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Hepatic Morphometric Correlation with Biophysical Profiling of Height

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Abstract

Introduction: Clinical assessment of hepatic span is usually subjective. And is based on the experience of the clinician. This is what has led to this study in using Biophysical profiling of Heights, Weights, and Body mass index to find the normal hepatic span of every individual. This study was conducted at HMG Hospital Limited, Abonnema in Rivers State in affiliation with the University of Port Harcourt. **Methodology:** The biophysical sampling method was instituted to select respondents. At the same time, a radiological formula was used to calculate the sample size, and subjects' weight, height and hepatic span where measured while the BMI was calculated and the data was analyzed using python programming language for data science. **Results:** The data obtained were subjected to descriptive statistics and the Pearson correlation coefficient. P value greater than or equal to 0.05 was taken as statistically significant. The respondents were mainly aged 30 to 63 years**. Conclusion:** The null hypothesis was rejected; hence this research has stated the law known as Belema's Law of hepatic-height correlation, which states that the hepatic span of an individual is directly proportional to the height of that individual except in disease conditions affecting the liver directly or indirectly.

Keywords

Hepatic Span, Height, Body Mass Index, Weight

1. Introduction

The human body is a remarkable system where every organ plays a crucial role. The liver, one of the largest internal organs, plays a vital role in detoxifying the blood and metabolizing nutrients. One aspect long debated by scientists is the correlation between liver span and height.

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Hepatic span has always been an under-researched yet vital element of human biomechanics, carrying far-reaching implications for our understanding of the human body. This research work probes into the association of hepatic span with the triad of height, weight, and Body Mass Index (BMI), a combination constituting our biophysical profile.

According to Monika *et al.* [1], hepatic span, the range of our liver across the widest section, plays a crucial role in understanding numerous diseases, particularly liver diseases. A study by Emamghorashi *et al.* [2], underlines the importance of gastrointestinal issues being rooted in an enlarged hepatic span.

Height, weight, and BMI constitute a meaningful biophysical profile that reflects much about a person's health and lifestyle. Height and weight are rudimentary anthropometric measurements, and when combined, they form the Body Mass Index (BMI), a standard measure of whether a person has a healthy body weight for a given height. Conversely, it should be noted that, the study done by (Singh & Anirvan, 2023) [3] suggested a weak correlation between liver span and height in healthy individuals.

Arguably, no study of the biophysical profile is entirely extensive without considering the hepatic span. A study conducted by (Tetteh *et al.*, 2021) [4], articulates that an increased hepatic span is usually indicative of health issues, specifically liver diseases, which are often correlated with BMI. Thus, understanding hepatic span's correlation with height, weight, and BMI can provide genuinely insightful observations about public health.

Gebremariam *et al.* [5] empirically establish a positive correlation between BMI and hepatic span. An increase in BMI leads to a concomitant increase in hepatic span, suggesting a key relation between the two. The implication is that abnormalities in body weight and height could potentially manifest themselves in the form of an enlarged hepatic span.

However, the relationship between hepatic span and biophysical profile is not unidimensional. Ejuiwu *et al.* [6] unveil the existence of a negative correlation between these variables in certain pathological states. Therefore, understanding the hepatic span does not merely hold implications for hepatology, the study of the liver, gallbladder, and biliary tree, but also for wider domains of health, including obesity, endocrinology, and so forth.

To wrap up, the correlation between hepatic span and the biophysical profile, comprising height, weight, and BMI, is manifold with intriguing implications for the understanding of human health. This inquiry contributes to the elaboration of the vast potential of hepatic investigations in complementing height and weight measurements. The spectrum of relationships posited between hepatic span and the biophysical profile urges further exploration into this sphere with greater depth and precision.

Faker Charles (2003) [7] state "Normative ranges for liver span are often developed from many data points combined in a normal distribution." The assertion signifies the complexity of determining normative liver spans. Liver span variations are often influenced by several factors, including height.

Physical attributes like height and weight form the Body Mass Index (BMI), a significant determinant in health studies. These parameters are often used to gauge overall health. Interestingly, they have also shown a relationship with hepatic function. This essay will delve into understanding the correlation between body indices and liver performance.

Our height is mostly pre-determined by genetics, yet the liver size can greatly vary during an individual's lifetime, influenced by factors such as obesity, age, disease, or malnutrition.

According to Juza & Pauli (2014) [8], a general rule for liver size has been 1 cm of liver span per inch of height.

It is essential to understand the correlation between liver span and height regarding medical diagnostics. It can help medical practitioners identify anomalies like hepatomegaly, where the liver is abnormally enlarged. This indication can help diagnose conditions such as liver disease, cancer, or metabolic disorders

In a study by Gupttu *et al.* (2015) [9], they said "Liver span positively correlated with height in children and adolescents." It indicates that growth patterns could influence liver size.

To truly understand the correlation, detailed research involving various demographics, age groups, ethnicities, and health parameters, needs to be conducted. For example, larger data from studies conducted across different countries and distinct environments would reinforce our understanding.

The predicated liver size based on height can give doctors an initial indication of liver health. However, various factors must be considered. For example, athlete's livers might deviate from the provided norms due to drastic morphological changes induced by extensive physical activity. Likewise, an individual's advanced age might not necessarily correlate with their liver size due to the potential presence of age-related health issues.

It is widely acknowledged by eminent organizations such as the World Gastroenterology Organisation and the British Liver Trust that the direct correlation between height and liver span is feeble.

Thapa *et al.* (2017) [10] concluded that liver span varies with age, sex, and body mass index, however, it does not show a significant correlation with height.

This assertion underlines the importance of personalized healthcare and evaluation. The association between liver span and height is a vital piece of this medical jigsaw puzzle. Still, it is only one of many elements that should be considered for providing the most accurate medical diagnosis and care.

1.1. Body Mass Index and Hepatic Function

Body Mass Index (BMI) is a measure that adults utilize to assess if a person has an optimal weight for a particular height (Bivins, 2019) [11]. It is calculated by dividing weight (in kgs) by the height (in m^2). A higher BMI can indicate obesity, often associated with fatty liver disease. A quantitative study by Younossi *et al.* (2018) [12], revealed that individuals with obesity are at a higher risk of developing non-alcoholic fatty liver disease (NAFLD).

1.2. Weight, Height, and Their Joint Influence on the Liver

Physical attributes like height and weight in isolation can also influence hepatic functionality. A higher weight generally dictates a higher fat mass. This fat can accumulate in the liver, causing issues like liver steatosis and progression to NAFLD (Schindhelm, Diamant, Dekker, Tushuizen, Teerlink & Heine, 2007) [13]. Contrarily, an individual's height does not directly affect the liver. Still, height variability can influence BMI, reflecting on liver health. Moreover, shorter height has been associated with metabolic syndromes inclining towards NAFLD, demonstrating an indirect influence (Kułaga *et al.* 2011) [14].

1.3. Height, Weight, BMI, and Hepatitis

Interestingly, the interaction between hepatic function and these body indices is not limited to Non-alcoholic fatty liver disease, NAFLD. According to research correlation between BMI, height, weight, and viral hepatitis studied by (Li, Zeng, Shi & Liu, 2017) [15]. Obesity has been observed as a risk factor for hepatitis progression, while height and weight, contributing to BMI, also become crucial factors.

1.4. Null Hypothesis

There is no significant correlation between hepatic span and height—Rejected.

Table 1 shows the regression equations for height, weight, and body mass index in relation to the various hepatic morphometry such as maximum hepatic span, craniocaudal hepatic span, and Ventro-dorsal hepatic span.

Table 1. A table showing bio-physical profiles and their corresponding regression equation.

Liver Parameters	Regression Equations		
Biophysical Profiles	**Maximum**	**Cranio-Caudal**	**Ventro-Dorsal**
Height	12.60x − 5.04	15.08x − 12.00	15.54x − 12.65
Weight	−0.04x + 16.80	0.03x + 11.62	−0.16x + 17.98
BMI	0.01x + 14.46	0.05x + 8.42	−0.03x + 15.39

2. Method

A total number of 30 research subjects were used and was ascertained using a radiological formula (Ibiabuo, P. B. 2023) [16]. This study was conducted at HMG Hospital Limited, Abonnema in Rivers State in affiliation with the University of Port Harcourt. Sonographic procedure on the abdomen at the midclavicular line, right subcostal margin was performed on subjects to measure the hepatic spans such as maximum, cranio-caudal and Ventrodorsal hepatic spans using an ultrasound scanning machine, sonostar model SS5 with a 3.5 MHz convex probe. The biophysical profiles such as height and weight were measured using a measuring tape and a weighing scale respectively. The study harnessed the capabilities of the python programming language with built-in libraries such as Panda and Numpy, a stalwart in the field of data science (Python Software Foundation, 2023) [17]. The python programming language's application in the study enhanced the analysis's efficiency, allowing for sophisticated data manipulations and explorations that otherwise would have been prohibitively complex.

The data obtained were also subjected to descriptive statistics and was further enriched by the employment of Pearson correlation coefficients, a statistical tool designed to reveal the strenght and direction of the linear relationship between two variables (Benesty *et al.*, 2009) [18]. When applied to this study's, P-value greater than or equal to 0.05 was taken as statistically significant.

Complementing this, descriptive statistics afforded a granular view of the data, offering a snapshot of the distribution and central tendency of the hepatic measurements. These statistics serve as the bedrock of data analysis, setting the scene for more intricate statistical tests and interpretations (Trochim, 2006) [19]

3. Results

Table 2 shows that the research subjects used were between the ages of 30 - 69, with female preponderance, and that the percentage of obese subjects out-weighs overweight and normal-weight subjects.

Table 2. Socio-demographic characteristics.

Variable	Frequency	Percent
Age (years)		
30 - 39	12	40.00
40 - 49	9	30.00
50 - 59	5	16.67
60 - 69	4	13.33
Sex		
Female	20	66.67
Male	10	33.33
Body mass index (BMI) (kg/m²)		
Underweight (18 <= 18.5)	-	-
Normal weight (18.5 - 24.9)	7	23.33
Overweight (25 - 29.9)	7	23.33
Obese (>=30)	16	53.33

Table 3 serves as important reference values for liver span, weight, height, and body mass index in the given population and help identify any deviation from the normal range.

Table 3. Mean and standard deviation of hepatic span, age, height, weight and body mass index.

Parameters	N	Minimum	Maximum	Mean	Standard Deviation
Maximum liver span	30	12.7	17.5	15.5367	1.51441
Cranio-caudal liver span	30	10	16.6	12.64	2.0987
Ventrodorsal liver span	30	7.9	16.1	12.7433	2.25567
Weight	30	64	109.3	82.8733	15.53241
Height	30	1.52	1.76	1.6337	0.07757
Body Mass Index (BMI)	30	23.45	41.09	31.9927	5.75652

Table 4 below shows a strong correlation between Maximum Liver Span and height, this is the same for Cranio-caudal Liver Span and height while the Ventrodorsal Liver Span negatively correlates with height.

Table 4. Correlation of the hepatic spans against age, height, weight, and body mass index.

Parameters		Age	Weight	Height	Body Mass Index
Maximum Liver Span	Pearson Correlation	0.184	−0.132	0.645**	0.232
	Sig. (2-tailed)	0.331	0.487	0	0.217
	N	30	30	30	30
Cranio-caudal liver span	Pearson Correlation	0.409*	−0.376*	0.558**	0.038
	Sig. (2-tailed)	0.025	0.04	0.001	0.84
	N	30	30	30	30
Ventrodorsal liver span	Pearson Correlation	−0.127	0.22	0.535**	−481*
	Sig. (2-tailed)	0.504	0.242	0.002	0.007
	N	30	30	30	30

Overview of Figure 1, Figure 2 & Figure 3

Figure 1 to Figure 3 below are the graphes showing the correlation between Height and Liver span (Maximum, Craniocaudal, and Ventro-dorsal). From our findings the correlation coefficient is 0.6452 for Maximum Liverspan in Figure 1, 0.5576 for Craniocaudal Liver span and 0.5347 for Ventro-dorsal. From this, we can conclude that Liver span is highly correlated with height.

Figure 2 and Figure 3 below shows fairly low correlations.

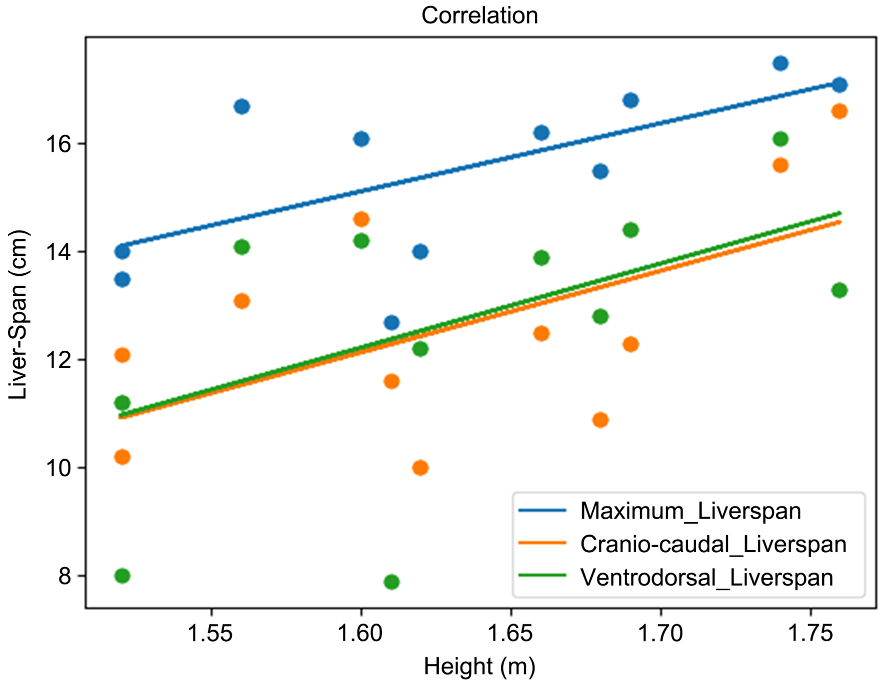

Figure 1. Scatterplot of liver span (maximum, craniocaudal, and ventro-dorsal) and height (m).

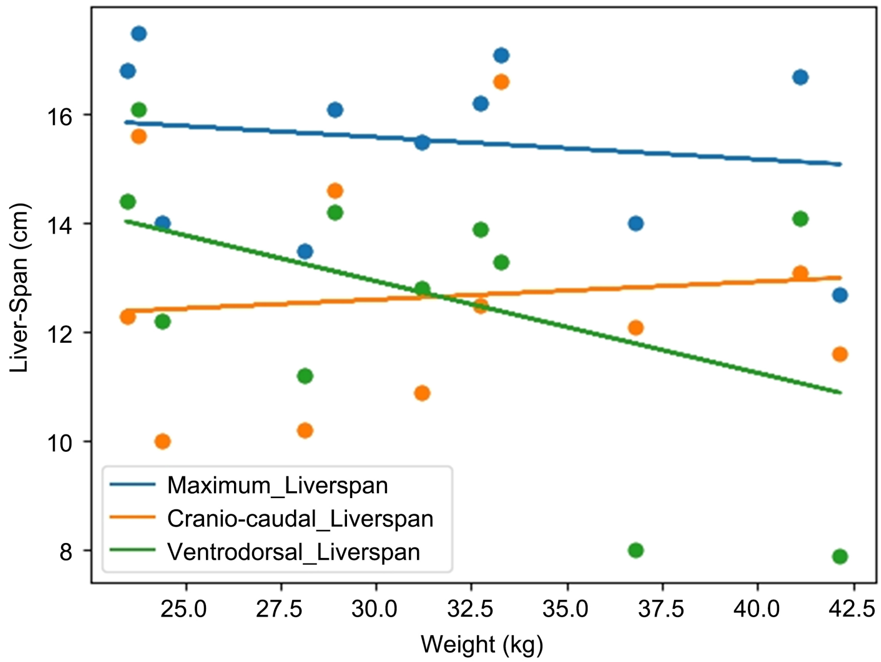

Figure 2. Scatterplot of liver span (maximum, craniocaudal, and ventro-dorsal) and weight (kg).

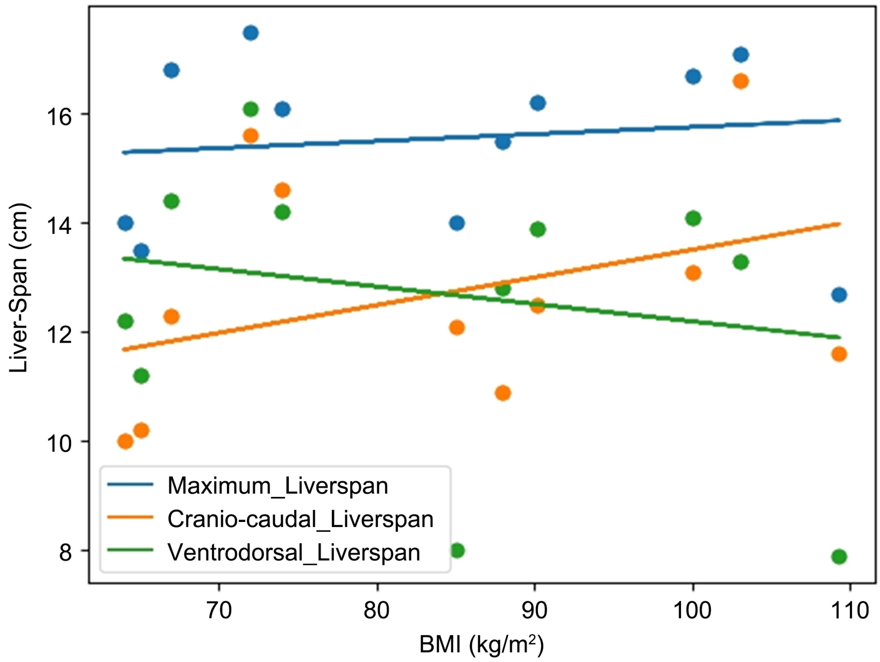

Figure 3. Scatterplot of liver span (maximum, craniocaudal, and ventro-dorsal) and BMI (kg/m^2).

4. Discussion

The relationship between height, weight, BMI, and hepatic function is intricate but significant. Obesity, contributed by unhealthy BMI, weight, and height, potentiates the liver's susceptibility to diseases. As the epidemic of obesity permeates society globally, these correlations become even more critical. The healthcare sector needs to pay more attention to these interactions to prevent and manage liver diseases effectively. The elucidation of the correlation between liver span and height is incredibly important to medical practice. While global normative ranges provide a starting point, it is noteworthy that a myriad of factors can influence this correlation, making individual assessments paramount.

In the confluence of clinical practice and medical research, the paramount objective remains the articulation and understanding of the human body's incalculable complexities. Core to this endeavor is the biophysical interrelation between disparate anatomical elements which, when robustly quantified, can precipitate leaps in diagnostic precision and therapeutic efficacy. A striking exemplar of such a relationship is encapsulated in the sobering elegance of the regression equation 12.60x + 5.04, which meticulously correlates the stature of an individual with the maximal dimensions of their hepatic organ. This correlation has led to the formulation of Belema's Law of Hepatic-Height Correlation, an axiomatic principle asserting the direct proportionality between the liver span and the height of a person (save for instances of pathologies influencing the liver either directly or in a removed capacity). This research posits that Belema's Law is a cornerstone in clinical applications, offering an indispensable tool for healthcare professionals and buttressing the edifice of personalized medicine, however, this study is not in tandem with the work of Thapa *et al.* (2017) [10], which asserted that liver span varies with age, sex, and body mass index, however, it does not show a significant correlation with height.

4.1. The Genesis of Belema's Law

Belema's Law originated from the rigorous analytical scrutiny of clinical data which discerned that, while variability exists, a linear relationship between an individual's height and the measure of their liver span is often present. The derivation of the specific regression equation was no mere act of academic intrigue, but emerged from the concerted investigative labour of researchers seeking to embed empirical precision into medical assessments. Addressing an intrinsic gap in clinical knowledge, this exploration ventured to provide a methodological compass by which the liver, an organ of pivotal import, could be evaluated with enhanced reliability. This research led to the establishment of Belema's Law, which serves as a valuable tool for clinicians in accurately assessing liver size based on an individual's height (Younoszai & Mueller, 1975) [20].

The biophysical profile, which includes measurements such as height, BMI, and weight, provides valuable information about an individual's overall physical health. One important aspect of physical health is the size and function of the liver (Petak *et al.*, 2013) [21]. Therefore, it is important to study the correlation between biophysical profile measurements and liver span (Kumar *et al.*, 2023) [22]. By analyzing data from various studies, it has been observed that there are correlations between certain biophysical profile measurements and liver span (Mubbunu *et al.*, 2018) [23].

Derivation of Belema's Law

$$h = 12.6x - 5.04$$

Assuming h is the maximum hepatic span of an individual and x is their height.

Liver span (h) is related to height (x) due to the similar developmental growth pattern of the liver and the body symmetry. Let's assume a proportional relationship between the two:

$$h \alpha x$$

We can write this as:

$$h = kx$$

where k is a proportionality constant.

To find the value of k, we used the fact that the liver span is approximately 2.5 - 3.5 cm shorter than the individuals's height (x). The average of this range was taken as 3 cm, and a set up equation becomes:

$$Kx - 3 = h$$

Finding the value of k. This study have shown that the maximum hepatic span is approximately 12.6% of the individual's height. So we can write:

$$K = 0.126$$

Substitute k into the equation:

$$0.126x - 3 = h$$

To match the original equation, multiply both sides by 100 (to convert percentage to decimal) and rearrange:

$$12.60x - 3 = h \ .$$

However, this study has put forward a regression correlation equation of:

$$12.60x - 5.04 = h$$

The constant such as 5.04 in the equation is approximately 2 standard deviations (SD) above the mean, indicating a larger liver span than average.

So, the original equation can be seen as an upper limit or a maximum value, while the equation with −3 represents the average value.

4.2. Clinical Importance

The utility of Belema's Law becomes most palpable within the clinical sphere, where uncertainties linger with obdurate tenacity. Physicians routinely rely on the palpable liver edge as a metric of organ size, the ascertainment of which is integral in diagnosing myriad conditions ranging from simple hepatic steatosis to ominous neoplasms. Inconsistencies in liver size estimations can spawn diagnostic ambiguities, a perilous prospect for patient care. By invoking Belema's Law, practitioners can tether their clinical cogitations to a statistical mooring, bolstering the diagnostic accuracy with the assurance of quantitative backing.

4.3. More than a Diagnostic Tool

The benefits transcending mere diagnostics are manifold, with Belema's Law aiding in the calibration of drug dosages, particularly for medications with hepatic metabolism destinations. A notable consideration is the individualized isoenzyme variability and the liver's role in drug clearance. Herein Belema's Law renders a service by contributing to the delineation of hepatic volume, which, when dovetailed with pharmacokinetic models, leads to a bespoke drug dosing regimen, an embodiment of precision medicine.

4.4. Defining the Outliers

The law accounts for the disease states that may alter the liver's size, offering a frame of reference upon which pathological deviations are gauged. It serves as a diagnostic beacon, enabling the swift recognition of anomalies. For example, conditions such as cirrhosis or cancerous growth may upend the normally proportionate heuristic. A liver span disproportionate to height, as governed by Belema's Law, directs the clinician's inquiry towards potential underlying ailments—thereby hastening interventions.

5. Limitations of the Study

Many underlying studies employ imaging techniques such as ultrasound, CT scans, and MRIs to measure liver span. Such modalities are operator-dependent and subject to inter-intraobserver variability, which may introduce inconsistencies in data, age less than 30 and above 70 and age-related changes, such as those due to senescence or the presence of age-related pathologies, are not encapsulated within the simplistic confines of Belema's law. Other hepatic pathologies create substantial limitations to this law.

6. Conclusions

In concordance with Belema's Law, it is evident that the Hepatic Span of an individual is conclusively tethered to their height barring pathological disruptions. Manifest within the utilitarian realms of diagnostics, drug dosification, and the illumination of disease-specific aberrations, its significance in clinical practice is indubitable. The incisive perspicacity of this correlation permits a nuanced approach to medicine, where general rules are tailored to the singularities of the individual. In summation, despite hypothesis testing and prospective scholarly debates, Belema's Law stands as a testament to the synthesis of scholarship and pragmatism, a beacon guiding the clinician through the nebulous waters of medical decision-making. Thus, in an age increasingly defined by the quest for personalised healthcare, Belema's Law emerges not merely as a methodological artefact but as a pivotal instrument of patient-centred medicine.

Reflective of a field perpetually in flux, continuous research must fortify Belema's Law, calibrating it against the advancing understanding of genetics, environmental factors, and hepatic physiology, only then can its place in the pantheon of clinical tools be wholly consolidated. As medicine marches onwards, Belema's Law, with its prophetic quantitative clarity, is destined to illuminate the path, one patient at a time.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

[1] Patzak, M., Porzner, M., Oeztuerk, S., Mason, R.A., Wilhelm, M., Graeter, T., *et al*. (2014) Assessment of Liver Size by Ultrasonography. *Journal of Clinical Ultrasound*, **42**, 399-404. https://doi.org/10.1002/jcu.22151

[2] Emamghorashi, *et al*. (2017) Correlation of Liver Span with Body Mass Index in Healthy School Children. Priority Ventures Group. https://www.pvg.com/child-liver-span-correlation

[3] Singh, S.P. and Anirvan, P. (2023) NAFLD in Indians: A Myopic Yet Alarming Perspective. *Journal of Clinical and Experimental Hepatology*, **13**, 7-9. https://doi.org/10.1016/j.jceh.2022.11.016

[4] Tetteh, J., Darko, N.D., Abaidoo, C.S. and Diby, T. (2021) Height Estimation Using Arm Span as a Proxy among Ghanaians. *International Journal of Anatomy and Research*, **9**, 7984-7990. https://doi.org/10.16965/ijar.2021.120

[5] Digssie, A., Argaw, A. and Belachew, T. (2018) Developing an Equation for Estimating Body Height from Linear Body Measurements of Ethiopian Adults. *Journal of Physiological Anthropology*, **37**, Article No. 26. https://doi.org/10.1186/s40101-018-0185-7

[6] Ejuiwa, C., Ezeteonu, A.I., Onyinye Mary, O., Sabastine, O.U. and Emmanuel, E. (2020) Estimation of Stature from Anthropometric Measurement of Chest Circumference and Weight of the Body amongst Indigenous Teenagers of Bekwarra and Obudu Local Government of Cross River State, Nigeria. *Journal of Bio Innovation*, **9**, 1258-1270. https://doi.org/10.46344/jbino.2020.v09i06.13

[7] Fikar, C.R. (2003) Making Sense of Liver Enzymes, Liver Function Tests, and Hepatobiliary Disorders at the Reference Desk. *Medical Reference Services Quarterly*, **22**, 15-22.

[8] Juza, R.M. and Pauli, E.M. (2014) Clinical and Surgical Anatomy of the Liver: A Review for Clinicians. *Clinical Anatomy*, **27**, 764-769. https://doi.org/10.1002/ca.22350

[9] Ghattu, V.K., Veena, S.R., Srinivasan, K., Osmond, C. and Fall, C.H.D. (2015) Linear Growth and Fat and Lean Tissue Gain during Childhood: Associations with Cardiometabolic and Cognitive Outcomes in Adolescent Indian Children. *PLOS ONE*, **10**, e0143231.

[10] Thapa, N.B., Shah, S., Pradhan, A., Rijal, K., Pradhan, A. and Basnet, S. (2017) Sonographic Assessment of the Normal Dimensions of Liver, Spleen, and Kidney in Healthy Children at Tertiary Care Hospital. *Kathmandu University Medical Journal*, **13**, 286-291. https://doi.org/10.3126/kumj.v13i4.16825

[11] Bivins, R. (2019) Weighing on Us All? Quantification and Cultural Responses to Obesity in NHS Britain. *History of Science*, **58**, 216-242. https://doi.org/10.1177/0073275319842965

[12] Younossi, Z.M., Koenig, A.B., Abdelatif, D., Fazel, Y., Henry, L. and Wymer, M. (2016) Global Epidemiology of Nonalcoholic Fatty Liver Disease—Meta-Analytic Assessment of Prevalence, Incidence, and Outcomes. *Hepatology*, **64**, 73-84. https://doi.org/10.1002/hep.28431

[13] Schindhelm, R.K., Diamant, M., Dekker, J.M., Tushuizen, M.E., Teerlink, T. and Heine, R.J. (2007) Alanine Aminotransferase Is a Marker of Non-Alcoholic Fatty Liver Disease Type 2 Diabetes Mellitus and Cardiovascular Disease. *Diabetes/Metabolism Research and Reviews*, **23**, 579-586.

[14] Kułaga, Z., Litwin, M., Tkaczyk, M., Palczewska, I., Zajączkowska, M., Zwolińska, D., *et al.* (2010) Polish 2010 Growth References for School-Aged Children and Adolescents. *European Journal of Pediatrics*, **170**, 599-609. https://doi.org/10.1007/s00431-010-1329-x

[15] Li, A.R., Zeng, F., Liu, M. and Shi, L. (2017) The Effect of Obesity on the Liver Diseases. *Journal of Liver & Clinical Research*, **4**, 1058. https://juniperpublishers.com/jlcr/JLCR.MS.ID.555643.php

[16] Ibiabuo, P.B. (2023) Ultrasonographic Findings of Selected Liver Parameters and Their Correlation to Lipidaemia in a Nigerian Population. *Journal of Biosciences and Medicines*, **11**, 18-29. https://doi.org/10.4236/jbm.2023.116002

[17] Python Software Foundation (2023) https://www.python.org

[18] Benesty, J., Chen, J., Huang, Y. and Cohen, I. (2009) Pearson Correlation Coefficient. In: Cohen, I., Huang, Y., Chen, J.D. and Benesty, J., Eds., *Noise Reduction in Speech Processing*, Springer, 1-4. https://doi.org/10.1007/978-3-642-00296-0_5

[19] Trochim, W. (2006) Descriptive Statistics. Research Methods Knowledge Base. http://socialresearchmethods.net/kb/statdesc/php

[20] Younoszai, M.K. and Mueller, S. (1975) Clinical Assessment of Liver Size in Normal Children. *Clinical Pediatrics*, **14**, 378-380. https://doi.org/10.1177/000992287501400410

[21] Petak, S., Barbu, C.G., Yu, E.W., Fielding, R., Mulligan, K., Sabowitz, B., *et al*. (2013) The Official Positions of the International Society for Clinical Densitometry: Body Composition Analysis Reporting. *Journal of Clinical Densitometry*, **16**, 508-519. https://doi.org/10.1016/j.jocd.2013.08.018

[22] Kumar, A., Kumar, N., Anamika and Satya (2023) Significance of Hepatic Enzymes: A Review. *International Journal of Advanced Biochemistry Research*, **7**, 95-100. https://doi.org/10.33545/26174693.2023.v7.i1b.170

[23] Mubbunu, L., Bowa, K., Petrenko, V. and Silitongo, M. (2018) Correlation of Internal Organ Weights with Body Weight and Body Height in Normal Adult Zambians: A Case Study of Ndola Teaching Hospital. *Anatomy Research International*, **2018**, Article ID: 4687538. https://doi.org/10.1155/2018/4687538