

Original research papers

Modeling Food Energy in Bioenergetics

Abstract

The measurement of net food energy is in great coup on the helm of designing an apt dieting. The prevailing procedures in this ground are relatively time consuming, laboratory tests induced and often the confusing data contributors while planning a balanced dieting in nutrition counseling. The dietician is often in confusion in planning a perfect dieting to hold up nutritional soundness of the sample at a population in a community. The aim of this current study is to make a dot over these enduring perils exploring a mathematical modeling to be used in an apt dieting in nutrition counseling. The study saga can directs a biophysical modeling to be used in energy balancing in bioenergetics to shirk the frequently of ongoing health horrors in worldwide nutritional epidemiology. The study verdict is the π modeling in biological mathematics in name of determinant of net food energy (DNFE) in nutritional physics on the envelop of a linear equation (16) which can be a superb mathematical modeling as a dieting tool in bioenergetics in worldwide nutritional physics and health statistics.

Keywords

Mathematical Modeling, Bioenergetics, EYDPH, Nutritional Physics, DNFE, Health Science.

1. Introduction

About 2 billion people in the world suffering from different forms of malnutrition [1]. Malnutrition is an underlying cause of death of about 2.6 million children each year [2-4].

Malnutrition is the leading causes of stunted growth and increasing mortality and morbidity rates [5-8]. About 4 of each 5 malnourished children in South-East-Asian (SEA) regions contributing about 83% of their deaths due to mild to moderate malnutrition [9-11]. Malnutrition in developing countries is on action due to poverty, household food insecurity, gender bias, population pressure, food taboos, health, hygiene and nutritional negligence, famine and man-made disasters [12-18]. Malnutrition also occurring for intra-family feud, lower class livelihood, child abuse, deprivation of schooling opportunity and consequence of faulty family planning practices in their families [19-22]. These nutritional giants are engulfing the population and therefore initiatives are in need of galore need to avoid these malnutrition facing factors [23-25].

Therefore, this study was conducted to form an effective dieting tool to help the dietician to plan the proper dieting for both the therapeutic and normal diet aiming to turn tail the ongoing malnutrition headache across the globe and the government and different international and national NGOs are urged to organize health and nutritional campaigning to

aid the population to practice a healthy diet using this study proposed π modeling of food energy in bioenergetics in nutrition counseling.

2. Methodology and Data Sources

The study was a cross-sectional study using secondary data analysis method. The data were collected from the biophysical equation of dietary energy, fuel factor of foods, the TEF content and the mass of consuming nutrients in bromatology. The π modeling of equations from mathematics was in application to undergo in analyzing all the data using mathematical modeling to hit upon a chic and time saving biophysical modeling to calculate net food energy needed for individuals in the communities due to consumption of foods aiming at curbing malnourishment maintaining an apt dieting in nutrition counseling.

3. Results in Biological Mathematics and Nutritional Physics

Food energy is the amount of energy released in human body through the digestion and absorption of foods associated in a diet [26-29]. Biophysically, it is the product of fuel factor and mass of consuming nutrients in food science [30-33].

So,

$$E_f = fm;$$

Where,

f = fuel factor of food,

m = mass of food in g and

E_f = food energy in kcal

$$\dots\dots\dots$$

$$(1)$$

The human diet comprises three main sources of dietary energy naming carbohydrates, proteins and fats among the six components in the diet and alcohol in lesser degree [34-36].

Let,

The fuel factors of carbohydrates, proteins, fats and alcohol be f_c , f_p , f_f and f_a kcal g^{-1} to be responsible to yield $(E_d)_c$, $(E_d)_p$, $(E_d)_f$ and $(E_d)_a$ kcal of dietary energy for corresponding consumption of m_c , m_p , m_f and m_a g of carbohydrates, proteins, fats and alcohol respectively.

So, considering the equation (1) in the gesture of carbohydrates, proteins, fats and alcohol consumption,

$$(E_d)_c = f_c m_c \dots\dots\dots$$

$$(2)$$

$$(E_d)_p = f_p m_p \quad \dots\dots\dots (3)$$

$$(E_d)_f = f_f m_f \quad \dots\dots\dots (4)$$

$$(E_d)_a = f_a m_a \quad \dots\dots\dots (5)$$

Adding the equations (2), (3), (4) and (5),

$$(E_d)_c + (E_d)_p + (E_d)_f + (E_d)_a = f_c m_c + f_p m_p + f_f m_f + f_a m_a \quad \dots\dots\dots (6)$$

None but carbohydrates, proteins, fats and alcohol are the dietary energy yielders in bromatology [37].

Hence,

$$(E_d)_c + (E_d)_p + (E_d)_f + (E_d)_a = (E_f)_T ;$$

Where,

$$(E_f)_T = \text{Total food energy}$$

$$\dots\dots\dots (7)$$

Putting the value of equation (7) in equation (6),

$$(E_f)_T = f_c m_c + f_p m_p + f_f m_f + f_a m_a \quad \dots\dots\dots (8)$$

The fuel factors of carbohydrates, proteins, fats and alcohol representing f_c , f_p , f_f and f_a are 4, 4, 9 and 7 kcal g^{-1} [38-41].

So,

$$f_c = 4 \quad \dots\dots\dots (9)$$

$$f_p = 4 \quad \dots\dots\dots (10)$$

$$f_f = 9 \quad \dots\dots\dots (11)$$

$$f_a = 7 \quad \dots\dots\dots (12)$$

100 Inserting the value of equations (9), (10), (11) and (12) into equation (8),

$$\begin{aligned}
 101 \quad (E_f)_T &= 4m_c + 4m_p + 9m_f + 7m_a \\
 102 \quad &= 4m_c + 4m_p + 4m_f + 5m_f + 4m_a + 3m_a \\
 103 \quad &= 4m_c + 4m_p + 4m_f + 4m_a + 5m_f + 3m_a \\
 104 \quad &= 4(m_c + m_p + m_f + m_a) + 5m_f + 3m_a \\
 105 \quad &= 4 \sum m_{c, p, f, a} + 5m_f + 3m_a \dots\dots\dots (13)
 \end{aligned}$$

106 The equation (13) is a meaningful mathematical statement to express the total energy gained
 107 through various sources of foods consumption and therefore this biophysical myth can be
 108 termed as the energy yielding determinant of the power house (EYDPH) or power house
 109 modulator in cell biology [81, 83, 84].

110 The net food energy yields in the body can be found considering the TEF content in
 111 bioenergetics [45, 46] as per the following equation in nutritional mathematics,

$$\begin{aligned}
 112 \quad (E_f)_n &= (E_f)_T - \text{TEF} \\
 113 \quad &= (E_f)_T - 10\% \text{ of } (E_f)_T \\
 114 \quad &= (E_f)_T - 0.1(E_f)_T \\
 115 \quad &= 0.9 (E_f)_T
 \end{aligned}$$

116 Where,

$$\begin{aligned}
 117 \quad (E_f)_n &= \text{Net food energy} \\
 118 \quad &\dots\dots\dots (14)
 \end{aligned}$$

119 Inserting the numeric value of π in mathematics in equation (14),

$$\begin{aligned}
 120 \quad (E_f)_n &= 0.9 \times 7/22 \times 22/7 (E_f)_T \\
 121 \quad &= 0.3 \pi (E_f)_T \\
 122 \quad &\dots\dots\dots (15)
 \end{aligned}$$

123 Putting the value of equation (13) into the equation (15),

$$\begin{aligned}
 124 \quad (E_f)_n &= 0.3 \pi (4 \sum m_{c, p, f, a} + 5m_f + 3m_a) \\
 125 \quad &\dots\dots\dots (16)
 \end{aligned}$$

126

The equation (16) can be used to determine the net food energy in nutritional physics and health statistics as so this linear equation could be a bold determinant of net food energy (DNFE) in health science and nutritional physics [47-53].

4. Discussion

Human health is the level of function or metabolic ability of individuals or communities to adapt and self-manage during physical, mental and social challenges [54-56]. The WHO defines health in a broader sense on its 1948 constitution as “a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity” [57]. To maintain healthy health is really harder due to different physical, social, economic and environmental affecting factors. The people are often deprived of their country’s constitution named basic health, hygiene, nutritional care and shelter [58-60]. The population is want of balanced diet for frequent occurring dieting malpractices and the dieticians are in search of a time saving and easy method in measuring total dietary energy needed for the observance of healthy population [57] in the community. There are different degree of health and nutritional problems such as concept of mass, dietary energy, fuel factor, TEF content and the information gap between the dietary energy and net dietary energy in nutritional physics. The study proposed determinant of net food energy (DNFE) in bioenergetics can be a solvable bid in overcoming different problems during designing an apt dieting in nutrition counseling [61-64]. The present study result is cut and dried by adding the fuel factor of alcohol along with other energy yielders naming carbohydrates, proteins and fats. The $(E_f)_n$ evaluating method is cut short using the upshot of the study [equation (16)] in name of the determinant of net food energy (DNFE) in nutritional biochemistry. This study proposed determinant of net food energy (DNFE) can be an effective spatial microsimulation modeling [65-68, 88-93] to be constructive in designing policies for the governments and NGOs for environmental and spatial effects across different countries [69-72] in the world to aid healthy dieting practices [73-75] for sustaining sound health. This health microsimulation modeling [equation (16)] found from the carried out study can be an effective tool at health pedagogy [76-80, 85-87] in nutritional epidemiology for maintaining health status learning the logarithmic biophysical modulator of health status in statistical modeling [81, 82, 94-96].

5. Conclusion

Malnutrition is the most common health crisis in the world. The present study results can take a serious turn in evading the malnutrition across the globe. This study rendering determinant of net food energy (DNFE) should be taking into action in designing healthy diet at different demographic sites in a country. So the health and nutritional think tank should bear the testimony in making awareness on the determinant of net food energy (DNFE) as a part of effective dieting tools in nutrition counseling and health science. Future research should adopt this cozy $(E_f)_n$ measuring modeling to explore a new trend in health pedagogy for taking intervention in policy designing, analysis and checking spatial effects for health and nutritional condition upgrading bid across the globe.

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