Electronic Biometric Detector and body composition index in predicting disease risk

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Abstract

According to the World Health Organization, COVID-19 has killed 14.9 million people worldwide by 2021. According to statistics from the World Obesity Alliance, if the domestic obese population exceeds 50% (three high diseases), the country's COVID-19 mortality rate will be 10 times higher. There seems to be a close relationship between obesity and the risk of hospitalization and treatment. In this study, the electronic biological information detector was used to collect the response values of the body cells of adults in Taiwan. Through the comparison and analysis of big data, the functional status of each organ system in the human body was calculated and compared with the body composition index. It was found that there is a high correlation between the two. The results of this study may provide feasibility of different health risk assessments.

Keywords: COVID-19, electronic biological information detector, big data, obesity, body composition index

1. Introduction

The aging of the global population has made people's lifestyles and living environment more complex and difficult. Sub-health issues derived from dietary content and habits are becoming more and more serious, leading to an increasing number of people with chronic Triple H (hypertension, hyperlipidemia, and hyperglycemia), rising major diseases and mortality rates. According to the 2017-2020 Nutrition and Health Survey in Taiwan, NAHSIT [1] conducted by the Health Promotion Administration, MOHW, the prevalence of obesity among adults over 19 years of age in Taiwan averaged 80.65% for men and 91.77% for women (Table 1). Researchers at the Chicago Medicine found that patients hospitalized for COVID-19 were more likely to die if they also had obesity, even when age, gender, and underlying disease were taken into account [2].

There appears to be a strong relationship between obesity and the risk of hospitalization and treatment. According to the information on the national health financial situation of the National Health Insurance Administration, MOHW, the medical expenses between 2011 and 2021 enhanced from 463.3 billion to 671.1 billion, with a significant increase of 45% in 10 years [3]. Therefore, it is a matter of great urgency to make it easier for people to understand their health risks and for health care professionals to help them make adjustments to stay away from the risk of obesity and reduce the country's financial burden on health care.

Table 1. Prevalence of obesity in adults (standardized by percentage of body fat)

Gender	Age (years old)	Number of samples	Excess fat percentage (%)
Male	19-30	250	65.06
	31-44	277	86.32
	45-64	621	82.95
	65 -	1008	85.99
	≧19	2,156	80.65
Female	19-30	256	89.94
	31-44	294	86.39
	45-64	678	94.25
	65 –	920	96.07

≧19	2,148	91.77

Source: 2017-2020 Nutrition and Health Survey in Taiwan, NAHSIT.

2. Theoretical Background

As the population continues to age, lifestyles and environments become more complex, leading to an increasing number of people suffering from chronic diseases and rising cancer incidence and mortality rates [4]. Much of the research in modern medical technology is focused on disease assessment and patient care. However, even if some of the risk factors are within normal limits, individuals are not necessarily completely healthy [5]. In the modern medical model, complex tests are used to obtain detailed data for diagnosis, which can be associated with high costs and wastage of resources. Diagnosing cancer early doesn't really improve the chances of survival, and it just lets patients know early when they get cancer [6]. Therefore, if health policies and resources are used for the purpose of treating the disease, it does not contribute significantly to improving people's quality of life and reducing the burden of national health care costs. COVID-19, which has emerged in recent years, is a highly contagious disease with viruses. There are currently 48,539,872 infections in 215 countries and 1,232,791 deaths [7]. National health and education policies around the world are under severe scrutiny and clinicians are facing major challenges, leading everyone to rethink the importance of preventive medicine and health promotion. Historically, healthcare has been biased towards curative medicine at the expense of preventive care, resulting in high levels of preventable disease and mortality [8].

With the development of information technology, collecting physiological data and health behavior data for analysis, and then providing health adjustment suggestions and services, has become a fairly complete service model. It is a trend in the development of big health industry [9] to build and cross-reference biological information data by using big data, artificial intelligence health management and cloud monitoring so as to observe changes in test values for disease risk prediction.

3. Materials and Methods

In this study, we applied the field of empirical research, both qualitative and quantitative, and combined theoretical and practical applications. The research content is that after using bioenergy test technology to detect the response signals of the subjects' body organs, through database comparison and analysis, the risk of hypertension and hyperlipidemia in chronic Triple H diseases (hypertension, hyperlipidemia, and hyperglycemia) is analyzed, and the data were then cross-checked with the body composition indices of the subjects to confirm the correlation between the two data. In this study, we attempted to construct an innovative service model for disease risk prevention, and the following is a detailed description of the research methodology.

3.1 Subjects

A total of 10 academic and project management workers, ranging in age from 26 to 70 years old, six females and four males, were enrolled in this study. Before participating in the study, the participants were informed of the study content and the precautions to be taken and signed a consent form for the use of their personal data. The results of the study will be used for academic research purposes only.

3.2 Research tools

A. Bio-Energy Testing Analyzer

The bio-energy testing analyzer technology originated from the health care sector of the former Soviet space agency program, and its research purpose was to monitor the body condition of astronauts in weightlessness. Over 35 years, tens of billions of dollars of national research funds have been spent to collect clinical data on tens of millions of test cases of different genders, ages and ethnicities. It is a scientific instrument that uses AI test and big data statistical analysis and comparison.

The principle of the device is to use the bio-cell resonance method to collect data for diagnosis and adjustment. The instrument uses a signal transmitter to send a signal to the brain. The corresponding organ part will generate the corresponding signal and return to the transmitter. The signal feedback time varies in speed and strength. The computer collects the relevant data, calculates and compares the similarity (data and line pattern) with the database to find out the risk of related diseases.

The instrument can test the 12 major systems of the body without the need to fast in advance, dressing or undressing, with a short testing time. If necessary, it can be used in conjunction with medical equipment for review and verification for the best treatment plan of the patient to achieve maximum therapeutic effect and minimum side effects and to reduce unnecessary waste of resources.

B. Body Composition Index (BCI)

The body composition index analyzer is the most commonly used device for weight management by ordinary people. The principle of obtaining the body composition index is the application of bioelectrical

impedance analysis (BIA). Impedance refers to the resistance to the flow of electricity (electrical resistance). Compared to muscle and blood, body fat and skin are less electrically conductive and have a higher impedance. Therefore, if the body weight is the same, the higher the body fat, the higher the impedance data will be. In this study, four items, namely body weight, visceral fat, body fat and basal metabolic rate, which are highly correlated with the risk of hypertension and hyperlipidemia, were selected for comparison.

3.3 Research process

Ten subjects were recruited and tested by the bio-energy testing analyzer and body composition index, and the obtained data were then cross-analyzed.

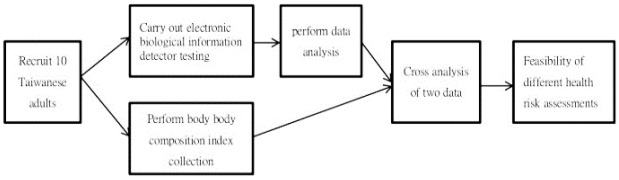

Fig. 1. Research process

3.4 Description of data interpretation criteria

There are two types of test data in this study, each of which has criteria for determining the risk of hypertension and hyperlipidemia or for warning signs of impending risk, as described below.

A. Bio-energy testing analyzer

In the three sub-categories of "Disease Classification," "Growth Factors" and "Pathological Pattern," there are items related to hypertension and hyperlipidemia, such as "atherosclerosis" and "vasculitis" representing possible triggers of hypertension, and "gallbladder dysfunction" representing possible triggers of hyperlipidemia. Please refer to Table 2 for the determination criteria.

Table 2. Bio-energy testing determining criteria

Number of testing	< 0.425	0.425 ~ 1	>1
Representative meaning	High risk	Medium risk	Low risk

B. Body Composition Index

Body Composition Index (BMI) is one of the most common references in modern medicine for determining body condition. Overweight, high body fat, high visceral fat and reduced basal metabolic rate are all clinically associated with the induction of hypertension and hyperlipidemia. When the value changes gradually increase or decrease, it is usually a reference for the time before or after the disease onset. Therefore, if the test data is not within the standard value range, an early warning will be given to the case. Please refer to Table 3 for the determination criteria.

Table 3. Body Composition Index (BCI) value testing criteria

Item	Name	Description
1	Weight	Normal body weight: The test value is within plus or minus 10% of the standard value. Obesity or underweight: The test value is more than plus or minus 20%.
2	Visceral fat	Normal visceral fat values for males are 4 to 6 and for females 2 to 4. Values between 10 and 14 are considered obese; values above 15 are considered dangerous.
3	Body fat	The normal body fat rate for men is between 15% and 25%, and the normal body fat rate for women is between 20% and 30%; adult male body fat rate more than 25%, adult female body fat rate more than 30% is obese.
4	Basal metabolic rate	The standard value is (13.7×weight (kg)+5×height (cm)-6.8×age) for male and (9.6×weight (kg)+1.8×height (cm)-4.7×age)+655 for female. If the basal metabolic rate is lower than the standard, it means weight gain occurs.

4. Research Results

The above two test methods, based on their academic theories or design principles, warnings to the risk of patients suffering from chronic diseases of hypertension and hyperlipidemia are provided. The results of the bio-energy testing analyzer test and the body composition index test for risk warning are shown in Table 4.

Table 4. Comprehensive evaluation form

Item	Bio-energy testing analyzer warning		Body Composition Index warning	
Number	Hypertension-related	Hyperlipidemia related	Hypertension-related	Hyperlipidemia related
A	■	▲	■	▲
B	■	▲	■	▲
C	■			
D	■		■	▲
E	■	▲	■	▲
F	■		■	▲
G	■	▲	■	▲
H	■	▲	■	▲
I	■	▲	■	▲

J	■	▲	■	▲

Note: "■, ▲" appearing in the same item in different testing methods represent the same recommendation for warning.

Cross-comparison results: For the seven cases, including A, B, E, G, H, I and J, the results of the bio-energy testing analyzer and the Body Composition Index (BCI) test for hypertension and hyperlipidemia were in 100% agreement.

Analysis of Case C: The bio-energy testing analyzer issued an alert for hypertension, mainly detecting the signals of "vegetative nervous system (VNS) vascular" and "vascular dysfunction." This symptom was related to autonomic nerves and should be related to project management work stress after consultation. However, the body composition indices were within the standard values and this result should be discussed.

Analysis of Case D: The body composition index was 4.3 kg, 3% and 2% above the standard values for body weight, body fat and visceral fat respectively, representing a slight risk. However, the basal metabolic rate was higher than the standard value of 42, which means that the body had good metabolic capacity. Therefore, the risk should be a short-term state.

Analysis of Case F: Body Composition Index (BMI) values for body weight, body fat, visceral fat and basal metabolic rate were 17.1 kg, 14.9% and 5% above the standard values respectively, representing a high risk of disease. Afterwards, the case was asked to provide a blood report, and the values of triglyceride (TG), cholesterol (TC) and low-density lipoprotein cholesterol (LDL-C) are all within the standard values (Table 5). This result should be discussed as there was no risk of hyperlipidemia in the case.

Table 5. Blood test items

Item	TG	TC	HDL-C	LDL-C
Test value	118	171	44.7	116.7
Test standard	30-150	130-200	35-85	0-130

5. Conclusions and Suggestions

The bio-energy testing analyzer measured the warning results for hypertension and hyperlipidemia, and the body composition index. The cross-comparison results of hypertension and hyperlipidemia were 90% and 80%, respectively.

The purpose of this study is to investigate the comparative analysis of electronic biomarkers and body composition index in predicting disease risk, and to verify the consistency through the data of the test results. It is expected to be applied to preventive medicine health management. The bio-energy testing analyzer uses test technology and big data to collect and compare data to provide detailed functional information of various systems of the body. If the bio-energy testing analyzer results can be used as the entry point for the first stage of a health management plan, and the warning information can be used to provide recommendations for follow-up care, it is the most complete service framework for preventive medicine.

The research scope of this project is only set to verify the hypertension and hyperlipidemia items of the chronic Triple H diseases, as the bio-energy testing analyzer provides very diverse and detailed information. It is recommended to increase the number of participating cases, test and analyze different occupational categories and age groups in the future research.

Conflicts of Interest

The author declares no conflicts of interest.

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Authors Introduction

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