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Viscoelastic or Viscoplastic Glucose Theory (VGT #65): Estimated Risk Probability Percentages of Having Kidney Cancer and its Moving Trend over a 7+ Year Period from 1/1/2015 To 4/20/2022 Using a Combined Score of Hyperglycemia (Hyperg or Hg for T2d), Insulin Resistance (Ir), Hypertension (Bp), and Albumin-To-Creatinine Ratio (Acr), Obesity, Diet, and Exercise as the 4 Key Influential Factors for Developing Kidney Cancer Based on GH-Method: Math-Physical Medicine (No. 654-A)

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Introduction

Recently, the author read a few published medical articles regarding kidney cancer. He then lists these articles in the Reference section.

From these 8 referenced papers, diabetes has been identified either directly related to or inconclusive about its relationship with kidney cancers; however, both obesity and chronicle kidney disease (CKD) have been mentioned as known risk factors. As we know, diet and exercise are directly related to obesity and T2D; therefore, the author can safely draw a picture which includes several "modifiable influential factors of kidney cancers" with their respective weighting factors as depicted below:

1. Diabetes, blood pressure & CKD, including hyperglycemia (PPG > 180 mg/dL), insulin resistance (FPG > 180 mg/dL), hypertension score, and albumin-to-creatinine ratio (ACR): 40%
2. Obesity or being overweight: 30%
3. Diet including both quantity and quality of food and meals: 15%
4. Daily walking exercise: 15%

As a result, relative kidney cancer risk can then be defined as follows:

Relative kidney cancer risk %
= (hyperglycemia + insulin resistance + hypertension + ACR) * 40% + obesity * 30% + diet *15% + exercise * 15%

The author's stringent lifestyle management efforts during the past 13 years, including both diet and exercise, are directly beneficial to his weight reduction, glucose control, and metabolism improvements. It is necessary to provide a brief description of his health history.

He was diagnosed with T2D in 1997 with a random glucose check at a 300 mg/dL level; however, his T2D condition most likely began earlier. He suffered his first two chest pain episodes in 1993-1994 and three more heart episodes until 2007. His primary physician informed him that he had diabetic kidney issues in 2010. He then consulted with two more clinical doctors who advised him to immediately start insulin injections and kidney dialysis. This was his wake-up call. He then decided to save his life by conducting his study and research on food nutrition and chronic diseases that same year. His health profile in 2010 was: body weight at 220 lbs. (BMI 32), average glucose at 280 mg/dL, fasting plasma glucose (FPG) in the early morning at 180 mg/dL, lab-tested HbA1C at 10%, triglycerides at 1160 mg/dL (target: <150 mg/dL), and his ACR at 116 (target: <30). In addition, by 2010, he has also suffered a total of 5 heart episodes, foot ulcer, hypothyroidism, diabetic retinopathy, etc.

Over the past 13 years, he has made significant lifestyle changes. For example, he consumes less than 20 grams of carbohydrates and sugar per meal, stops eating processed food, reduces his food quantity by 50%, walks 6-7 miles or 10-11 kilometers daily, sleeps 7-8 hours each night, and avoids stress as much as possible. As a matter of fact, he has never drunk alcohol, smoked cigarettes, or used any illicit drugs in his life.

As of April 10, 2022, his health profile for the first 3 months of 2022 was: body weight at 169 lbs. (BMI 24.95), daily average glucose at 106 mg/dL, FPG in the early morning at 94 mg/dL, lab-tested A1C at 5.8%, triglycerides at 108, and ACR at 16.

A significant accomplishment since he discontinued taking 3 different kinds of diabetes medications on 12/8/2015. **Fortunately, he has not detected any sign of cancer to date**.

Methods

Since December of 2021, the author applied theories of viscoelasticity and viscoplasticity (VGT) from physics and engineering disciplines to investigate more than 60 sets of input/output biomarkers, including nearly 10 sets of cancer cases. The purpose is to identify certain hidden relationships between certain output biomarkers, such as cancer risk, and its corresponding multiple inputs, such as glucose, blood pressure, blood lipids, obesity or overweight, and metabolism index of 6 lifestyle details and 4 chronic diseases. In this study, the hidden biophysical behaviors and possible inter-relationships among the output symptom (kidney cancer) and multiple input causes (T2D, obesity, diet, walking exercise) are "**time-dependent**" and change from time to time. These important time-dependency characteristics provide insight into the cancer risk's moving pattern. It also controls the cancer risk curve shape, the associated energy created, stored, or burned inside during the process of stress up-loading (moving upward or increasing) and stress down-loading (moving downward or decreasing) of the input biomarkers with the output biomarker of cancer risk %. This VGT application emphasizes the time-dependency characteristics of involved variables. In the medical field, most biomarkers are **time-dependent** since body organ cells are organic in nature and change all of the time. Incidentally, VGT can generate a stress-strain curve or cause-symptom curve, known as a "**hysteresis loop**" in physics, in which area size can also be used to estimate the relative energy created, stored, or burned during the process of uploading (e.g., increasing glucose) and unloading (e.g., decreasing body weight) over the timespan of the cancer risk %. **He calls this relative energy the "VGT energy"**.

It should be emphasized here that **both cancer risk % and its associated VGT energy are estimated relative values, not "absolute" values**.

The following defined stress and strain equations are used to establish the VGT stress-strain diagram in a space domain (SD):

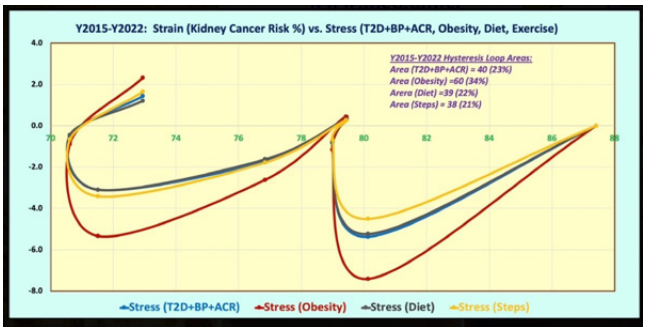
VGT strain
= ε (symptom)
= individual symptom at the present time

VGT Stress
= σ (based on the change rate of strain, symptom, multiplying with one or more viscosity factors or influential factors)
= η * (dε/dt)
= η * (d-strain/d-time)
= (viscosity factor η using normalized factor at present time) * (symptom at present time - symptom at a previous time)

Where the strain is the kidney cancer risk percentage and the stress is his kidneys cancer risk change rate multiplied by several chosen input biomarkers as the individual viscosity factor. In his VGT studies, sometimes, he carefully selects certain normalization factors for each input biomarker, respectively. The normalization factors are the dividing lines between a healthy state and an unhealthy state. For example, 170 lbs. for body weight, 6.0 for HbA1C, 120 mg/dL for glucose, 180 mg/dL for hyperglycemia, 73.5% for overall MI score, and 10,000 steps for daily walking exercise, etc. [1-8].

Results

Figure 1 shows the stress-strain diagram of kidney cancer risk % with 4 hysteresis loops via a VGT energy analysis in a space domain.



4/7/22	Viscosity 1	Viscosity 2	Viscosity 3	Viscosity 4	PC Risk %	25%	25%	25%	25%				
Kidney Cancer Risk	T2D+BP+ACR	Obesity	Diet	Steps	Kidney Cancer %	Stress (T2D+BP+ACR)	Stress (Obesity)	Stress (Diet)	Stress (Steps)	Area (T2D+BP+ACR)	Area (Obesity)	Area (Diet)	Area (Steps)
Y2015	0.89	1.03	0.70	0.70	87	0.0	0.0	0.0	0.0	0	0	0	0
Y2016	0.74	1.02	0.72	0.62	80	-5.4	-7.4	-5.2	-4.5	20	27	19	16
Y2017	0.73	1.03	0.68	0.59	79	-6.8	-1.2	-0.8	-0.7	4	5	3	3
Y2018	0.75	1.01	0.67	0.61	79	0.3	0.4	0.3	0.3	0	0	0	0
Y2019	0.66	1.02	0.63	0.69	77	-1.7	-2.0	-1.6	-1.8	2	3	2	2
Y2020	0.58	1.00	0.58	0.64	72	-3.1	-5.3	-3.1	-3.4	13	21	13	14
Y2021	0.56	0.99	0.51	0.73	71	-0.5	-0.9	-0.5	-0.7	2	3	2	2
Y2022	0.62	0.99	0.52	0.71	73	1.4	2.3	1.2	1.7	1	2	1	1
Average or Sum	0.69	1.01	0.63	0.66	77	-1.2	-1.8	-1.2	-1.3	40	60	39	38
										Area Ratio =	23%	34%	22%	21%

Conclusion

The following four described biophysical characteristics have demonstrated certain behaviors of the author's kidney cancer risk probability under 4 specific influential factors, using the viscoelastic or viscoplastic energy (VGT) approach:

(1) From the x-axis value or the strain value on the stress-strain diagram, **his kidney cancer risk % covers a range from the high-end of 87% in 2015 to the low-end of 73% in 2022**. These kidney cancer risks are only relative numbers, not absolute numbers. However, on a relative scale, the reduction of his kidney cancer risk has not been as significant as the other types of cancer risks due to his long term diabetic damage to his kidneys. Nevertheless, he feels at ease that **his kidney cancer risks are decreasing**.

(2) From the y-axis (stress) values and the hysteresis loop areas, we can see that both the stress values and the hysteresis loop areas for the period of Y2015-Y2018 are larger than the period of Y2019-Y2022. This indicates that, from the perspective of kidney cancer risk, he is "healthier" during the recent 4 years; therefore, his kidney cancer risks have been reduced accordingly due to the improvements made on his four influential factors, especially for factors of T2D+BP+ACR (disease biomarkers) and diet (food quality and quantity). On contrary, both obesity (body weight) and exercise (walking step) are more and less remaining at constant levels.

(3) Based on the comparison of hysteresis loop area size or degrees of influence, the summarized sub-area of 96 (54%) for the earlier 4 years of Y2015-Y2018 is somewhat larger than the summarized sub-area of 81 (46%) for the recent 4 years of Y2019-Y2022. **His stringent lifestyle management program initiated in Y2014 has indeed changed his risk perspective of having kidney cancer**.

(4) When he delved deeper into the comparisons among these four influential factors, he can further identify some additional details regarding these "efforts and results" from each influential factor. Examples of the detailed observations are: obesity (body weight) contributes the most of 34% of the influence on his kidney cancer risk; the contributions from the other three influential factors are very close to each other with an order of T2D+BP+ACR of 23%, diet of 22%, and excise of 21%.

In summary, conclusions 1 and 2 can also be observed from time-domain waveforms. However, conclusions 3 and 4 regarding energies and degrees of influence associated with kidney cancer risk factors cannot be identified using time-domain curves. More importantly, the unique "time-dependency" character of strain

change rate (i.e. kidney cancer risk change amount over time) can only be presented via VGT tool.

This kidney cancer risk article has demonstrated how the author utilizes the physics and engineering, VGT energy methodology, to construct and display the research result findings of his risk perspective of developing kidney cancer resulting from four interrelated influential factors.

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