ISSN: 2475-6296

Research Article

Journal of Clinical & Experimental Immunology

Relationship Between Lifestyle in Relation to Food Quality, Food Quantity and Exercise Versus Estimated Risk Probabilities of Having 5 Metabolic Disorder Diseases Using 8 Pathologies of Metabolic Syndrome's Intra-Cellular Pathways and Collected Data Over 6.5 Years Based on GH-Method: Math-Physical Medicine (No. 497)

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Submitted: 17 Nov 2021; **Accepted**: 22 Nov 2021; **Published**: 29 Nov 2021

Citation: *Gerald C Hsu (2021) Relationship Between Lifestyle in Relation to Food Quality, Food Quantity and Exercise Versus Estimated Risk Probabilities of Having 5 Metabolic Disorder Diseases Using 8 Pathologies of Metabolic Syndrome's Intra-Cellular Pathways and Collected Data Over 6.5 Years Based on GH-Method: Math-Physical Medicine (No. 497). J Clin Exp Immunol, 6(6): 373-382.*

Abstract

The author was a professionally trained mathematician, physicist and engineer. His view of health and medicine is similar to his past experience on designing a physical object such as a building structure or a working machine, which he calls an "object". The object's strength or its expected lifespan is similar to the health conditions and longevity of a human being based on the following three key factors:

(1) The original strength of the object's material which is similar to the genetic factors of a human body. Generally speaking, the genetic (not "epigenetic") portion only contributes 15% to 30%, approximately 20% or less, of having various chronic diseases.

(2) The quality of engineering design and construction or manufacturing of this object are similar to the fundamental influential causes, including lifestyle details, life-long bad habits, and environmental damaging factors on human health. Among the external causes, one category that has the most impact on health is food, particularly with processed foods causing the most damage. Therefore, he tries to exclude all kinds of processed foods from his own food category.

(3) The object suffers from different operational problems due to external forces or impacts which are similar to various diseases affecting humans. After the object suffers from external forces or impacts such as an earthquake or hurricane, we must use some structural reinforcements to fix the problems or replace the malfunctioned parts of the machine. These engineering after-actions are similar to the medical "treatments" post-injury/infection provided to patients by doctors. The medical treatments include medication interventions (either oral drugs or biochemical injections), necessary surgeries or organ transplants, which are similar to the engineering repair of the damaged object. Nevertheless, all type of medical treatments bring some degree of traumatic effects on the human body. In addition, up to now, there are no medications which can cure chronic diseases induced by metabolic disorders. The different medications given to patients only suppress the symptoms of different chronic diseases and do not deal with the root causes. Therefore, they are not able to reverse, repair, or cure chronic diseases.

In this article, the author intends to address the inter-relationship of 5 selected diseases: cancers, cardiovascular diseases (CVD), chronic kidney diseases (CKD), diabetic retinopathy (DR), and type 2 diabetes (T2D), where the main root cause of chronic diseases is food. This food category in his study contains 25 defined elements. The input data of food are collected via his developed iPhone APP on a daily basis. There are 5 elements designed for the "Food Quantity" such as the amounts for breakfast, lunch, dinner, between-meals snacks and fruits, and average daily food consumption***. It should be noted that his food quantity is not measured by calories rather he utilizes a visual check of the totally consumed amount in his plate during a meal.*** In addition, there are 20 selected elements for "Food Quality" (see Figure 1). In summary, his food quality follows these basic guidelines, ***i.e., low-carbs/sugar from real food only and not from refined carbs/sugar in processed food, high fiber, low-fat, no red-meat (white meat only such as fish and chicken), low-sodium, high-quality proteins (egg, tofu, and cheese), a variety of fresh vegetables, and nuts, olive oil, not-too-sweet fresh fruits (e.g., berries), practice Mediterranean diet style, and avoiding any processed food.*** The combined Food score is the average value of both food quantity score and food quality score.

In the US, there were ~2.85 million deaths occurred in 2019. There were 10% of total deaths caused by infectious diseases (2020 & 2021 will have a higher grade due to the COVID epidemic), while another 12% involved accidents, injuries or suicide. The remaining 78% of deaths are due to various diseases associated with internal organs, particularly cancers (~29%). However, among the 78% disease deaths, there was about 10% of deaths related to malpractice of medical treatments - "195,000 (~7%) patients die in hospitals each year because of preventable medical mistakes", from the national trial law, medical malpractice statistics, Dr. George Stanislaw, 2019".

Generally speaking, genetic factors only contributes about 20% or less (10%-30%) to various chronic diseases, while lifestyle and metabolism cause ~80% of disease deaths of the 71% (78%-7%) chronic disease complications and cancers. The following simple arithmetic calculation can draw a conclusive fact that ***about 56% (0.8*0.71) of ~1.6 million deaths caused by chronic diseases and their induced complications which are preventable through lifestyle management and overall metabolism improvements. Even if after having some metabolic disorder induced complications, at least we still can apply the same prevention methods to control them from getting worse at each life-threatening stage.***

This article investigates the inter-relationship between food and five selected complications from chronic diseases. It uses the author's collected data of his own food consumption and exercise with his calculated risk probabilities of having CVD, CKD, DR, cancers, and T2D, over a period of 6.5 years from 1/1/2015 to 8/11/2021. In this study, he also separates diabetes from the other four severe complications by investigating the roles played by both carbs/sugar intake amount and post-meal walking steps on his weight, PPG, eAG, and A1C.

Furthermore, he intends to use his collected personal data (~1 million data) during the past 6.5 years and his math-physical medicine methodology to prove some excellent descriptions and conclusions regarding the ***8 intra-cellular pathological process & pathways cited from Chapter 7, Reference 1, by Dr. Robert H. Lustig.*** Essentially, he uses his own big data analytics and learned academic disciplines, i.e., mathematics, physics, and engineering, to prove the excellent biomedical descriptions using cell-biology and chemistry by Dr. Lustig.

In summary, since 2015, the author has maintained a strict diet pattern which contains ***low-carbs/sugar from real food only and not from refined carbs/sugar in processed food, high fiber, low-fat, no red-meat (white meat only such as fish and chicken), low-sodium, high-quality proteins (egg, tofu, and cheese), a variety of fresh vegetables, and nuts, olive oil, not-too-sweet fresh fruits (e.g. berries), practice Mediterranean diet style, and avoiding any processed food.***

Giving the fact of maintaining his excellent food quality scores resulted from his careful diet (from 55% in 2015 to 50% in 2021 with an average score of 52%), ***both his food quantity score and total food score (quantity plus quality) have shown very strong correlations (i.e. inter-relationships, not necessarily causes vs. results) in the range of 68% to 95% with 4 selected complications, CVD, CKD, DR, and cancers (with average scores of 79% from total food and 87% from food quantity). However, the selected single element of carbs/sugar amount does not have a strong correlation (36% to 58% with an average 49%) with these 5 diseases***. The second analysis between carbs/sugar plus post-meal walking steps, i.e., carbs+steps, and the 5 diseases has shown that ***the combined score of carbs/sugar plus exercise demonstrated very high correlations (68%-90% with an average 79%) with diabetes.***

The exercise contribution is 30% which comes from the correlation difference between carbs only and carbs+steps. It also provides a 62% ratio of steps/carbs. In comparison, the 8 intra-cellular pathologies have 8 pathways related to food and only 5 pathways related to exercise. Therefore, it provides a 63% ratio of exercise/food. Although this analysis style and results comparison are rough, not precise enough, but they still provide a reasonable pattern of examination by the two different approaches (math-physical medicine vs. biochemical medicine) regarding the roles played by food and exercise in chronic diseases and their complications.

A long and healthy life is a desirable goal for everyone. Cancers, CVD, and CKD are deadly diseases while DR could cause blindness. Lifestyle management (particular food management) is crucial for achieving these health and longevity goals. This article depicts the strong influence on risk probability of having cancers, CVD, CKD, DR, and even T2D control (combining with exercise). In addition, the author strongly agrees with ***the excellent viewpoints by Dr. Lustig: (1) chronic diseases are not "druggable", but they are "foodable"; (2) medication can't cure chronic diseases, but nutrition can; (3) process food isn't just toxic, it's addictive; and we should avoid consuming all kinds of processed food.***

Introduction

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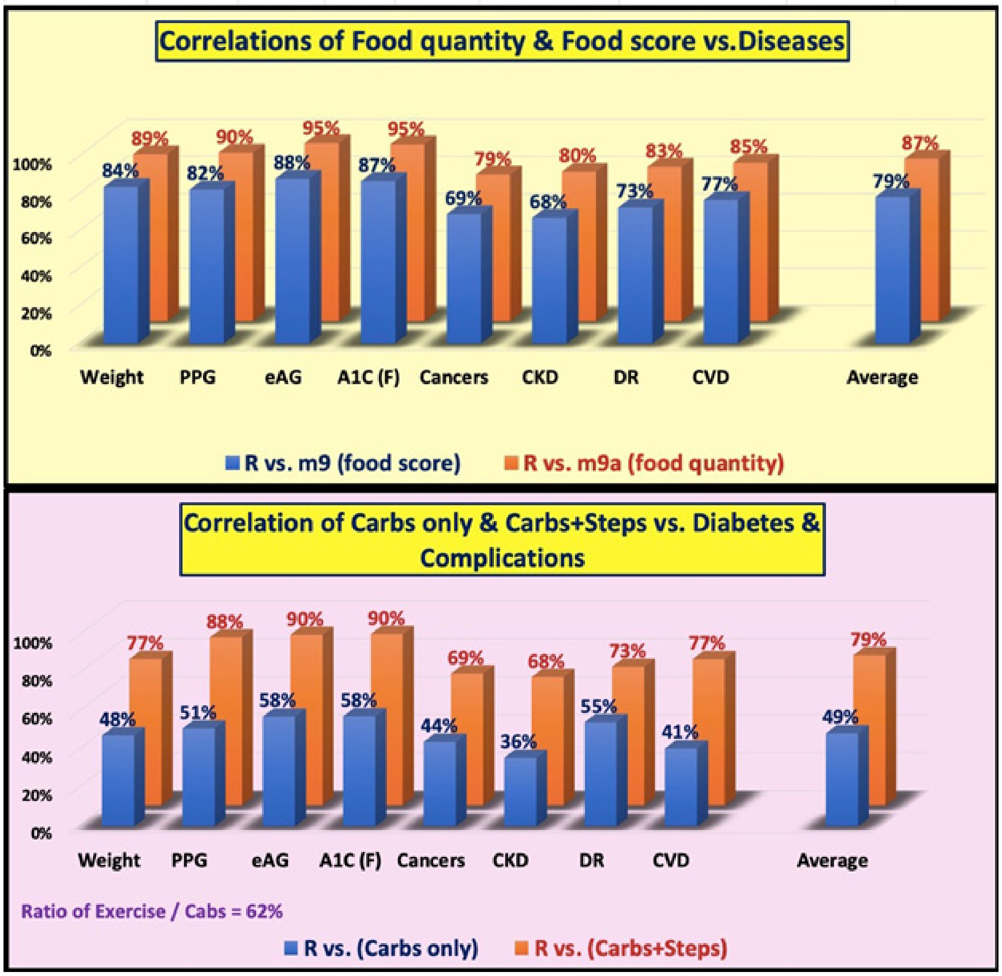

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Methods

Research method in this article:

The author described how to apply his engineering science background, including mathematics, physics, and computer science to conduct his medical research on the subject of "risk probability of having cancers, CVD, CKD, DR". He has reviewed his own past 6.5-years record of collected medical conditions and lifestyle details.

As a part of his medical research, he applied his acquired mechanical and structural engineering knowledge to develop several biomedical models to research four chronic diseases (overweight/obesity, type 2 diabetes, hypertension, hyperlipidemia) and their complications. They include cardiac vascular disease (CVD), coronary heart disease (CHD), stroke, chronic kidney disease (CKD), diabetic retinopathy (DR), pancreatic beta cells impairment, and even risk probabilities of having cancer or dementia in order to estimate the impact on human lives.

The engineering analogy of deaths caused by disease and human expected lifespan can be explained simply by using an example of a new machine or a new bridge. If we develop a monitoring system to continuously measure, record, and analyze the external forces, material strength and damages of material of a machine or a bridge, as well as the relationship between force/stress (causes of disease such as lifestyle details) and deformation/strain (symptoms of disease such as medical conditions), we can then have a clear idea how severe the damages are and how long this machine or bridge will last which is their useful life or expected lifespan.

The author self-studied chronic diseases, metabolism, and food nutrition for 4-years from 2010 to 2013. He started his medical research work by building a mathematical metabolism model in 2014. He named his research methodology as the "GH-method: math-physical medicine (MPM approach)".

Over the past 11 years of his MPM research, he has learned that the most important factor is knowing how to apply physics principles and engineering modeling techniques to various biomedical problems. This is different from inserting your biomedical data into some existing mathematical equations extended from physical theories and engineering models. The reason for doing this is that the original mathematical equations associated with the inventors' theories or models usually go along with their original boundary conditions. This may or may not perfectly fit with your biomedical situations directly; therefore, you must understand the scope and applicability of these physical theories and engineering models first, and then find a suitable way to apply them. In other words, by learning other people's wisdom first and then find a way to apply their wisdom to your own biomedical problem is the most practical way to solve these biomedical issues.

The author's numerical calculation of diseases risk for a patient is based on his knowledge and applications of physics law/concept and engineering modeling, big data analytics, and developed mathematical metabolism model. It has depicted a possible way to extend lowering the risk probability of having diseases via an effective metabolic condition improvement and lifestyle maintenance program. This practical method has already been applied and proven effectively in his own case in controlling T2D and its various complications without taking medications over the past 6 years since 12/8/2015.

The author hopes that this method can also be easily applied to other patients who face the risks of having certain metabolic disorder induced chronic diseases.

GH-Method: math-physical medicine:

Topology is a relatively newer branch of mathematics which was created around 1900. It studies key properties of "spaces", such as metabolism of the human body space, which are invariant under any continuous deformation happened during the lifespan. A few key properties or characteristics are not going to change as long as the space itself is not encountering a "breaking" situation, such as operational discontinuity of organs or death (death is a total "breaking" case). Topology optimization is a mathematical method that optimizes material layout within a given design space, for a given set of loads/forces, boundary conditions and constraints with the goal of maximizing the performance of the system. As a matter of fact, topology optimization has been applied by some engineers on obtaining the best layout design and best expected performance of some automotive components. When we look at human organs and try to determine how to achieve certain predetermined health goals, we recognize that the human metabolism is also a related subject of the "topology optimization". This problem can be solved by using some available mathematical programming method in combination with finite element engineering modeling method from both structural and mechanical engineering disciplines to conduct the targeted analysis in order to obtain an optimized human organ performance or predict certain human organ's biochemical response.

Based on the above-mentioned learned academic knowledge and acquired professional experience, the author spent the entire year of 2014 to develop a mathematical metabolism model. This human metabolism model consists of a total of 10 categories, including 4-categories of disease conditions (body outputs, like deformation/strain) and 6-categories of lifestyle details (body inputs, like force/stress). Similar to an engineering finite element model, these 10 categories further consist of around 500 detailed elements. Finally, utilizing complicated mathematical derivations and multiple programming techniques, including artificial intelligence, he was able to proceed his topological response analysis and obtained his 14-page long equation sheets which was then used in 2014 for his expanded software programming work. This application software development task is a rather sophisticated job that obtains an approximated estimation of human metabolism situation.

In mid-2021, he pictured a physical analogy of this mathematical metabolism model in his mind. It is similar to "using a finite numbers of nails that are encircled by millions rubber bands" on a piece of wood plate. At first, we hammer 10 nails with 36 degree of angle each into a piece of flat wood with an initial shape of a circle with a center in the middle of the circle, then take 3,628,800 (=10!) rubber bands to encircle all of these 10 nails, starting with 2 nails, and then 2+ nails, and finally enclosing all of these 10 nails. These ~3.63 million rubber bands represent the maximum possible relationships existing among these 10 nails (a "big relationship" problem). In other words, a small number of data elements of 10 would create a huge number and rather complex relationships to connect these small amount of only 10 data elements. Some rubber bands encircle 2 nails, or 3 nails, and so on, until the last rubber band encircles all of the 10 nails together (no rubber band to encircle a single nail is allowed). Now, if we move any one of the nails outward (i.e., moving away from the center of the nail circle), then this moving action would create some internal tension (or stretch force) inside the encircled rubber band. Moving one particular nail "outward" means one of these ten metabolism categories is becoming "unhealthy" which would cause some internal stress to our body. Of course, we can also move some or all of these 10 nails outward at the same time, and with different moving scale for each nail. If we can measure and calculate the summation of all of these internal tensions which are created inside of the affected rubber bands, then this summarized tension force is equivalent to the total metabolism value of human health. The higher tension means the higher metabolism value which creates an unhealthy situation. The author uses the above-described physical scenario of moving nails and estimating tensions inside of their encircled rubber bands to explain his developed model of mathematical metabolism for human health. Although the computer can handle this huge amount of numerical calculations, but he still had to develop certain approximation methods in order to simplify his burden of developing a set of highly accurate but very complicated mathematical equations.

At first, he developed a medical software APP on his iPhone in 2011, then began collecting his own health data of weight and glucose since 1/1/2012. After that, he started a category by category to enter his other medical conditions such as blood pressure, lipids, and others along with the detailed lifestyle data from 2013 to 2014. By now 8/7/2021, he has already collected more than 2 million data regarding his own body health and lifestyle details. Finally, by the end of 2014, he compiled all of his available big data together and expressed them in terms of two newly defined dynamic biomedical terms: the ***metabolism index (MI),*** similar to the combined tension force inside all of those 3.63 million rubber bands, which is a combined daily score to show the body health situation, and ***general health status unit (GHSU), which is the 90-days moving average number to show the health trend.*** He has also identified a ***"break-even line or point" at 0.735 or 73.5%*** to separate his metabolic conditions between the healthy state (below 0.735) and unhealthy state (above 0.735).

With his collected 2+ million big data, he focused initially on weight and glucose to conduct further analysis in order to put his severe type 2 diabetes (HbA1C above 10%) under control. This was his top priority. Like engineers looking at a project's dynamic structural design data or cardiologists reviewing a patient's EKG chart, he adopted the traditional time-series analysis approach. He then quickly realized that he could easily obtain a different conclusion dependent upon the selected data size and selected time window of his data.

As the author studied the history of medicine one day, he found an interesting story about how Dr. John Snow from the UK discovered the cholera outbreak, which spread in the Broad Street area of London in 1854. He decided to adopt this similar concept of spatial analysis, from statistics as an additional tool to analyze his big and complicated medical data. A good example of his spatial analysis applications is the close relationship between the morning's body weight and morning's fasting glucose which can be identified easily through a visual check and confirmed precisely by mathematics. If he uses a spatial analysis approach and analyzed all data he collected within the entire long period of time span, he could easily see a bigger picture such as the data's relationship and data moving trend. Sometimes, the conclusion derived from a global view using spatial analysis might not be consistent with certain local views using time series analysis from a shorter time period. Spatial analysis is a powerful tool that offers a clear view of the relationship and data moving trend with a big enough data size.

He also applied Fourier transform to convert a time domain dataset into a frequency domain dataset. This is to calculate and compare associated energy between high frequency but with lower amplitude glucose components versus low frequency but with higher amplitude glucose components. The energy theory from mechanical engineering is frequently utilized by him to calculate different degrees of energy on the internal organs carried by different glucose components. He also applied the frequency domain analysis to discover the damage on human organs due to different input waves such as a glucose wave or a heartbeat wave. ***Actually, everything in this universe can be expressed through a wave format and apply wave theory to explore its secrets***. This is how he connected the energy theory application of mechanical engineering with the wave theory application of electronics engineering. After all, both of them are part of physics.

At times, he also applied signal processing techniques from wave theory (electronic engineering, radio-wave communication, and geophysics) to decompose a glucose waveform into many component-based sub-waveforms in order to study the impact on glucose by different contribution components such as food, exercise, etc. For example, he has successfully decoupled a PPG wave into 19 sub-wave components.

One day in early 2020, he suddenly realized that Albert Einstein invented quantum mechanics and theory of relativity to figure out the complex relationship among planets in the universe which is "outer space". Inside the human body, there is an "inner space" which contains many inter-connected organs. It is similar to the many mutually-influenced planets in outer space. The complexity of human organs and diseases are very similar to the complexity of the planets in the universe. The author then decided to apply the perturbation theory (single variable with first-order to third-order polynomials only) of quantum mechanics to predict an approximate postprandial glucose (PPG) waveform before the patients eat their meals. He also applied the perturbation theory's approximation method on his risk assessment of having CVD, CHD, CKD, stroke, DR, cancers, and expected health age of longevity. Remarkably, all of his analyses to date have achieved 95% (single factor with first-order) to 99% (single factor with third-order) of prediction accuracy.

The author has suffered many complications resulting from his obesity, diabetes, hypertension, and hyperlipidemia, including five cardiac episodes, critical kidney condition, bladder infection, diabetic foot ulcer, retinopathy, neuropathy, hypothyroidism, diabetic constipation, diabetic fungal infection, and more. By using metabolism index as the foundation of his analysis, he is able to extend his research into many different but inter-related medical branches as long as the diseases share some or many overlapping root-causes. In his extended risk study of disease complications, genetic factors, and certain environmental influences were also included in his mathematical modeling.

In some of published medical papers regarding the study of identifying direct relationships among diseases, some phrases used frequently by some medical research scientists such as, *"lacking epidemiological evidence, having incomplete biological links, or facing unclear pathophysiologies underlying of the association between disease A and disease B, etc."*.

Consequently, the author began to contemplate the meaning of this subject of medical diseases deeper by using his physics and engineering background. For example, various cancers (Disease A) and diabetes (Disease B) have their own separated root-causes, but the majority of the two families of disease causes are overlapping with each other. In order to identify the direct relationship between diabetes and cancers based on symptoms only is far more difficult or even obtain a fussy or blurry view of results. However, it may be easier to start with delving into their overlapping causes, e.g., lifestyle, genetics, life-long bad habits, or environmental factors, and the overall metabolism. This approach would end with a clearer view of the results.

This situation can be illustrated using the author's engineering and physics background. For example, a steel structure can undergo three types of external forces, one-dimensional (1D: tensile/compression), two-dimensional (2D: shear), or three-dimensional (3D: bulk pressure). The 1D tensile stress (stretching force) and strain (longitudinal stretched deformation) are dependent on the Young's modules; the 2D shear stress (shear force) and strain (shear deformation) are reliant on the shear modules; and the 3D stress and strain are contingent on the bulk modulus. However, these 3 Modulus of the steel material are actually part of the same steel material properties which are similar to our body health and organ strength. Let us take 1D and 2D cases to demonstrate the similar relationship between cancer and diabetes. If the Young's modules is equivalent to the cancers relationship between their causes and symptoms, and shear modules is similar to the diabetes relationship between its causes and symptoms, then both diseases (symptoms or deformations) are directly related to the actual causes or forces which are further dependent on the material properties of the subject (steel or human body). The engineering material (or human body material) contains Young's modules and shear modules that are similar to human body as being under the influences of common causes of diseases such as genetics, life habits, lifestyle details, environmental factors, medical conditions, and overall metabolism. Therefore, we need to start with the understanding of the material (body and organs) first or the underlying causes (lifestyles, genetic, habits, environmental) instead of directly searching for the relationship between these two sets of symptoms such as tension and shear (e.g., the different symptoms of cancers and diabetes) which is far more difficult.

The above-mentioned information depicts how a mechanical and structural engineer, physicist, computer scientist, and mathematician who lacks formal training on both biology and chemistry, learned about deaths caused by various chronic diseases and their complications and is able to conduct all related medical research work. With all of his developed math-physical medicine research work, his final goal is to fight against different diseases in order to survive by avoiding "pre-mature" death (at least ~80% of death cases). Living a healthier and longer life is everyone's ultimate objective. This is also his driving force in dedicating his entire efforts on medical research since 2010.

This article also emphasizes the direct relationship between the most important cause, food and diet, and its outcome results of the 5 diseases, not just focusing on the symptoms of the disease. However, he has learned that the medical field is the most sophisticated system he has ever dealt with. Sometimes, the dividing lines between causes and results are blurry. Through the symptoms of Disease A, we may be able to identify the cause of Disease B or vice versa, or the symptoms from Diseases A and B are the same but their causes are either separated or overlapped, or both A and B are caused by Disease C, etc. There are many possibilities to consider.

Excerpt from "Metabolical":
"The 8 intra-cellular or sub-cellular pathological processes (or pathways) are the basic causes of chronic diseases which are not mutually exclusive. Each interacts with the others, and so they tend to cluster together.

These 8 processes are:

(1) Glycation
(2) Oxidative stress
(3) Mitochondrial dysfunction
(4) Insulin resistance
(5) Cell membrane integrity & fluidity
(6) Inflammation
(7) Epigenetics, not genetic
(8) Cell autophage

All of these 8 pathologies are related to food and nutrition. *In order to maintain excellent health and avoid metabolic syndrome, we must consume real food with good nutrition.* ***Processed food must be avoided since they cause the most damage to the body and metabolism system.***

Food is related to all of the 8 pathologies. However, exercise is only related to 5 pathologies, *i.e., Mitochondrial dysfunction, Insulin resistance, Inflammation, Epigenetics, and Cell autophage;* ***exercise has no relationships with Glycation, Oxidative stress, Cell membrane integrity & fluidity.***

The key to fend off chronic diseases is to keep the eight intra-cellular pathological pathways running correctly.

Drugs and nutraceuticals don't work for metabolic syndrome. *All of the 8 pathologies are driven by and are responsive to specific components of real food, because real food gets where it needs to inside the cell.* ***Processed food*** *gets in and* ***poisons*** *the 8 pathways instead."*

Results

Figure 1 is a copy of the screenshot of food quality item list from his developed iPhone APP. It contains 20 elements which are self-explanatory. The food quality occupies 50% of the weight in calculating the total food category, while the food quantity occupies the other 50% of the weight.

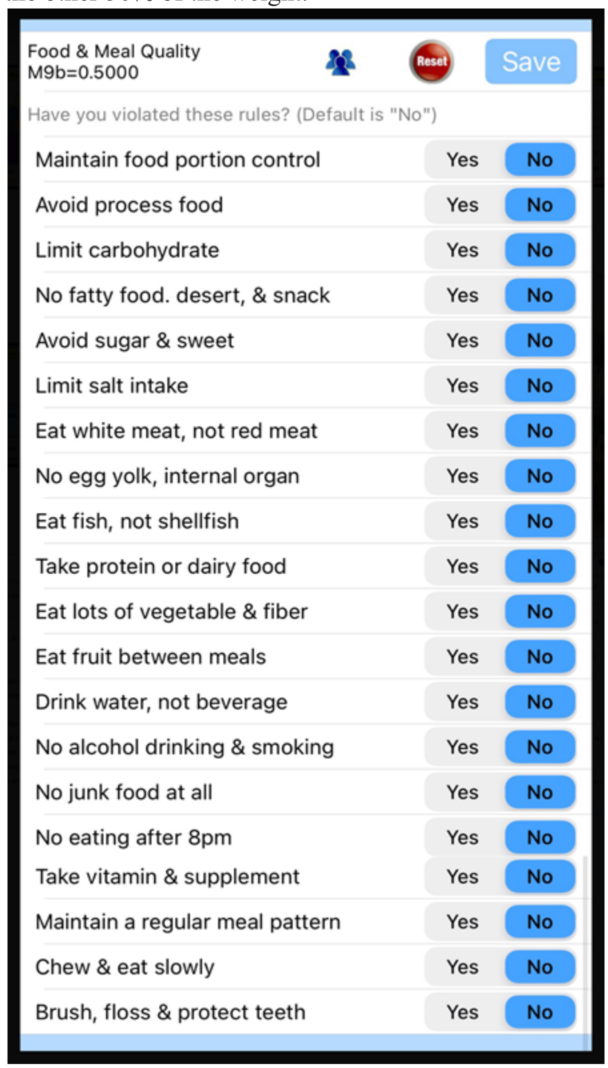

Figure 1: 20 elements of food quality list (from eclaireMD APP)

From this screenshot, you can see how the author uses the iPhone APP as a reminder tool to help his food quality control.

Again, he describes his diet style below:

"Low-carbs/sugar from real food only and not from refined carbs/sugar in processed food, high fiber, low-fat, no red-meats (white meat only such as fish and chicken), low-sodium, high-quality proteins (egg, tofu, cheese), variety of fresh vegetables, and nuts, olive oil, not-too-sweet fresh fruits (e.g. berries), practice Mediterranean diet style, avoid any processed food."

It should be noted that dental health is also included in this list due to its impact on chronic diseases.

The author will write another dedicated article regarding food quality in the near future. He is currently modifying and enhancing his software program in order to perform suitable data-mining tasks.

Figure 2 depicts the data table of both food and diseases as well as the calculated correlations among food and diseases

Food	m9a-Quantity	m9b-Quality	m9-Food	Carbs	Diabetes	Weight	PPG	eAG	A1C (F)	eAG/A1C
2015	94%	55%	70%	14.2	2015	175	130	129	7.68	16.8
2016	88%	55%	72%	15.5	2016	173	120	119	7.04	17.0
2017	85%	52%	68%	14.2	2017	174	117	117	6.93	16.9
2018	84%	51%	67%	15.5	2018	171	117	116	6.87	16.9
2019	76%	51%	63%	13.2	2019	173	114	114	6.75	16.9
2020	65%	50%	58%	13.7	2020	170	108	106	6.33	16.8
2021	58%	50%	54%	11.7	2021	169	109	106	6.17	17.1
Average	79%	52%	65%	14.0	Average	172	116	115	6.82	16.9
Food	m9a-Quantity	m9b-Quality	m9-Food	Carbs	Diabetes	Weight	PPG	eAG	A1C (F)	eAG/A1C
					R vs. m9a	89%	90%	95%	95%	
					R vs. m9	84%	82%	88%	87%	
					R vs. Carbs	48%	51%	58%	58%	

8/19/21

Food	m9a-Quantity	m9b-Quality	m9-Food	Carbs	Diseases	Cancers	CKD	DR	CVD	Carbs+Steps
2015	94%	55%	70%	14.2	2015	46%	61%	60%	61%	61%
2016	88%	55%	72%	15.5	2016	43%	55%	56%	57%	57%
2017	85%	52%	68%	14.2	2017	41%	54%	54%	55%	55%
2018	84%	51%	67%	15.5	2018	42%	55%	56%	55%	56%
2019	76%	51%	63%	13.2	2019	42%	55%	55%	57%	56%
2020	65%	50%	58%	13.7	2020	41%	52%	54%	52%	53%
2021	58%	50%	54%	11.7	2021	40%	52%	52%	52%	52%
Average	79%	52%	65%	14.0	Average	42%	55%	55%	56%	55%
Food	m9a-Quantity	m9b-Quality	m9-Food	Carbs	Complications	Cancers	CKD	DR	CVD	Average
					R vs. m9a	79%	80%	83%	85%	82%
					R vs. m9	69%	68%	73%	77%	72%
					R vs. Carbs	44%	36%	55%	41%	44%
					R vs. Carbs+Steps	98%	98%	97%	98%	98%
					Steps Contribution	28%	30%	24%	21%	26%
					Steps / Food	41%	45%	33%	28%	37%

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Food	Carbs	Steps	Nor. Carbs	Norm. Steps	Carbs+Steps	Diabetes	Weight	PPG	eAG	A1C *10
2015	14.2	3681	86%	96%	91%	2015	175	130	129	77
2016	15.5	4110	96%	85%	90%	2016	173	120	119	70
2017	14.2	4440	87%	77%	82%	2017	174	117	117	69
2018	15.5	4538	96%	75%	85%	2018	171	117	116	69
2019	13.2	4038	79%	87%	83%	2019	173	114	114	68
2020	13.7	4468	83%	76%	80%	2020	170	108	106	63
2021	11.7	4305	69%	80%	75%	2021	169	109	106	62
Average	14.0	4226	85%	82%	84%	Average	172	116	115	68
						R (PPG vs. Carbs+Steps)		88%		
						R (eAG vs. Carbs+Steps)			90%	
						R (A1C vs. Carbs+Steps)				90%
						R (Weight vs. Carbs+Steps)	77%			

Figure 2: Data table of food and 5 diseases and calculation results of correlation coefficients between food and diseases

Figure 3 illustrates the line charts of food, diabetes, and complications. There are 3 key observations:

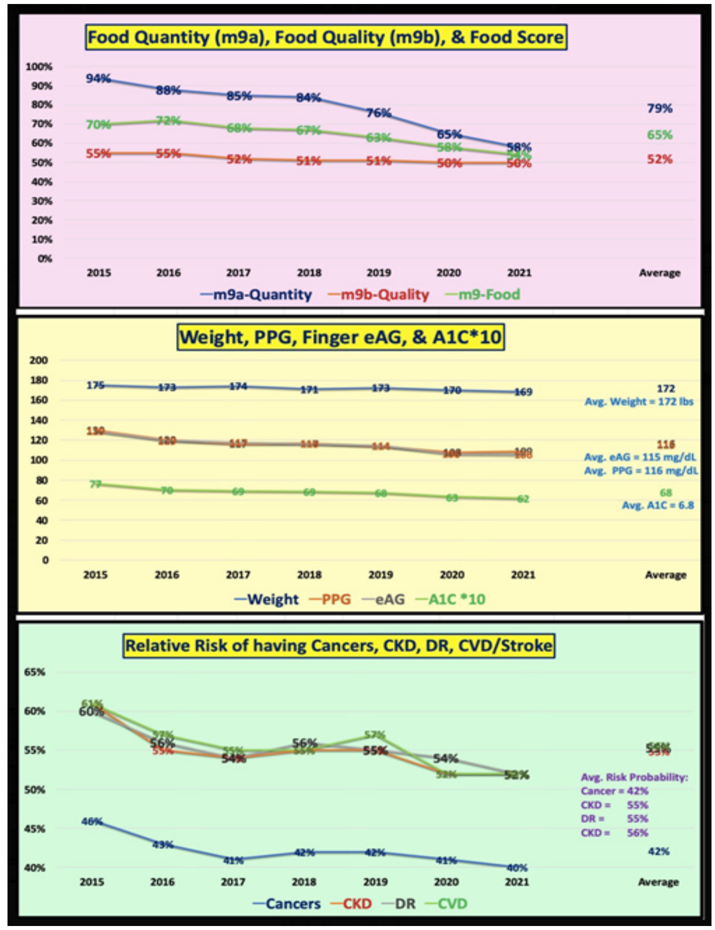

Figure 3: 3-line charts of Food scores, Diabetes conditions, Risk Probability of having Cancers, CVD, CKD, and DR (2015-2021)

1. His food quality scores remain low (i.e., healthy) while both food quantity score and total food score are declining through the 6.5 years.
2. His weight is a flatline with a slight degree of declination while both of his glucoses and his HbA1C have clear declinations through these 6.5 years.
3. His risk probabilities of having 4 complications, i.e., Cancers, CVD/Stroke, CKD, and DR, are declining year after year except during 2018-2019 of his heavy traveling years for medical conferences. The development of these 4 risk curves are based on his mathematical metabolism index (MI) model.

Figure 4 reveals the high correlations between food (food quantity and total food score) and 5 diseases (diabetes, cancers, CVD, CKD, and DR).

Diabetes ~ Carbs	Weight	PPG	eAG	A1C (F)	Diabetes ~ Carbs	Diabetes Avg
R vs. Carbs	48%	51%	58%	58%	R vs. Carbs	54%
R vs. Carbs+Steps	77%	88%	90%	90%	R vs. Carbs+Steps	86%
Steps Contribution	29%	37%	32%	32%	Steps Contribution	33%
steps / Carbs	61%	72%	55%	56%	steps / Carbs	61%
Complications ~ Carbs	Cancers	CKD	DR	CVD	Complications ~ Carbs	Complications Avg
R vs. Carbs	44%	36%	55%	41%	R vs. Carbs	44%
R vs. Carbs+Steps	69%	68%	73%	77%	R vs. Carbs+Steps	72%
Steps Contribution	25%	32%	18%	36%	Steps Contribution	28%
steps / Carbs	56%	88%	33%	88%	steps / Carbs	66%
Food (pathology)					Food (pathology)	8
Exercise (Pathology)					Exercise (Pathology)	5
Exercise / Food					Exercise / Food	63%

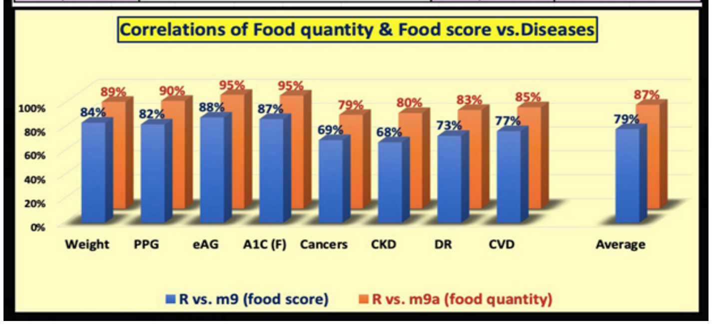

Figure 4: Data Table and Bar Chart of Correlations Between Food Quantity with Total Food Score, and 5 Diseases

Both his food quantity score and total food score (quantity plus quality) have shown very strong correlations (i.e., inter-relationships, not necessarily causes vs. results) of 68% to 95% with 5 complications: diabetes, CVD, CKD, DR, and cancers (with average scores of 79% from total food and 87% from food quantity).

Figure 5 reflects the mixed correlations between carbohydrates and sugar intake amount (medium/low correlations for carbs only and high correlations for carbs plus walking steps) and 5 diseases (diabetes, cancers, CVD, CKD, and DR).

Diabetes	Weight	PPG	eAG	A1C (F)	Cancers	CKD	DR	CVD		Average
R vs. (Carbs only)	48%	51%	58%	58%	44%	36%	55%	41%		49%
R vs. (Carbs+Steps)	77%	88%	90%	90%	69%	68%	73%	77%		79%
Steps Contribution	29%	37%	32%	32%	25%	32%	18%	36%		30%
Steps / Carbs	61%	72%	55%	56%	56%	88%	33%	88%		62%

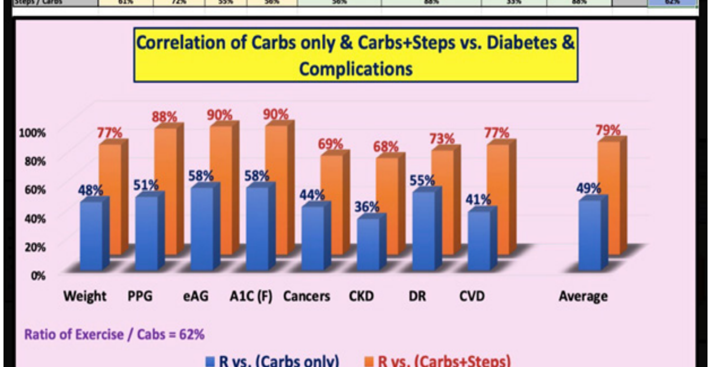

Figure 5: Data Table and Bar Chart of Correlations Between Carbs Only with Carbs+steps, and 5 diseases

The selected single element of carbs/sugar intake amount does not have a strong correlation (36% to 58% with average 49%) with these 5 diseases. However, the second analysis between carbs/sugar amount plus post-meal walking steps, i.e., carbs+steps, and the 5 diseases has shown that the combined scores of carbs/sugars plus exercise have demonstrated very high correlations (68%-90% with an average 79%).

In the background analysis of Figure 5, it also demonstrates that the correlation difference between carbs only and carbs+steps is 30% which also provides a normalized 62% ratio of post-meal walking steps versus carbs/sugar from real food. In comparison, the intra-cellular pathologies have 8 pathways related to food and only 5 related to exercise, it provides a 63% ratio (5/8) of exercise versus food. ***Therefore, the math-physical medicine approach concludes the exercise contribution is at 62% level of the food contribution (the author's big data analytics), while the biochemical medicine approach indicates the exercise contribution is at 63% level of the food contribution (Chapter 7 of Dr. Lustig's book).***

Conclusions

In summary, since 2015, the author has maintained a strict diet pattern which contains ***low-carbs/sugar from real food only and not from refined carbs/sugar in processed food, high fiber, low-fat, no red-meat (white meat only such as fish and chicken), low-sodium, high-quality proteins (egg, tofu, and cheese), a variety of fresh vegetables, and nuts, olive oil, not-too-sweet fresh fruits (e.g. berries), practice Mediterranean diet style, and avoiding any processed food.***

Giving the fact of maintaining his excellent food quality scores resulted from his careful diet (from 55% in 2015 to 50% in 2021 with an average score of 52%), ***both his food quantity score and total food score (quantity plus quality) have shown very strong correlations (i.e. inter-relationships, not necessarily causes vs. results) in the range of 68% to 95% with 4 selected complications, CVD, CKD, DR, and cancers (with average scores of 79% from total food and 87% from food quantity). However, the selected single element of carbs/sugar amount does not have a strong correlation (36% to 58% with an average 49%) with these 5 diseases.*** The second analysis between carbs/sugar plus post-meal walking steps, i.e., carbs+steps, and the 5 diseases has shown that ***the combined score of carbs/sugar plus exercise demonstrated very high correlations (68%-90% with an average 79%) with diabetes.***

The exercise contribution is 30% which comes from the correlation difference between carbs only and carbs+steps. It also provides a 62% ratio of steps/carbs. In comparison, the 8 intra-cellular pathologies have 8 pathways related to food and only 5 pathways related to exercise. Therefore, it provides a 63% ratio of exercise/food. Although this analysis style and results comparison are rough, not precise enough, but they still provide a reasonable pattern of examination by the two different approaches (math-physical medicine vs. biochemical medicine) regarding the roles played by food and exercise in chronic diseases and their complications.

A long and healthy life is a desirable goal for everyone. Cancers, CVD, and CKD are deadly diseases while DR could cause blindness. Lifestyle management (particular food management) is crucial for achieving these health and longevity goals. This article depicts the strong influence on risk probability of having cancers, CVD, CKD, DR, and even T2D control (combining with exercise). In addition, the author strongly agrees with ***the excellent viewpoints by Dr. Lustig: (1) chronic diseases are not "druggable", but they are "foodable"; (2) medication can't cure chronic diseases, but nutrition can; (3) process food isn't just toxic, it's addictive; and we should avoid consuming all kinds of processed food.***

References

1. Lustig Robert H (2021) "Metabolical", HarperWave, HarperCollins Publisher, New York.