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Original Research Article

FOODS OBSTRUCT AND OVERCOME DISEASES (FOOD): THE MISSING INTERDISCIPLINARY AND TRANSDISCIPLINARY PUBLIC HEALTH ART TILL COVID-19 PANDEMIC

R. Vinodh Rajkumar.

Physiotherapist & Anthropologist, Director – Prabhanjeet Fitness Research Institute OPC Private Limited, Bangalore, Karnataka, India.

ABSTRACT

The entireness of life is to gain energy to (i) support growth and maturation of the body (ii) defend and control diseases (iii) build survival skills and competence and (iv) lengthen the lifespan. Quite obviously, such magnificent energy is derived by consuming food in diverse mixtures and patterns. Are we curious and equipped enough to learn the efficacy of dietary practices at individual and community level? The well-known recommendation of Sir. Hippocrates has been "If we could give every individual the right amount of nourishment and exercise, not too little and not too much, we would have found the safest way to health". But in general, the health care system has been rarely giving importance to exercise and nutrition as the principal determinants to facilitate enhancement, restoration and maintenance of health and fitness of the individuals. On the other hand, the researches and advancements in the domains of Exercise and Nutrition have been establishing the realities of their tremendous health and therapeutic benefits. It is also clearly evident, neither the general public nor the patients are completely benefited by the modernized practices in the field of Exercise and Nutrition. The best example is patients who underwent Anterior Cruciate Ligament (ACL) surgical repair inevitably presenting thigh muscle atrophy that appears as a major setback for rehabilitation, though this surgical complication could have been prevented by adapting right amount of scientific nourishment and exercise. Is it not important for Physiotherapists to be critical about such adverse outcomes of the medical procedures? Therefore, Physiotherapists must expedite acquiring skills and experience to strongly participate in public health predominantly relying on Exercise prescriptions. In order to ensure the effectiveness, it also becomes indispensable for Physiotherapists to collaborate with the Dietitians, so that suitable hydration, calories and nutrients (macro and micro) are supplied to blend its therapeutic benefits with that of the exercises for general public health and specific rehabilitation regimens of communicable and non-communicable diseases. It is also need of the hour to augment interdisciplinary and transdisciplinary approaches in the medical field apt for the stressors of the contemporary world and the evolutionary stage of humans to not only ensure the healthy human life span but also the sustainability of human life on the Earth.

KEY WORDS: Exercise, Food, Nutrition, Diet, Body weight, Body composition, Somatotype, Public Health, Interdisciplinary approach, Transdisciplinary approach.

Address for correspondence: R. Vinodh Rajkumar, Physiotherapist & Anthropologist, Director – Prabhanjeet Fitness Research Institute OPC Private Limited, Bangalore, Karnataka, India.
E-Mail: dreamofkalam@rediffmail.com

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INTRODUCTION

Meticulous design of neuromusculoskeletal system is to be fit enough to resist succumbing to gravitational force, and of vital organs is to orchestrate homeostatic metabolism, for healthy life span. Hence, our most fundamental survival

schema is “Consume food to move. Move to collect food”. Food for movement and Movement for food ensures Metabolic Operations Vitalize Existence ‘MOVE’ [1]. Are we curious and equipped to learn the efficacy of dietary practices at individual and community level? From the perspective of kinanthropometry, to certain extent, sports nutrition could be revealing the benefits of dietary practices through functional capabilities and performances of athletes in competitions. But for general health, healthy longevity and recovery from illnesses, the conjoint role of exercise and nutrition is yet to be clearly established. “What is a healthy diet? Many clinicians find themselves at a loss to answer this common question from patients, that is unfortunate, because there are now enough solid strands of evidence from reliable sources to weave simple but compelling recommendations about diet [2].

Malnutrition and nutritional alterations, include disorders of food intake, nutrient absorption, and intermediary metabolism, play a significant and independent role in morbidity and mortality [3]. Although a long-lived elixir has not yet been found, physicians and scientists agree that nutrition has a major impact on the overall mortality and morbidity [4]. Another important health dimension, which at present has gained only very weak attraction, is the relationship between diet and functional status of the individuals. Despite a number of scientific studies of a variety of tools for functional assessment, there is to date no definitive tool for use in all individuals in all settings, necessitating the Nutrition scientists and clinicians to continue to collaborate with colleagues in physical and occupational therapy, geriatrics, and nursing to refine current functional assessment tools to more effectively correlate with nutrition and malnutrition assessment parameters [5].

Various health disorders and ageing process could lead to considerable amount of loss of muscle mass leading to functional deterioration, many times to an irreversible extent. In a consistent and reliable manner, the Dietitians need to understand techniques to appropriately identify losses of muscle and fat to incorporate them into a malnutrition diagnosis [6].

The domain of Nutrition has attained greatest advancements through exploration of bioactive compounds (anti-inflammatory, antioxidant, anti-cancer properties) in food and nutrigenomics. Bioactives from food waste can be extracted and utilized for development of nutraceuticals and functional foods and their beneficial effects have been attributed mainly to their antioxidant and radical scavenging activities which can delay or inhibit the oxidation of DNA, proteins and lipids [7]. Nutrigenetics (Nutrigenomics) is concerned with the effects of individual genetic variation (single nucleotide polymorphisms) on response to diet, and in the longer term may lead to personalised dietary recommendations and it is envisaged to facilitate prevention of diet-related common diseases [8].

The individual-specific differences in the food intake habits (calories, food composition or nutrient distribution, meal timing, frequency of meals) are well-known and its varied impact on the human physique is also visible. The relationship between food, physical activity and human physique can also be investigated through anthropometry (especially Heath Carter anthropometric somatotyping). Imbalance in input and output of calories could lead to malnutrition which we seldom try to figure out for maximizing general health or overcoming many communicable and non-communicable diseases. Greater underestimation of calories in the meals by overweight persons is a consequence of their tendency to consume larger meals [9]. Foods also get fortified to optimize health by reducing the risk of nutritional deficiencies. Fruit-enriched breakfast cereals have the potential to be a good source of antioxidants, iron, dietary fibre, vitamin C and total carotene [10].

Cooking and preservation methods of food have been noticed as important developments and variables of health. Paleolithic man discovered fire that led to cooking and preservation of foods and then cooking led to the invention of cooking utensils, braziers for heating, and, eventually, to pottery and metallurgy [11]. In a large population-based cohort study, eating home cooked meals more frequently was associated with better dietary quality and lower

adiposity [12]. Despite all these developments in the field of Nutrition, we are still facing challenges to prevent and cure diseases of people in all age groups, regardless of their lifestyle. A comprehensive campaign of health promotion is required to begin to address the development of risk behaviors – especially those associated with an increasingly sedentary, calorie-rich, and "Westernized" urban lifestyle – that are contributing to a rapidly increasing burden of Non-communicable diseases [13]. Analyses of the socioeconomic distribution indicated that between 70% and 90% of the population burden of diabetes, hypertension, and obesity was among the higher socio economic status groups, and this figure was similar across states in India [14].

In India there is an increasing trend in hypertension prevalence among the general population and an increasing trend was found in the prevalence of hypertension in adult tribal populations across three decades, so concerned policy makers should focus on the changing health needs of tribal communities [15]. If not scientifically monitored and regulated, both food availability and unavailability could engender serious health risks or even lead to major disasters like COVID-19 pandemic. Food is directly linked to fitness, survival, morbidity and mortality. A re-assessment of the mortality statistics and the medical observations leads to the conclusion that starvation, rather than climate or social displacement, accounts for the bulk of deaths [16].

The 21st century provides new information, new challenges and with new technologies and political changes, it is hoped that a healthier, more disease-free, and better-nourished population will emerge [17]. But in the evolution of disease trends, intersection of communicable disease and non-communicable diseases (Epidemiological Intersection) could lead to disastrous outcomes across the globe [18]. Numerous empirical evidences exist to reveal the weak or absent inter-disciplinary and transdisciplinary public health model, although each sub-discipline of medical field has almost attained the pinnacle of their best scientific developments within their professional ambit. This deficiency in the medical field must be addressed as early as possible before the trajectory of human evolution begins to move in the direction of recurrence of epidemiological intersections, pandemics and eventually extinction of humans.

METHODOLOGY

To elucidate the technical deficiencies (lack of interdisciplinary and transdisciplinary health care model) encountered in the services for general health and medical rehabilitation by citing two clinical scenarios.

Scenario – 1: 45 years old male with left knee ACL surgical repair done on 14.02.2020. When the patient approached a private Physiotherapist on 16.03.2020, he was found walking with the support of one elbow crutch on the wrong side (on the left side) and it was immediately intervened by the Physiotherapist. Salient findings of the assessment done by the Physiotherapist are shown in Table-1 and Table-2.

Table 1: 45 years old male with left knee ACL repair.

Weight	**75 Kg**
Height	171 cm
Fat % (7 sites Skin fold thickness test)	32. 5
Somatotype (Heath Carter)	8.9: 3.9: 1.1 (Mesomorphic Endomorph)
5 meters walk test without the support of any walking aid (based on the space availability)	21 seconds, 0.86 Km/h speed
Prone lying active knee flexion range (Goniometry)	Right: 125° – 130° Left: 110°
Grip strength (Dynamometer)	Right hand = 50 Kg Left hand = 55 Kg

Table 2: Lower limb girth measurement as on 16.03.2020 (a month later post-surgery).

	Right Lower Limb	Left Lower Limb
Thigh (8 cm above patella)	40 cm	39 cm
Thigh (20 cm above patella)	53 cm	48 cm
Calf (11 cm below patella)	34.5 cm	33 cm

The walking speed got improved to 2.8 Km/h on 19.03.2020 after three exercise sessions. Further progressions could not be made because the lockdown phases of COVID-19 pandemic repeatedly interrupted the rehabilitation under the Physiotherapist.

Scenario – 2: 45 years old male who underwent Cardiac Surgery abroad (Sierra Stent) on 22.05.2019 approached a private Physiotherapist on 02.11.2019 for supervised exercise-based cardiac rehabilitation. Salient findings of the assessment done by the Physiotherapist are shown in Table- 3, 4 and 5.

Table 3: 45 years old male who underwent a Cardiac Surgery for myocardial infarction.

Weight	**70 Kg**
Height	177 cm
Fat % (7 sites Skin fold thickness test)	28.5
Somatotype (Heath Carter)	7.6:4:2.5 (Mesomorphic Endomorph)
Heart rate at rest	76 beats per minute
Blood pressure at rest	90 / 60 mmHg
Grip strength (Dynamometer)	Right hand = 63 Kg Left hand = 76 Kg
Standing long jump	178 cm (improved up to 220 cm in two months, after 20 exercise sessions)
Sprinting speed (28 meters at Basketball court)	20.5 Km/h (Step length = 145 cm approximately)

Table 4: Sprint speed and Standing long jump of the Cardiac Surgery patient was found better than other males who were opted for RPM maximum test as discussed in table – 5. All these males belonged to Mesomorphic Endomorph Body type.

	Cardiac Surgery patient	A (46 years)	B (39 years)	C (45 years)
Weight	70 Kg	83 Kg	94 Kg	80 Kg
Height	177 cm	173 cm	172 cm	177 cm
Fat %	28.5	33	32	30
Somatotype	7.6 : 4.0 : 2.5	7.0 : 4.6 : 0.1	9.8 : 7.9 : 0.1	8.9 : 3.7 : 1.6
Sprint speed	20.5 Km/h	18.7 Km/h	17.7 Km/h	20 Km/h
Standing long jump	220 cm	154 cm	190 cm	170 cm

Table 5: Comparison of RPM maximum test from resistance level 1 to 10 using static cycle (Technogym equipment). Recommendation: 5 to 10 seconds fast-paced work with rest after each level is personal choice (usually the rest ranged from 30 seconds to 60 seconds to reduce the exertion). All these males were allowed to adjust and opt the seat height which comes close to their hip level from the ground when they stand next to the cycle. Individuals A, B and C apparently had no major health ailments in the past. Various other variables are beyond the scope of this discussion.

Resistance Level	RPM (Revolutions per minute)			
	Cardiac Surgery patient	A (46 years)	B (39 years)	C (45 years)
1	195	216	175	166
2	197	210	156	184
3	193	207	165	182
4	186	200	174	176
5	191	195	159	171
6	190	188	163	166
7	188	184	159	173
8	186	177	160	169
9	186	176	151	163
10	187	169	169	150
Time taken and Distance reached	9 minutes, 50 seconds. 2.54 Km	8 minutes, 45 seconds. 3.6 Km	6 minutes, 40 seconds. 2.47 Km.	10 minutes. 2.82 Km

Interpretation: In the scenario-1, the thigh muscle atrophy could have been prevented if the patient was given the right dosage of nutrition and exercise from the early stages post-surgery. Quite consistently, including this patient, about 5 – 10% of thigh muscle loss (especially mid-thigh muscle mass) were found in many other ACL surgery patients as well, chiefly due to immobilization and inadequate exercise dosage post-surgery.

All these patients commonly accepted that their thigh girth was not assessed pre-surgery and post-surgery in the respective hospitals where they received ACL reconstruction. Girth measurement offers indispensable information and does not require complex procedures but just only

needs an inch tape (cost of an inch tape is also not more than 20 INR). So, it is obvious that either the impact of the ACL reconstruction on the thigh muscle mass is unknown/unnoticed/ neglected in the medical field or the art of preventing the thigh muscle atrophy is not yet acquired through conjoint scientific inquisitions of experts of relevant sub-disciplines in the medical field. Though it might look like a negligible atrophy but they could hamper major functions of lower limb like walking, single leg balance, lunges, squats, stair climbing, jumping and running, so the rehabilitation cannot be claimed successful merely on the basis of restoration of a slow independent walking. Therefore, a long-term interdisciplinary follow up care is mandatory to prevent secondary complications of such surgical interventions. In the scenario-2, the functional status of cardiac surgery patient as revealed by various physical efficiency tests either equals or surpasses the performances of many other apparently healthy individuals of his age group and even younger age groups. Complete fitness data of this cardiac surgery patient were not fully mentioned in the table 3, 4 & 5, but his ability to tolerate challenging structured exercise programs (strength and conditioning, endurance runs, rowing) has been commendable. Before developing the cardiac ailment that necessitated surgical intervention abroad, he had been regularly doing yoga and outdoor running. In fact, during that stage, he had only once visited the same Physiotherapist for a different purpose when he had no major medical ailments and, a body composition test was done for him as a part of health education. The data of his early body composition was fortunately available to compare the impact of the unexpected cardiac ailment (Table – 6).

Table 6: Unhealthy weight reduction accompanied by loss of lean body mass and increased fat percentage. Cardiac surgery was performed on 22.05.2019.

BODY COMPOSITION ANALYSIS	22.09.2018	02.11.2019
Body weight	74 Kg	70 Kg
Fat % (7 sites skin fold thickness test)	27.6	28.6
Fat free mass (Lean body mass)	53.5 Kg	50 Kg
Fat Mass	20.5 Kg	20 Kg

Despite the development of unfavourable body composition associated with muscle loss, he could exhibit athletic efficiency and able to show progressions in various key fitness determinants. The major drawbacks in his cardiac rehabilitation have been (i) the patient's unchangeable apprehension of developing the recurrence of myocardial infarction (ii) the medicines that were evidently prescribed to be consumed the rest of his life (iii) the Cardiac surgeon had recommended him to exercise in specific heart rate zone, not more than 100 beats per minute, so this patient constantly monitors his heart rate monitor in fear throughout the exercise session after every single set of any exercise and, (iv) the lack of direct communication between the physiotherapist and the cardiac rehabilitation team abroad. These drawbacks and the patient's athletic abilities show that the technical advancements in the field of exercise and its therapeutic benefits are not yet fully utilized in the sphere of cardiac rehabilitation.

However, through encouragement, the Physiotherapist could overcome his apprehension to certain extent and extracted the hidden athletic abilities of the patient. Also, the additional impediment is inability to get the rationale for the medicines (about 5 medicines) to be regularly consumed by this patient. His blood pressure remains in the range of 90/60 mmHg due to these medications. Among the four types of cardiac performance (Table -7), it gives an impression that these medicines are aimed to obtain Type-3.

Table 7: Different types of cardiac performances. Type-2 can be regarded as the best performance at rest (like athletes' bradycardia). Type -1 can be naturally expected during the exercise. Type-3 and Type-4 resemble the cardiac abnormalities, Tachycardia and Bradycardia, respectively.

Cardiac Performance	Cardiac pump	Heart rate
Type - 1	Strong	High
Type - 2	Strong	Low
Type - 3	Weak	High
Type - 4	Weak	Low

So, is weakening the cardiac pump to this extent of low blood pressure an ideal pharmacological strategy to prevent recurrence of his cardiac ailment? Is this kind of trade-off approach in the medical field need to be revisited? Is it impossible to deliver precise medical prescription without producing the side-effects?

DISCUSSION

Both communicable and non-communicable diseases should be handled by interdisciplinary approach failing which the patients will receive medical injustice in many occasions. Interdisciplinary model of health care will eventually result in transdisciplinary approach, which is the need of the hour for development of a school of thought in the field of medicine apt for the evolutionary stage of humans and stressors in the contemporary world. Food is enriched with calories, micronutrients and infinite pharmacological properties. Health and disease management should always revolve around proper hydration and food regulation, augmented by structured exercise dosage and sufficient rest/sleep. Low water intake is associated with negative health and performance outcomes and, we need large scale studies and randomized control trials to investigate how increased water intake impacts health and well-being [19]. Although much solid information on optimal diets has emerged, the full picture of the relationships between diet and health will take years of further research to fill in [20]. Although an understanding of what foods are best for health is a step forward in nutrition, other major challenges are getting high-quality food to the masses and food sustainability [21].

The infrequency of severe mortality crises and the low prevalence of famine and disease are characteristics of modern industrial and post-industrial societies but understanding the processes leading to their decline, and the associated improvements in living standards and life expectancy, is a precondition for knowing what is needed to prevent their re-emergence [22].

Food selection is viewed as a potentially sustainable and non-pharmaceutical method of improving symptoms and, for some disorders, it has become the only (or simplest) proven treatment method [23].

By increasing our understanding of interactions between diet, immunity, and the microbiota, we might develop food-based approaches to prevent or treat many diseases and there now is scientific evidence to support the adage “we are what we eat,” and this process begins in early life [24]. All hospitalized COVID-19 patients must undergo a meticulous nutritional assessment and a malnutrition screening including anthropometric parameters, impedance and vector analysis, hematochemical parameters and intake assessment [25]. Gut microbiota interacts with host immune system in ways that influence the development of disease and there is an immunological link between the gut and the lung, ‘the gut-lung axis’ [26]. As in pharmacogenomics, where a drug will have diverse impacts on different segments of the population, researchers recognize that only a portion of the population will respond positively to specific nutritional interventions, while others will be unresponsive, and still other could even be adversely affected [27].

There was a large degree of variability in error of calorie estimation for both exercise and food, indicating that many individuals have a poor understanding of calories [28]. Recent research showed that foods made with refined carbohydrates rich in sugar and fat promote resistance to satiation because they interfere with the messages sent to the brain that normally signal the animal to cease food ingestion. if we want to institute healthy alimentation, then we must direct our attention to the feeding behaviour of our species during the Paleolithic hunter-gatherer phase and make appropriate changes [29].

Undoubtedly, sufficient literatures pertinent to food substantiate the extent to which the nutritional and pharmacological properties of food have been researched so far and the need for individual-specific diet plans and nutrition education to the public. In the present conditions, the biggest setback is the isolated way of functioning of various sub-disciplines of the medical field that makes the health care practice often futile. The neglect of prescribing or incorporating cutting-edge science of food and exercise for the general and special populations to achieve maximum functional restoration cannot be refuted. This circumstance is currently in favour of quackery as we can easily find a large number of fitness trainers lacking relevant educational background pretending as experts in both exercise and diet prescription. The illegitimate practice of such fitness trainers must be banished as early as possible

before they become deep-rooted cause for sabotaging the noble tenets of public health.

Homocysteine is one best example of the meticulous revelation of the interconnection between the aetiology and pathogenesis of hyperhomocysteinemia and the role of nutrition to prevent its cardiovascular risks. Homocysteine is an independent cardiovascular disease risk factor modifiable by nutrition and exercise, by its adverse effects on cardiovascular endothelium and smooth muscle cells with resultant alterations in subclinical arterial structure and function [30]. Hyperhomocysteinemia can also arise from nutritional deficiencies of folate, vitamin B_6, and vitamin B_{12} [31]. It is advisable to increase fruit and vegetable consumption, which could lower homocysteine concentrations [32]. This kind of comprehensive knowledge about advancements in the field of food science must be well-informed to the experts of sub- disciplines dealing with disease prevention and health promotion. At the same time, the Dietitians should also be enthusiastic to know the functional status (physical efficiency or fitness parameters) of the general and special populations working in coordination with Physiotherapists and Exercise Professionals to gain abundant experience to customize the diet for individual-specific requirements. The field of Exercise and Nutrition basically relies on non-invasive diagnostic procedures to gather data about anthropometry, body composition and fitness components, so collaborated functioning of these two domains will not be troublesome and also it is highly possible for them to become strong pillars in the field of medicine and simplify the public health and clinical approaches.

It is important to formulate numerous simple, inexpensive and non-invasive diagnostic tools in the health education and health care system [33]. For example, Dietitians should be able to interpret the clinical findings in the scenario – 1 (Table 1 and 2) to ensure the nutritional plan to support prevention of thigh muscle atrophy or restoration of lost muscle mass, so that the patients can withstand the exercise techniques and concomitantly retain or regain the muscle mass for improving the functional independence or even returning to sports. Biomechanically speaking, even small amounts of loss of muscle mass will have greater impact on posture, flexibility, strength, endurance and various other functions of daily living and occupational tasks. The nutritional benefits and therapeutic effects of food should be studied curiously and thoroughly in coordination with the relevant experts to overcome all types of health challenges posed by environment, lifestyle, ageing, pregnancy, musculoskeletal ailments, injuries, congenital disorders, metabolic errors, hormonal imbalances, infectious diseases and genetics.

Ethnobiologically, "Food" can be classified as: (i) Main food, which satisfies hunger; (ii) Supplementary food, the type or form of food that can be used as additional or subsidiary to the main food (such as fruits, salad and healthy drinks—milk, juice etc.); (iii) Food items—this category should include: (a) Precautionary food; (b) Food ingredients that could be used as powder, paste, drinks, dry leaves extraction [34]. The basics of this ethnobiology of food should be made aware to all the medical experts of diverse medical disciplines, so the first thought about health and disease must be (i) what went wrong in diet and physical efficiency? (ii) how to heal or maximize the functions through nutrition and exercise? Human existence and their health rely on their intellectual interactions with ecosystem which eventually accompanies brilliant technological innovations [18]. Somatotype diversity is unimaginably vast and among thirteen major somatotypes, it was found that a larger percentage of population display 'Mesomorphic Endomorph' body type, though they differ a lot among themselves in appearance, body mass index, fat percentage and functional status [35].

Therefore, from the perspective of somatotype diversity and the tendency of human body to transform into a better or worser somatotype due to the influence of various factors, everyone must periodically review the consequences of their dietary practices and lifestyle modifications under the supervision of Dietitian, Physiotherapist, Exercise Professional and other relevant medical specialities. Regardless of the nutritional composition and plan of individual's choice, DIET must be aimed at improving the functional capacity, thus can be remembered or

regarded as Diet Improves Exercise Tolerance.

CONCLUSION

Food is the sole determinant of evolution and extinction. With the present knowledge and empirical evidences, the medical field must actually serve as an axis for agriculture to channelize the production and necessitate the supply of nutritious food to the people coupled with stringent policies of Government. Human existence might be in great trouble due to incessant health miseries (like COVID-19), so as the first step, the incorporation of advancements in nutrition in every aspect of health care should be given prime importance equitably across the socioeconomic gradients. All the divergent focus of sub-specialities working towards betterment of general and special populations must converge as 'maximizing the function of the body and the life span' as one single goal, completely devoid of trade-offs. Genetics, Epigenetics, Nutrition, Exercise and Somatotype (G.E.N.E.S) can be amalgamated to enhance the precision of all the strategies of public health (disease prevention, rehabilitation, health promotion). Utilization of G.E.N.E.S. requires involvement of all disciplines in the medical field to prevent or manage almost all the diseases including the highly intimidating disasters like COVID-19. Food should not only be regarded as the base for the survival or life, but as the principal divine energy in health care practices dealing with all the diseases, ageing and lifespan. Initially the Dietitians, Physiotherapists and Exercise professionals should understand that their expertise can never work independently, hence integrating their roles should become an eternal trend. Subsequently, the inter-disciplinary and transdisciplinary health care approaches and researches in the medical field must be expedited and strengthened keeping "Foods Obstruct and Overcome Diseases" as the foundation to construct an indestructible and immortal school of thought.

Conflicts of interest: None

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