to show that green-type fatty acid (ALA, C18:3 ω3) does reduce ischemic and arrhythmic events in secondary prevention, whereas long-chain, game-type fatty acids (EPA, C20:5 ω3; DPA, C22:5 ω3; DHA, C22:6 ω3) are more specific towards final-stage arrhythmia. Given that ALA and DHA can compete with LA and AA, on the one hand, and that both can be turned to EPA, on the other hand, one sees that green-type and game-type omega-3 fatty acids have complementary and synergistic health benefits within the human body, as reflected by the results of the clinical trials reported in Table 2.

7. AGRIBUSINESS STANDARDS UNDER THE COLUMBUS CONCEPT

Chloroplast-bearing grasses and greens are relatively low in fat (±1%), but proportionally rich in omega-3 fatty acids and antioxidants that protect them against sunshine irradiation. On the other hand, grains and cereals are energy-dense (e.g., rich in fats and/or carbohydrates) but proportionally poor in omega-3 fatty acids and antioxidants. Most grains and cereals are rich in omega-6 fatty acids. The Columbus Concept favors omega-3 rich seeds and grains, which when combined with low-fat cereals (wheat, rice) and natural antioxidants, provide composite animal feeds with fatty-acid patterns and oxidative stability similar to those of grasses and greens (Table 3).

Table 3
Omega-6:Omega-3 Ratio in Wild-Type Animal Feed and Leafy Vegetables

		MUFA	*PUFA*		
Vegetable plant	*SAFA*	*ω7 + ω9*	*ω6*	*ω3*	*ω6:ω3*
Cabbage, red	25	5	30	40	0.75
Columbus Feed	**12**	**18**	**25**	**45**	**0.58**
Parsley	18	3	26	54	0.48
Lettuce	18	3	17	44	0.38
Cabbage, white	18	8	15	58	0.26
Flax seeds	9	18	15	57	0.26
Cauliflower	22	15	13	50	0.26
Brussels sprouts	20	5	12	63	0.19
Spinach	12	3	8	52	0.16

Fatty acid composition of total lipid extracted from edible parts of the vegetable (i.e., roots, stems, leaves, flowers, as appropriate *[7]*).

Table 4
Antioxidants (A.O.) in Wild-Type Animal Feed and Leafy Vegetables

Antioxidants	*Derivatives*
Vitamin C	Ascorbic acid, esters, etc.
Vitamin E	Tocopherols, esters, etc.
Polyphenols	Catechins, antocyanins, etc.
S-containing A.O.	Glutathione, lipoic acid, etc.

Antioxidants present in green leafy vegetables are numerous (Table 4) and must be incorporated in one way or another into the feed ration of the domesticated animal when that feed composition is returned to its wild standard in terms of fatty acid distribution. In fact, the presence or absence of essential nutrients in animal feeds is almost always additional (i.e., the presence of appropriately balanced amounts of essential omega-6/3 fatty acids in an animal feed also requires that appropriate amounts of antioxidant vitamins and minerals be present in that feed if only for stability reasons). On the other hand, modern feeds rich in saturated and omega-6 fatty acids require far fewer antioxidant vitamins and minerals.

8. FOOD TECHNOLOGY STANDARDS UNDER THE COLUMBUS CONCEPT

8.1. Land-Based-Animal-Derived Foods

Because alpha-linolenic acid (C18:3ω3; ALA) is metabolized faster than linoleic acid (C18:2ω6; LA) in land-based animals, wild-type animal feed (ω6:ω3-EFAs/TGs = 0.55:1 ± 0.05) transform into animal body fat balanced (ω6:ω3-EFAs/TGs = 1:1 ± 0.1) in essential fatty acids and doing so, into balanced sources of wild-type dietary lipids in humans (Table 5).

Table 5
Body Fat and Meat/Yolk in Standard and Wild-Type Animals

	ω6:ω3-EFAs/TGs		*%ω6/(ω6 + ω3)-HUFAs/TLs*		*Variations (Δ) in HUFAs*	
	Standard	*Wild-type*	*Standard*	*Wild-type*	*Δω6-HUFAs*	*Δω3-HUFAs*
Egg	>10:1	1:1 ± 0.1	60%	25%	–67.0%	+42.0%
Broiler	>10:1	1:1 ± 0.1	75%	25%	–36.0%	+175%
Pork	>10:1	1:1 ± 0.1	70%	25%(*)	–66.5%	±0%

Note: Table 5 presents experimental results obtained in commercially run standard and wild-type husbandries for layers, broilers, and pork. Standard and wild-type animals are distinguished from each other in their fat-deposit ω6:ω3-EFAs/TGs ratios and meat/yolk ω6/(ω6 + ω3)-HUFAs/TLs proportions (%); standard animals exhibit the characteristic >10:1 omega-6 to omega-3 EFAs ratio and >60% omega-6 HUFAs in total meat/yolk HUFAs, whereas their wild-type correspondents show a balanced 1:1 omega-6 to omega-3 EFAs ratio and ±25% omega-6 HUFAs in total tissue HUFAs, respectively. (*) In pork, the 25% is reached only if ALA is included in the HUFAs/TLs.

As seen in Table 5, the return to a balanced ω6:ω3-EFAs/TGs ratio in wild-type-animal body fat is associated with substantial changes in the content of highly unsaturated fatty acids (HUFAs) in their meat: omega-6 HUFAs (mainly AA) are substantially reduced (35–70%), whereas omega-3 HUFAs (EPA, DPA, DHA) increase in various proportions according to the species (from 0% in pork to 42% in eggs and 175% in broilers). Generally speaking, wild-type, animal-derived foods distinguish themselves from omega-3 rich and/or enriched foods. They are better described through their sharply reduced content of proinflammatory omega-6 HUFAs and their substantially improved content of anti-inflammatory omega-3 fatty acids and antioxidants, therefore contributing to healthily balanced blood-cholesterol levels (LDL-CC:HDL-CC) in humans. As demonstrated in Table 5, ω6/(ω6 + ω3)-HUFAs/TLs = 25% in animal meat is reached when their body fat comply with the Golden Game Standard (i.e., ω6:ω3-EFAs/TGs = 1:1).

8.2. Land-Based, Plant-Derived Foods

Wild-type, plant-derived foods are based on the same principle as that erected for wild-type, animal-derived foods (i.e., a balanced ratio of essential fatty acids [ω6:ω3-EFAs/TGs = 1:1] in the bulk triglyceride fraction of consumer products [e.g., table oil, bread, rice]). The reasoning behind this principle is that most fats from plant origins in the modern diet had no equivalent in the Paleolithic era and that these "new" fats in modern, energy-dense foods must then comply with the composition of the major source of fats in the hunter-gatherer diet (i.e., wild-animal body fat).

Modern table oils are extremely diverse in terms of their ω6:ω3-EFAs/TGs ratios, and the most commonly used in the modern diet (sunflower, peanut, and corn oils) rank high to very high (50 to 500) in the ω6:ω3-EFAs/TGs scale (Table 6). Mediterranean olive oil has an incidentally better pattern thanks to its high content of oleic acid (C18:1ω9) and resulting low content of linoleic acid (C18:2ω6), but it does not represent an ideal choice in terms of essential fatty acid content as such. On the other hand, Columbus Oil, a composite, naturally stabilized oil made of olive oil, flaxseed oil, and

Table 6
Table Oils Currently Available on the Market and Columbus Oil

		MUFA	*PUFA*			*Total*	
Lipid source	*SAFA*	*ω7 + ω9*	*ω6*	*ω3*	*ω6:ω3*	*P:S*	*S+M+P*
Sunflower	13	27	61	0.1	610	4.7	101.1
Peanut	14	43	35	0.1	350	2.5	92.1
Grapeseed	14	21	68	0.5	136	4.9	103.5
Corn	16	32	51	1	51	3.2	100
Palm	51	40	9	0.25	36	0.2	100.25
Olive (1)	16	70	13	0.6	22	0.8	100.6
Coconut	92	7	1.5	0.1	15	0.02	100.6
Olive (2)	15	79	5	0.6	8	0.4	99.6
Wheat germ	20	18	55	7	8	3.1	100
Soybean	16	22	54	7.5	7	3.8	99.5
Walnut	11	15	62	12	5	6.7	100
Canola	7	63	20	10	2	4.3	100
Columbus	**14**	**72**	**7**	**7**	**1**	**1.0**	**100**
Chia	9.7	6.7	19	64	0.3	8.6	99.4
Flax	6.9	19.5	15	57.5	0.26	10.5	98.9
Perilla	8.5	14.4	12.6	63.2	0.20	8.9	98.7

Adapted with permission from ref. *17*; *www.eatchia.com.*

green-type antioxidants, exhibits an ideal balanced fat to essential-fatty-acid ratio (P:M:S = 1:6:1 and ω6:ω3 = 1:1) for human daily consumption in partial or total substitution to animal fats.

Wheat bread and rice are two other food staples consumed in large quantities around the globe as a source of energy (carbohydrates). Their fat content is low (±1%), and their ω6:ω3-EFAs/TGs ratio is 10 to 20 times higher than ideal, making them excellent choices for rebalancing the average diet. A mixture of wheat-germ flour and rice with small amounts of flax, chia, and perilla seeds provides an easy model for designing land-based, wild-type, plant-derived food staples.

9. HEALTH PROMOTION AND DISEASE PREVENTION

When positioned on Lands' diagram, it becomes obvious that Columbus land-based, wild-type animal foods have similar patterns of blood HUFAs to humans suffering less from coronary heart disease (CHD); in contrast, modern animal foods share similar compositions to the blood of humans suffering the most from CHD (*see* Fig. 5).

Because wild-type foods simply fit Lands' diagram so nicely, determining dietary recommended intakes for essential fatty acids becomes an almost superfluous task. In fact, dietary essential fatty acids need just to be present in sufficient quantities and balanced to secure the 25% ratio of omega-6 HUFAs to total HUFAs in human blood and therefore maximum protection against heart diseases and probably against most modern degenerative diseases. How much of the green-type and game-type lipids

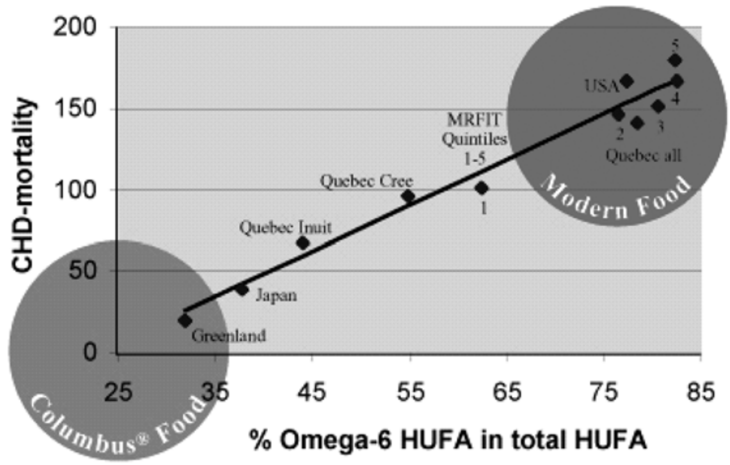

Fig. 5. Columbus and modern standard animal foods in lands' diagram. Shown is a Lands' diagram where %ω6/(ω6 + ω3)-HUFAs/TLs data from Table 5 for Columbus wild-type and Modern animal-derived foods are positioned according to the *x*-axis representing proportions of omega-6 HUFAs in total HUFAs in the different populations studied by Lands.

Table 7
Adequate Intakes for Essential and Conditionally-Essential Fatty Acids in Humans *(Vitamin-F)*

Fatty acid	*Infant (1)*	*Adult (2)*	*Pregnant (2)*
ω-6			
LA	600	4400	4400
AA	40	–	–
ω-3			
ALA	50	2200	2200
EPA	–	220	220
DHA	20	220	300

Note: Figures expressed in mg/2000-Cal diet, except for infants where numbers are given per kg body weight (BW) or per 150-mL (100-Cal) term infant formula. Adapted with permission from refs. *18* and *19*.

Abbr: LA: linoleic acid; ALA: alpha-linolenic acid; AA: arachidonic acid; EPA: eicosapentaenoic acid; DHA: docosahexaenoic acid.

should one eat every day to minimize the risk of heart disease is a question that was addressed in 1999 by an international expert committee, whereupon recommended daily intakes in close compliance with the wild-diet hypothesis were agreed upon and published (Table 7) *(19)*.

As seen, there seems to be an optimum ratio (5:1) of intake of green-type fatty acids (ALA: 2200 mg/d) and game-type fatty acids (EPA + DHA: 440 mg/d[1]) to be considered

[1]Based on an average 10%-conversion factor from ALA to EPA + DHA *(20)*, it is recommended to increase the daily intake of the latter to 660-mg when ALA is not sufficiently present in the diet and/or when the ω6:ω3 ratio of EFAs in the diet substantially deviates from unity.

Table 8
Nutrients and Non-nutrients, and Their Potential Influence on Diet/Health-Disease Relationships

	Nutrients		*Non-Nutrients*	
Type	*Essential nutrients*	*Nonessential nutrients*	*Functional components*	*Nonfunctional components*
Nature	EAAs, EFAs vitamins, minerals	AAs, MUFAs carbohydrates SFAs, cholesterol	non- or poorly-absorbed active food ingredients, physical, social and spiritual activities.	Residues, additives, contaminants stress, depression, sedentarism
Exchangeable	No	Yes	–	–
Contribution to DEI	±10%	±90%	Negligible	Negligible
Causal factors in diet/health disease relationships	Primary or independent	Secondary or nonindependent	Direct or indirect	Direct or indirect

Note: Essential nutrients are those that the body cannot synthesize or exchange; therefore, they must be found in the diet in appropriate amounts and proportions. When this is not the case, these nutrients become primary or independent risk factors in diet/health-disease relationships. Nonessential nutrients, on the other hand, represent the bulk of the diet and the diverse sources of energy. Cholesterol and saturated fats belong to this category. When ingested in excessive amounts, nonessential nutrients lead to obesity and its comorbidities and eventually show up as secondary or non-independent causal factors in diet/health-disease relationships. Non-nutrients can have positive/negative influences on regimen/health-disease relationships. They do not contribute substantially to the DEI.

Abbr: EAA: essential amino-acid; AA: non-essential amino-acid; EFA: essential fatty acid; SFA: saturated fatty acid; MUFA: monounsaturated fatty acid.

as maximum protection against heart diseases. On the other hand, vegetarians and more specifically vegans should be recommended to balance their LA and ALA intakes to 4400 mg/d because they do not have direct access to the long-chain fatty acids EPA and DHA. Basically, the 1999 Expert Committee expresses the wild-diet hypothesis developed under the brand Columbus.

10. THE HIDDEN EVIDENCE

The wild-diet hypothesis does not include the former cholesterol-based diet-heart hypothesis or, in fact, it does, but from the more logical standpoint that cholesterol, just as saturated fatty acids, is not essential to humans and, therefore, cannot represent an independent risk factor in ill-health diseases (Table 8).

11. DIETARY CHOLESTEROL AND CVD

Ravnskov has written an entire book on "The Myth of Cholesterol" that shed some interesting light on how a scientific hypothesis has been transformed into public dogma, a story reminiscent to that experienced by Einstein with his Theory of Relativity.

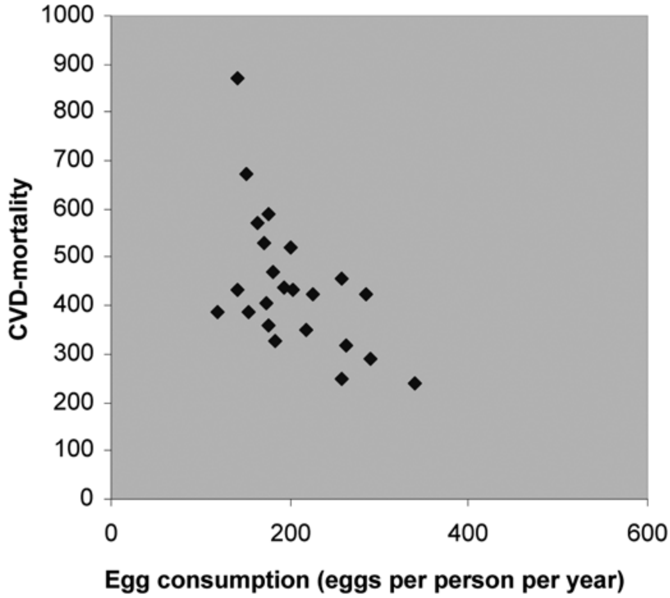

Fig. 6. CVD-mortality and egg consumption in 24 industrialized countries. The graph displays the mortality index in 24 industrialized countries, expressed as the frequency (#/100,000 inhabitants/yr) of fatal coronary outcomes (CVD-mortality) in the man-population of 35 to 74 yr of age as a function of the average annual egg consumption (eggs per person per year) in these countries.

However, and in contrast to Einstein's theory, the cholesterol-based, diet-heart hypothesis has not found confirmation, no matter how many human resources and financial means have been invested in clinical trials over the last 20 yr. At the same time, epidemiological data have provided ample information and confirmation that the hypothesis is wrong and have also suggested that reducing egg, milk, and meat consumption and blood cholesterol could be detrimental to human health.

12. DIETARY CHOLESTEROL AND CVD

Epidemiological data suggest that countries where egg consumption is the highest are those where the risk of fatal cardiovascular diseases is the lowest *(21)* (*see* Fig. 6).

It is interesting to note that the three countries (France, Mexico, Japan) where CVD-mortality and egg consumption are at the lower and higher ends, respectively, are those where omega-3 fatty acids (fish and greens) and antioxidant vitamins and minerals (vegetables, spices, wine) are omnipresent in the daily diet.

13. BLOOD CHOLESTEROL AND CHD

The former diet-heart relationship is strongly supported by the "7-country" study (*see* Fig. 7) *(22)*, which was once presented as the most solid epidemiological evidence that blood cholesterol was one of, if not the major culprit associated with CHD in humans. In fact, it appears from new insights in the published data based on Lands' observations (*see* Fig. 3) that the population absolute CHD mortality rate (ordinate) and the individual relative risk (slope) of CHD within each population differed substantially

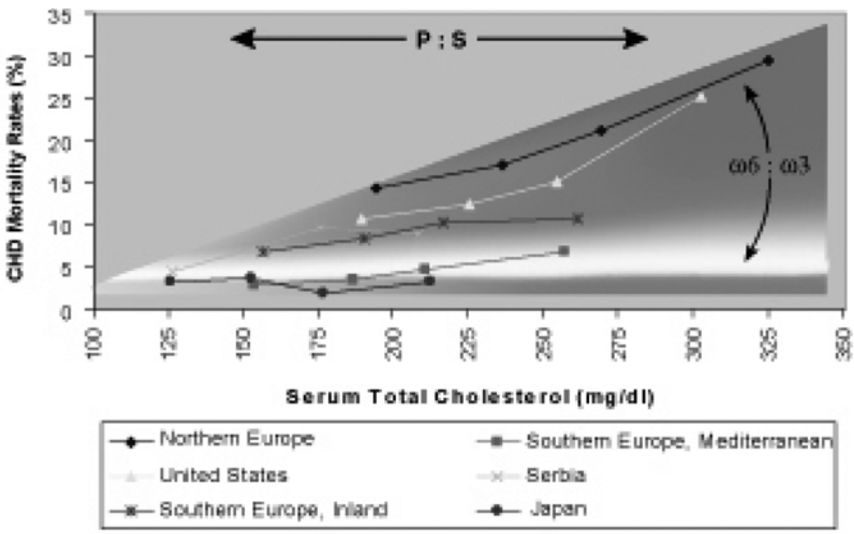

Fig. 7. The 7-country study. The graph displays the 25-yr coronary heart disease (CHD) mortality rates per baseline serum cholesterol quartile, adjusted for age, cigarette smoking, and systolic blood pressure, in 16 ethnic groups of 7 industrialized countries (5 European countries, the United States, and Japan). Observe that the large ordinate scale (0–35% CHD), reflecting the long timeframe (25 yr) of the study, reveals an impact of blood cholesterol not seen in the shorter timeframe clinical and epidemiological studies reported by Lands (*see* Fig. 4). Reprinted with permission from ref. *12*.

among cultures, and that those (Northern Europe, United States) suspected to be maintained at the time period of the study (1st part of 2nd half of the 20th century) on dietary patterns high (between 20:1 and 10:1) in ω6:ω3 ratios exhibited much higher absolute rates and relative risks of CHD than populations (Southern Europe, Mediterranean, Japan) that were supposed to naturally benefit from dietary patterns moderate or low (5 to 1:1) in ω6:ω3 ratios.

From this new angle, neither dietary saturated fats nor blood cholesterol appear as independent risk factors for CHD in the 25-yr follow-up study. Instead, the multiethnic absolute rates and relative risks of CHD seem to accurately respond to a single mathematical equation derived from Lands' diagram, such as:

% CHD-Mortality @ 25-yr =

$$\underbrace{2.5 + (TC - 100) \times TAN}_{\text{Bood cholesterol (Vershueren)}} \times \underbrace{(\omega6/(\omega6+\omega3) - HUFAs/TLs - 0.25)}_{\text{Bood proportion of omega–6 HUFAs (Lands)}}$$

Risk factor	Secondary	Primary

The "7-Country Study" demonstrates how the peripheral tissue (or total blood lipids) %ω6/(ω6 + ω3)-HUFAs/TLs precipitates death by CHD as the only independent or

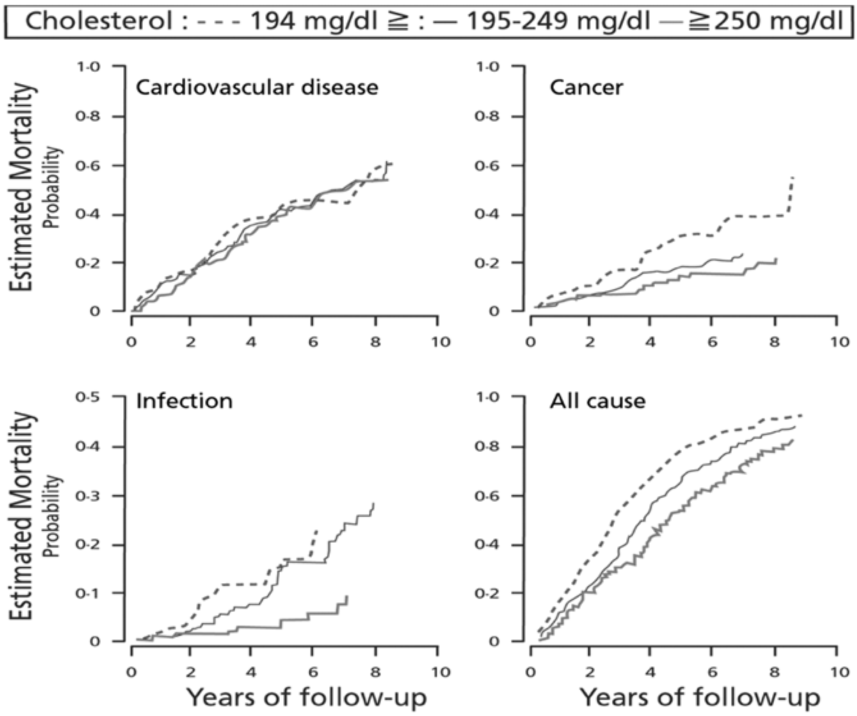

Fig. 8. Cholesterol levels and mortality rates in the elderly Oldest olds (over 85 yr old) followed for 10 yr in the Netherlands *(7)*. Among them, no significant correlation was found between serum-cholesterol level and CHD mortality. Instead, both cancer mortality and mortality from infectious diseases were higher when serum cholesterol was lower, and all causes of mortality were negatively correlated with serum-cholesterol levels. A similar conclusion was reached when people older then 70 yr were followed for 10 years in the USA *(8)*.

primary risk factor. This study, when reanalyzed from the essential fatty acid perspective, clearly shows that blood cholesterol is a non-independent secondary risk factor in the diet-heart hypothesis, because CHD is a low value constant (±2.5) at all TC values once blood ω6/(ω6 + ω3)-HUFAs/TLs is equal to 25%, whereas it seems to indeed worsen the body's response to challenges in essential fatty-acid-supplies, as perhaps also to other essential nutrients (trace elements, minerals, vitamins) when blood ω6/(ω6 + ω3)-HUFAs/TLs deviates from 25% or when dietary ω6:ω3 ratio deviates from 1:1, the Golden Game Standards in the Paleolithic diet.

14. BLOOD CHOLESTEROL AND LONGEVITY

It is generally observed that blood cholesterol increases with age for reasons that we still do not exactly know except that the response seems to be related to physiological changes associated with aging. In those who survive adulthood, epidemiological studies tend to conclude that a high blood-cholesterol level does promote longevity through improving body's defense against infections and cancers, with no influence whatsoever on risk of cardiovascular diseases, as expected from the wild-diet hypothesis (*see* Fig. 8).