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Research Article

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Relationships of Estimated Visceral Fat Ratio with Body Weight and Waistline and Connectivities with Type 2 Diabetes, Hpertension, Dislipidemia, Cardiovascular Diseases, and Cancers Using Viscoplastic Energy Model of GH Method: Math-Physical Medicine (no. 990, vmt #389, 12/6-7/2023)

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Abstract

The author has been tracking his body weight (BW) daily from 2010 (183 lbs, 83 kg) to 2023 (168 lbs, 76 kg) and waistline (WL) quarterly from 2013 (43 inch, 109 cm) to 2023 (34 inch, 86 cm). Starting from August 11, 2023, he also began monitoring his visceral fat ratio (VFR) daily (average 16%). To estimate his VFR for the period before August 11, 2023, he used a ratio of 10.11 (his BW/VFR value from 8/11/2023 to 12/5/2023) to create an initial VFR curve. He then re-adjusted this preliminary curve using his annual WL waveform, resulting in an finalized annual VFR dataset for the years 2013 to 2023. He names it the estimated visceral fate ratio (E. VFR).

Analysis

He employed the space-domain viscoplastic medicine energy theory (SD-VMT) to evaluate the ultimate dynamic relationships (or energies) between his E. VFR and five related health conditions: diabetes, hypertension, dyslipidemia, cardiovascular disease (CVD) risk, and cancer risk.

This SD-VMT analysis comprised two segments: the first explored the contribution on his E. VFR through his BW and WL, while the second focused on the association between E. VFR and his five aforementioned health conditions. It is important to note that he has switched the roles between the singular visceral fat and those five health conditions. He adopts this reversed approach to highlight their interconnectedness, rather than performing five independent numerical operations.

Results

***To summarize,** the initial SD-VMT energy calculations and statistical correlations over the past 11 years between his estimated visceral fat ratio and two key factors are:*

- ***Weight: 46% (with an 85% correlation)***
- ***Waistline: 54% (with a 100% correlation)***

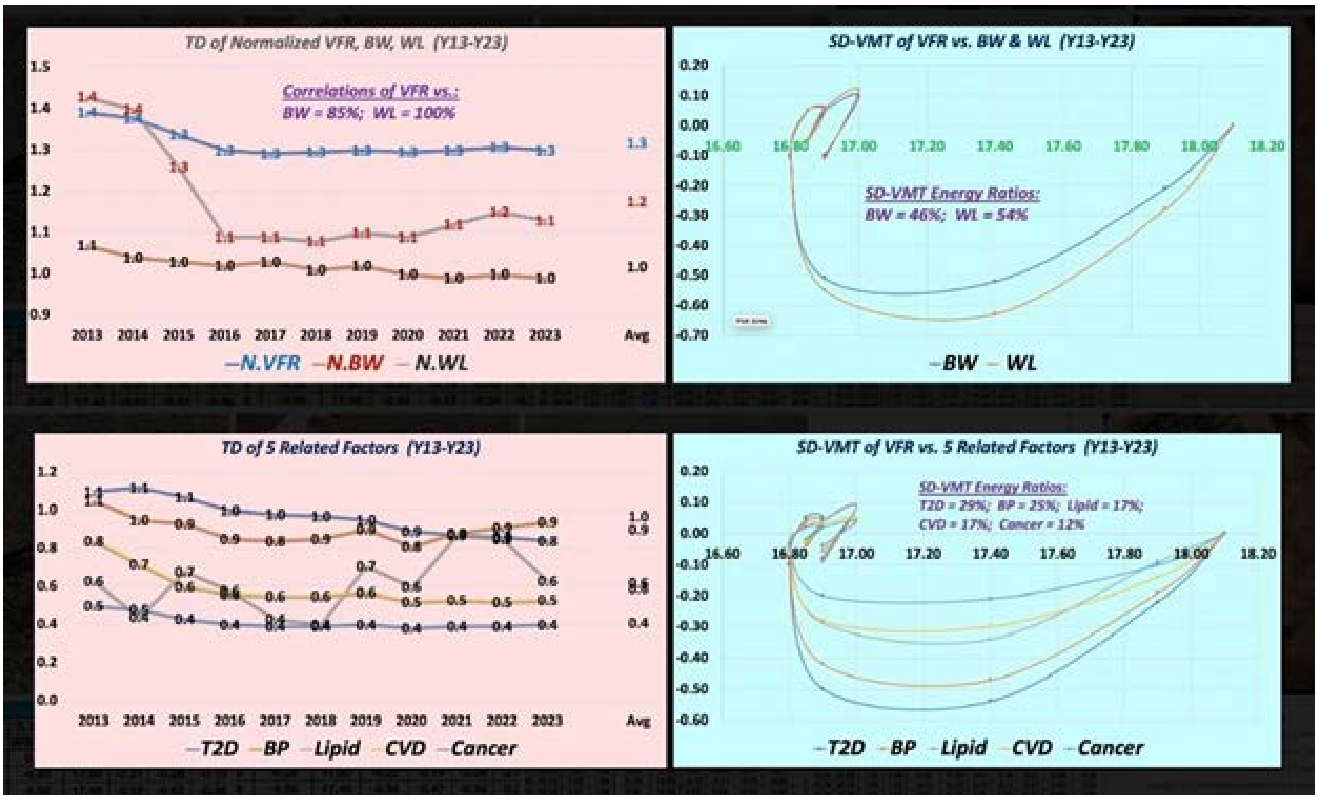
The second set of SD-VMT energy calculations, focusing on the relationship between his estimated visceral fat ratio and five health conditions over the same period, revealed the following contributions:

- ***Energy related to Type 2 Diabetes (T2D): 29%***
- ***Energy related to Hypertension: 25%***
- ***Energy related to Dyslipidemia: 17%***
- ***Energy related to Cardiovascular Diseases (CVD): 17%***
- ***Energy related to Cancers: 12%***

Key Insights

From the first set of results, his waistline (54%) has a stronger influence on his visceral fat than his body weight (46%). This is logical, considering that changes in waistline size are directly influenced by the amount of fat deposited around internal organs in the abdominal area.

According to the second set of results, his Type 2 Diabetes (29%) is the condition most impacted by his abdominal fat (or belly fat). This is followed by elevated blood pressure (25%) and high cholesterol levels (17%). His risk of cardiovascular diseases or strokes (17%) is low but still higher than his risk of cancers (12%), indicating the significant impact of visceral fat on these different health conditions.



1. Introduction

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2. Analysis

He employed the space-domain viscoplastic medicine energy theory (SD-VMT) to evaluate the ultimate dynamic relationships (or energies) between his E. VFR and five related health conditions: diabetes, hypertension, dyslipidemia, cardiovascular disease (CVD) risk, and cancer risk. This SD-VMT analysis comprised two segments: the first explored the contribution on his E. VFR through his BW and WL, while the second focused on the association between E. VFR and his five aforementioned health conditions. It is important to note that he has switched the roles between the singular visceral fat and those five health conditions. He adopts this reversed approach to highlight their interconnectedness, rather than performing five independent numerical operations.

3. Biomedical Information

The following sections contain excerpts and concise information drawn from multiple medical articles, which have been meticulously reviewed by the author of this paper. The author has adopted this approach as an alternative to including a conventional reference list at the end of this document, with the intention of optimizing his valuable research time. It is essential to clarify that these sections do not constitute part of the author's original contribution but have been included to aid the author in his future reviews and offer valuable insights to other readers with an interest in these subjects.

4. Visceral Rat Ratio

The normal healthy range for visceral fat levels can vary depending on factors such as age, gender, and overall body composition. However, ***a general guideline is that a visceral fat level of 1-12 on a scale of 1-59 (measured by a CT or MRI scan) is considered within a healthy range for adults***. It is important to note that these ranges can differ between individuals, so it is advisable to consult with a healthcare professional for personalized recommendations based on your specific health and fitness goals.

A visceral fat rate of 20% is considered high and can be an indicator of increased health risks. Visceral fat, also known as belly fat, is located deep within the abdominal cavity and is associated with a higher risk of developing heart disease, type 2 diabetes, and other health issues. It is generally recommended to maintain a lower level of visceral fat for optimal health.

The normal healthy range of visceral fat for a 70-year-old male can vary, but generally, a visceral fat area (VFA) of less than 100 cm² is considered healthy. VFA is commonly measured using imaging techniques such as CT scans or MRI scans. However, it is essential to keep in mind that individual health circumstances and body composition can influence what may be considered a healthy range for visceral fat.

5. Pathophysiologically, What Diseases are Related to high Visceral Fat?

High levels of visceral fat have been linked to an increased risk of several diseases and health conditions, including:

5.1. Cardiovascular Disease: Excess visceral fat has been associated with an elevated risk of developing heart disease, including atherosclerosis, heart attacks, and stroke.

5.2. Type 2 Diabetes: Studies have shown a strong correlation between high visceral fat levels and insulin resistance, a key factor in the development of type 2 diabetes.

5.3. Metabolic Syndrome: *Visceral fat accumulation is a central component of metabolic syndrome, a cluster of conditions that includes high blood pressure, high blood sugar, abnormal cholesterol levels, and increased waist circumference, leading to an increased risk of heart disease, stroke, and diabetes.*

5.4. Certain Cancers: Research has indicated that high levels of visceral fat are linked to an increased risk of developing certain types of cancers, including ***colorectal cancer and breast cancer.***

5.6. Liver Disease: Visceral fat is associated with ***non-alcoholic fatty liver disease (NAFLD),*** a condition characterized by an accumulation of fat in the liver, which can lead to inflammation and liver damage. Furthermore, ***non-alcoholic fatty liver disease (NAFLD) can potentially lead to the development of liver cancer.*** Over time, longstanding NAFLD can progress to more severe liver conditions, such as ***non-alcoholic steatohepatitis (NASH),*** which is characterized by inflammation and liver cell damage. ***In some cases, NASH can further progress to liver fibrosis, cirrhosis, and eventually, hepatocellular carcinoma (HCC), which is the most common type of primary liver cancer.***

The exact mechanisms by which NAFLD progresses to liver cancer are complex and still being studied, but ***it is well-established that individuals with advanced NAFLD, particularly those with NASH and cirrhosis, have an increased risk of developing liver cancer.*** Therefore, it is important for individuals with NAFLD, especially those with advanced stages of the disease, to undergo regular monitoring and receive appropriate medical care to mitigate the risk of liver cancer and other serious complications.

5.7. Sleep Apnea: Excessive visceral fat has been correlated with an increased likelihood of developing sleep apnea, a sleep disorder marked by disrupted breathing patterns during sleep.

5.8. Overall Mortality: High levels of visceral fat have been linked to a higher risk of premature death from various causes, making it a significant risk factor for overall mortality. It is important to note that the relationship between visceral fat and these conditions is complex and can be influenced by genetic, lifestyle, and environmental factors. This underscores the significance of maintaining a healthy body composition and lifestyle for minimizing the risk of these diseases associated with excessive visceral fat.

6. MPM Background

To learn more about his developed GH-Method: math-physical medicine (MPM) methodology, readers can read the following three papers selected from his published 760+ papers.

The first paper, No. 386 (Reference 1) describes his MPM methodology in a general conceptual format. The second paper, No. 387 (Reference 2) outlines the history of his personalized diabetes research, various application tools, and the differences between biochemical medicine (BCM) approach versus the MPM approach. The third paper, No. 397 (Reference 3) depicts a general flow diagram containing ~10 key MPM research methods and different tools.

7. The Author's Diabetes History

The author was a severe T2D patient since 1995. He weighed 220 lb. (100 kg) at that time. By 2010, he still weighed 198 lb. with an average daily glucose of 250 mg/dL (HbA1C at 10%). During that year, his triglycerides reached 1161 (high risk for CVD and stroke) and his albumin-creatinine ratio (ACR) at 116 (high risk for chronic kidney disease). He also suffered from five cardiac episodes within a decade. In 2010, three independent physicians warned him regarding the need for kidney dialysis treatment and the future high risk of dying from his severe diabetic complications.

In 2010, he decided to self-study endocrinology with an emphasis on diabetes and food nutrition. He spent the entire year of 2014 to develop a metabolism index (MI) mathematical model. During 2015 and 2016, he developed four mathematical prediction models related to diabetes conditions: weight, PPG, fasting plasma glucose (FPG), and HbA1C (A1C). Through using his developed mathematical metabolism index (MI) model and the other four glucose prediction tools, by the end of 2016, his weight was reduced from 220 lbs. (100 kg) to 176 lbs. (89 kg), waistline from 44 inches (112 cm) to 33 inches (84 cm), average fingerpiercing glucose from 250 mg/dL to 120 mg/dL, and A1C from 10% to ~6.5%. One of his major accomplishments is that he no longer takes any diabetes-related medications since

12/8/2015.

In 2017, he achieved excellent results on all fronts, especially his glucose control. However, during the preCOVID period, including both 2018 and 2019, he traveled to ~50 international cities to attend 65+ medical conferences and made ~120 oral presentations. This hectic schedule inflicted damage to his diabetes control caused by stress, dining out frequently, post-meal exercise disruption, and jet lag, along with the overall negative metabolic impact from the irregular life patterns; therefore, his glucose control was somewhat affected during the two-year traveling period of 2018-2019.

He started his COVID-19 selfquarantined life on 1/19/2020. By 10/16/2022, his weight was further reduced to ~164 lbs. (BMI 24.22) and his A1C was at 6.0% without any medication intervention or insulin injection. In fact, with the special COVID-19 quarantine lifestyle since early 2020, not only has he written and published ~500 new research articles in various medical and engineering journals, but he has also achieved his best health conditions for the past 27 years. These achievements have resulted from his non-traveling, low-stress, and regular daily life routines. Of course, his indepth knowledge of chronic diseases, sufficient practical lifestyle management experiences, and his own developed high-tech tools have also contributed to his excellent health improvements.

On 5/5/2018, he applied a continuous glucose monitoring (CGM) sensor device on his upper arm and checks his glucose measurements every 5 minutes for a total of 288 times each day. Furthermore, he extracted the 5minute intervals from every 15minute interval for a total of 96 glucose data each day stored in his computer software.

Through the author's medical research work over 40,000 hours and read over 4,000 published medical papers online in the past 13 years, he discovered and became convinced that good life habits of not smoking, moderate or no alcohol intake, avoiding illicit drugs; along with eating the right food with wellbalanced nutrition, persistent exercise, having a sufficient and good quality of sleep, reducing all kinds of unnecessary stress, maintaining a regular daily life routine contribute to the risk reduction of having many diseases, including CVD, stroke, kidney problems, micro blood vessels issues, peripheral nervous system problems, and even cancers and dementia. In addition, a long-term healthy lifestyle can even "repair" some damaged internal organs, with different required time-length depending on the particular organ's cell lifespan. For example, he has "self-repaired" about 35% of his damaged pancreatic beta cells during the past 10 years.

8. Energy Theory

The human body and organs have around 37 trillion live cells which are composed of different organic cells that require energy infusion from glucose carried by red blood cells; and energy consumption from laborwork or exercise. When the residual energy (resulting from the plastic glucose scenario) is stored inside our bodies, it will cause different degrees of damage or influence to many of our internal organs.

According to physics, energies associated with the glucose waves are proportional to the square of the glucose amplitude. The residual energies from elevated glucoses are circulating inside the body via blood vessels which then impact all of the internal organs to cause different degrees of damage or influence, e.g. diabetic complications. Elevated glucose (hyperglycemia) causes damage to the structural integrity of blood vessels. When it combines with both hypertension (rupture of arteries) and hyperlipidemia (blockage of arteries), CVD or Stroke happens. Similarly, many other deadly diseases could result from these excessive energies which would finally shorten our lifespan. For an example, the combination of hyperglycemia and hypertension would cause micro-blood vessel's leakage in kidney systems which is one of the major cause of CKD.

The author then applied Fast Fourier Transform (FFT) operations to convert the input wave from a time domain into a frequency domain. The y-axis amplitude values in the frequency domain indicate the proportional energy levels associated with each different frequency component of input occurrence. ***Both output symptom value (i.e. strain amplitude in the time domain) and output symptom fluctuation rate (i.e. the strain rate and strain frequency) are influencing the energy level (i.e. the Y-amplitude in the frequency domain).***

Currently, many people live a sedentary lifestyle and lack sufficient exercise to burn off the energy influx which causes them to become overweight or obese. Being overweight and having obesity leads to a variety of chronic diseases, particularly diabetes. In addition, many types of processed food add unnecessary ingredients and harmful chemicals that are toxic to the bodies, which lead to the development of many other deadly diseases, such as cancers. For example, ~85% of worldwide diabetes patients are overweight, and ~75% of patients with cardiac illnesses or surgeries have diabetes conditions.

In engineering analysis, when the load is applied to the structure, it bends or twists, i.e. deform; however, when the load is removed, it will either be restored to its original shape (i.e, elastic case) or remain in a deformed shape (i.e. plastic case). In a biomedical system, the glucose level will increase after eating carbohydrates or sugar from food; therefore, the carbohydrates and sugar function as the energy supply.

After having labor work or exercise, the glucose level will decrease. As a result, the exercise burns off the energy, which is similar to load removal in the engineering case. In the biomedical case, both processes of energy influx and energy dissipation take some time which is not as simple and quick as the structural load removal in the engineering case. Therefore, the age difference and 3 input behaviors are "dynamic" in nature, i.e. timedependent. *This time-dependent nature leads to a "viscoelastic or viscoplastic" situation.* ***For the author's case, it is "viscoplastic" since most of his biomarkers are continuously improved during the past 13-year time window.***

Time-Dependent Output Strain and Stress of (Viscous Input*Output Rate)

Hooke's law of linear elasticity is expressed as:

Strain (ε: epsilon) = Stress (σ: sigma) / Young's modulus (E)

For biomedical glucose application, his developed linear elastic glucose theory (LEGT) is expressed as:

PPG (strain) = carbs/sugar (stress) * GH.p-Modulus (a positive number) + post-meal walking ksteps * GH.w-Modulus (a negative number)

Where GH.p-Modulus is reciprocal of Young's modulus E.

However, in viscoelasticity or viscoplasticity theory, the stress is expressed as:

Stress = viscosity factor (η: eta) * strain rate ($d\varepsilon/dt$)

Where strain is expressed as Greek epsilon or ε.

In this article, in order to construct an "ellipse-like" diagram in a stressstrain space domain (e.g. "hysteresis loop") covering both the positive side and negative side of space, he has modified the definition of strain as follows:

Strain = (body weight at certain specific time instant)

He also calculates his strain rate using the following formula:

Strain rate = (body weight at next time instant) - (body weight at present time instant)

The risk probability % of developing into CVD, CKD, Cancer is calculated based on his developed metabolism index model (MI) in 2014. His MI value is calculated using inputs of 4 chronic conditions, i.e. weight, glucose, blood pressure, and lipids; and 6 lifestyle details, i.e. diet, drinking water, exercise, sleep, stress, and daily routines. These 10 metabolism categories further contain ~500 elements with millions of input data collected and processed since 2010. For individual deadly disease risk probability %, his mathematical model contains certain specific weighting factors for simulating certain risk percentages associated with different deadly diseases, such as metabolic disorderinduced CVD, stroke, kidney failure, cancers, dementia; artery damage in heart and brain, micro-vessel damage in kidney, and immunity-related infectious diseases, such as COVID death.

Some of explored deadly diseases and longevity characteristics using the ***viscoplastic medicine theory (VMT)*** include stress relaxation, creep, hysteresis loop, and material stiffness, damping effect ***based on time-dependent stress and strain*** which are different from his previous research findings using ***linear elastic glucose theory (LEGT) and nonlinear plastic glucose theory (NPGT).***

9. Results

		/ 170	/ 30	N. 1	N. 2	S. Rate	Strain	Strs 1	Strs 2	Hgt 1	Hgt 2	Area 1	Area 2	Time
	E.VFR	BW	WL	BW	WL	VFR Rate	E.VFR	BW	WL	BW	WL	BW	WL	Zone
2013	18.10	182.57	43.00	1.07	1.43	0.00	18.10	0.00	0.00	0.00	0.00	0.00	0.00	Y13-17
2014	17.90	177.23	42.00	1.04	1.40	-0.20	17.90	-0.21	-0.28	-0.10	-0.14	0.02	0.03	1.07
2015	17.40	175.40	37.68	1.03	1.26	-0.50	17.40	-0.52	-0.63	-0.36	-0.45	0.18	0.23	98%
2016	16.90	172.94	32.83	1.02	1.09	-0.50	16.90	-0.51	-0.55	-0.51	-0.59	0.26	0.29	
2017	16.80	174.29	32.75	1.03	1.09	-0.10	16.80	-0.10	-0.11	-0.31	-0.33	0.03	0.03	
2018	16.85	171.09	32.50	1.01	1.08	0.05	16.85	0.05	0.05	-0.03	-0.03	0.00	0.00	Y18-19
2019	16.90	172.57	33.12	1.02	1.10	0.05	16.90	0.05	0.06	0.05	0.05	0.00	0.00	0.02
2020	16.85	170.02	32.78	1.00	1.09	-0.05	16.85	-0.05	-0.05	0.00	0.00	0.00	0.00	2%
2021	16.90	168.58	33.50	0.99	1.12	0.05	16.90	0.05	0.06	0.00	0.00	0.00	0.00	
2022	17.00	169.18	34.50	1.00	1.15	0.10	17.00	0.10	0.12	0.07	0.09	0.01	0.01	
2023	16.90	168.19	34.00	0.99	1.13	-0.10	16.90	-0.10	-0.11	0.00	0.00	0.00	0.00	
Avg	17.14	172.91	35.33	1.02	1.18	-0.11	17.14	-0.11	-0.13	-0.11	-0.13	0.50	0.59	
Correl.	100%	85%	100%							SD-E:	1.09	46%	54%	

		/ 1	/ 1	/ 1	/ 1	/ 100	N. 1	N. 2	N. 3	N. 4	N. 5	S. Rate	Strain	Strs 1
	E. VFR	T2D	BP	Lipid	CVD	Cancer	T2D	BP	Lipid	CVD	Cancer	VFR Rate	E. VFR	T2D
2013	18.10	1.10	1.05	0.63	0.84	50.00	1.10	1.05	0.63	0.84	0.50	0.00	18.10	0.00
2014	17.90	1.12	0.95	0.44	0.72	48.00	1.12	0.95	0.44	0.72	0.48	-0.20	17.90	-0.22
2015	17.40	1.07	0.93	0.68	0.60	42.60	1.07	0.93	0.68	0.60	0.43	-0.50	17.40	-0.54
2016	16.90	1.00	0.85	0.58	0.56	40.20	1.00	0.85	0.58	0.56	0.40	-0.50	16.90	-0.50
2017	16.80	0.98	0.84	0.43	0.55	38.90	0.98	0.84	0.43	0.55	0.39	-0.10	16.80	-0.10
2018	16.85	0.97	0.85	0.40	0.55	38.60	0.97	0.85	0.40	0.55	0.39	0.05	16.85	0.05
2019	16.90	0.95	0.90	0.71	0.57	40.10	0.95	0.90	0.71	0.57	0.40	0.05	16.90	0.05
2020	16.85	0.89	0.81	0.60	0.52	38.00	0.89	0.81	0.60	0.52	0.38	-0.05	16.85	-0.04
2021	16.90	0.87	0.88	0.87	0.53	39.10	0.87	0.88	0.87	0.53	0.39	0.05	16.90	0.04
2022	17.00	0.86	0.91	0.85	0.52	38.70	0.86	0.91	0.85	0.52	0.39	0.10	17.00	0.09
2023	16.90	0.84	0.94	0.63	0.53	39.70	0.84	0.94	0.63	0.53	0.40	-0.10	16.90	-0.08
Avg	17.14	0.97	0.90	0.62	0.59	41.26	0.97	0.90	0.62	0.59	0.41	-0.11	17.14	-0.11
Correl.	100%	78%	84%	-12%	95%	98%								

	Strs 2	Strs 3	Strs 4	Strs 5	Hgt 1	Hgt 2	Hgt 3	Hgt 4	Hgt 5	Area 1	Area 2	Area 3	Area 4	Area 5	Time
	BP	Lipid	CVD	Cancer	T2D	BP	Lipid	CVD	Cancer	T2D	BP	Lipid	CVD	Cancer	Zone
2013	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Y13-17
2014	-0.19	-0.09	-0.14	-0.10	-0.11	-0.10	-0.04	-0.07	-0.05	0.02	0.02	0.01	0.01	0.01	1.72
2015	-0.47	-0.34	-0.30	-0.21	-0.38	-0.33	-0.21	-0.22	-0.15	0.19	0.16	0.11	0.11	0.08	99%
2016	-0.42	-0.29	-0.28	-0.20	-0.52	-0.45	-0.32	-0.29	-0.21	0.26	0.22	0.16	0.15	0.10	
2017	-0.08	-0.04	-0.05	-0.04	-0.30	-0.25	-0.17	-0.17	-0.12	0.03	0.03	0.02	0.02	0.01	
2018	0.04	0.02	0.03	0.02	-0.02	-0.02	-0.01	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00	Y18-19
2019	0.04	0.04	0.03	0.02	0.05	0.04	0.03	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.03
2020	-0.04	-0.03	-0.03	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2%
2021	0.04	0.04	0.03	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2022	0.09	0.08	0.05	0.04	0.06	0.07	0.06	0.04	0.03	0.01	0.01	0.01	0.00	0.00	
2023	-0.09	-0.06	-0.05	-0.04	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Avg	-0.10	-0.08	-0.07	-0.06	-0.11	-0.09	-0.08	-0.06	-0.04	0.51	0.44	0.30	0.29	0.21	
Correl.								SD-E:	1.74	29%	25%	17%	17%	12%	

Figure 1: shows data tables.

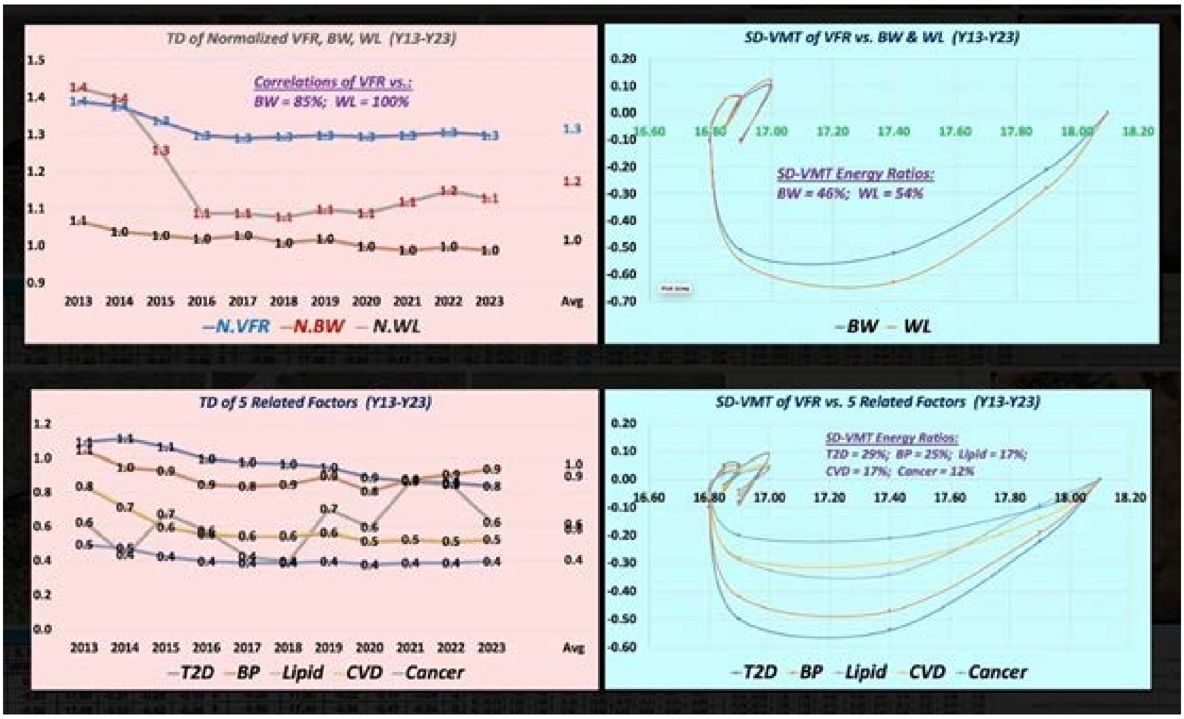

Figure 2: Input/output diagrams

10. Conclusions

To summarize, the initial SD-VMT energy calculations and statistical correlations over the past 11 years between his estimated visceral fat ratio and two key factors are:

- ***Weight: 46% (with an 85% correlation)***
- ***Waistline: 54% (with a 100% correlation)***

The second set of SD-VMT energy calculations, focusing on the relationship between his estimated visceral fat ratio and five health conditions over the same period, revealed the following contributions:

- ***Energy related to Type 2 Diabetes (T2D): 29%***
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- ***Energy related to Cancers: 12%***

Key Insights

From the first set of results, his waistline (54%) has a stronger influence on his visceral fat than his body weight (46%). This is logical, considering that changes in waistline size are directly influenced by the amount of fat deposited around internal organs in the abdominal area.

According to the second set of results, his Type 2 Diabetes (29%) is the condition most impacted by his abdominal fat (or belly fat). This is followed by elevated blood pressure (25%) and high cholesterol levels (17%). His risk of cardiovascular diseases or strokes (17%) is low but still higher than his risk of cancers (12%), indicating the significant impact of visceral fat on these different health conditions.

References

For editing purposes, majority of the references in this paper, which are self-references, have been removed for this article. Only references from other authors' published sources remain. The bibliography of the author's original self-references can be viewed at www.eclairemd.com.

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