International Journal of Nutrition and Dietetics

http://www.pphmj.com
http://dx.doi.org/10.17654/ND005010029
Volume 5, Number 1, 2017, Pages 29-41 **ISSN: 2347-5277**

MATHEMATICAL MODELING OF ENERGY BALANCING FOR DIET PLANNING IN NUTRITIONAL PHYSICS

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Abstract

The measurement of net dietary energy is in great triumph on the helm of designing an apt dieting. The prevailing procedures in this arena are relatively time consuming, laboratory tests induced and often the misleading data contributors while planning a balanced dieting in nutrition counseling. The dietician is often at bay in the route ahead of perfect dieting to hold up nutritional soundness of the sample at a population in a community. The aim of this current study is making a dot over these ongoing perils exploring a mathematical modeling used in prescribing a confounding free diet. The study can divulge a biophysical modeling to be used in energy balancing for diet planning to curb the possible health horrors in nutritional epidemiology. The study finding is the determinant of net dietary energy (DNDE) [equation (18)] can be an excellent mathematical modeling as a dieting tool in human nutrition.

1. Introduction

About 2 billion people in the world suffering from different forms of

Received: February 23, 2017; Revised: March 10, 2017; Accepted: May 22, 2017
Keywords and phrases: energy balancing, nutritional physics, diet planning, mathematical modeling, co-efficient of total dietary energy (CTDE), health pedagogy.

malnutrition [1]. Malnutrition is an underlying cause of death of about 2.6 million children each year [2-4].

Malnutrition is the premier 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 shirk 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 determinant of net dietary energy (DNDE) in nutritional physics.

2. Data Sources and Methodology

The study was a cross-sectional study using secondary data analysis method. Secondary data refers to data that was collected by some researchers to be used in their studies. Secondary data analysis technique in biostatistics is in popular use in an anew study to conduct an anew study with a view to attain the ultimate gaining in newly formed studies. The data were collected from the biophysical equation of dietary energy, fuel factor, the TEF content and the mass of consuming nutrients in bromatology. The logarithmic modeling of equations from mathematics was in application to undergo in analyzing all the data using mathematical modeling to hit upon a trendy and

time saving biophysical modeling to calculate net dietary energy needed for individuals in the communities due to consumption of foods.

3. Results

Dietary 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,

$$E_d = fm, \tag{1}$$

where

f = fuel factor of food,

m = mass of food in g and

E_d = Dietary energy in kcal.

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:

$$(E_d)_c = f_c m_c, \tag{2}$$

$$(E_d)_p = f_p m_p, \tag{3}$$

$$(E_d)_f = f_f m_f, \tag{4}$$

$$(E_d)_a = f_a m_a. \tag{5}$$

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

$$(E_d)_c + (E_d)_p + (E_d)_f + (E_d)_a = f_c m_c + f_p m_p + f_f m_f + f_a m_a. \tag{6}$$

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

Hence,

$$(E_d)_c + (E_d)_p + (E_d)_f + (E_d)_a = (E_d)_T, \tag{7}$$

where $(E_d)_T$ = total dietary energy.

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

$$(E_d)_T = f_c m_c + f_p m_p + f_f m_f + f_a m_a. \tag{8}$$

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,

$$f_c = 4, \tag{9}$$

$$f_p = 4, \tag{10}$$

$$f_f = 9, \tag{11}$$

$$f_a = 7. \tag{12}$$

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

$$\begin{aligned}(E_d)_T &= 4m_{c+}4m_{p+}9m_{f+}7m_a \\ &= 4m_c + 4m_p + 4m_f + 5m_f + 4m_a + 3m_a \\ &= 4m_{c+}4m_p + 4m_f + 4m_a + 5m_f + 3m_a\end{aligned}$$

$$= 4(m_c + m_p + m_f + m_a) + 5m_f + 3m_a$$

$$= 4\sum m_{c,\,p,\,f,\,a} + 5m_f + 3m_a. \tag{13}$$

Taking log [42-44] on the equation (13),

$$(E_d)_T = \log^{-1}\log(4\sum m_{c,\,p,\,f,\,a} + 5m_f + 3m_a). \tag{14}$$

Let,

$$\log(4\sum m_{c,\,p,\,f,\,a} + 5m_f + 3m_a) = e_d, \tag{15}$$

where e_d = co-efficient of total dietary energy (CTDE).

Inflowing the equation (15) into equation (14),

$$(E_d)_T = \log^{-1} e_d. \tag{16}$$

The net dietary energy yields in the body adhering TEF content in bromatology [45, 46] as per the following equation:

$$(E_d)_n = (E_d)_T - TEF$$

$$= (E_d)_T - 10\% \text{ of } (E_d)_T$$

$$= (E_d)_T - 0.1(E_d)_T$$

$$= 0.9(E_d)_T, \tag{17}$$

where $(E_d)_n$ = net dietary energy.

Inserting equation (16) into equation (17),

$$(E_d)_n = 0.9\log^{-1} e_d. \tag{18}$$

The equation (18) can be used to determine the net dietary energy in human nutrition as so this linear equation could be marked as the determinant of net dietary energy (DNDE) in health science and nutritional physics [47-54].

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 [55-57]. 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” [58]. 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 [59-61]. The population is in want of balanced diet for frequently 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 [58] 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 dietary energy (DNDE) in human physiology can be a solvable bid in overcoming different problems during designing an apt dieting in nutrition counseling [62-65]. In the present study, result is cut and dried by adding the fuel factor of alcohol along with other energy yielder naming carbohydrates, proteins and fats. The $(E_d)_n$ evaluating method is cut short using the result of the study [equation (18)] in name of the determinant of net dietary energy (DNDE) in nutritional biochemistry. This study proposed determinant of net dietary energy (DNDE) can be an effective spatial microsimulation modeling [66-69] to be constructive in designing policies for the governments and NGOs for environmental and spatial effects across different countries [70-73] in the world to aid healthy dieting practices [74-76] for sustaining sound health. This health microsimulation modeling [equation (18)] found from the carried out study can be an effective tool at health pedagogy [77-80] in nutritional epidemiology for maintaining health status learning the logarithmic biophysical modulator in biostatistical modeling [80-83].

5. Conclusion

Malnutrition is the most common crying happening in the world. In the present study, results can take a serious turn in evading the malnutrition across the globe. This study rendering determinant of net dietary energy (DNDE) 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 dietary energy (DNDE) as a part of effective dieting tools in nutrition counseling. Future research should adopt this hassle free $(E_d)_n$ measuring modeling to explore a new road in health pedagogy for taking intervention in policy designing, analysis and checking spatial effects for health and nutrition condition upgrading bid in the world of nutritional epidemiology.

Acknowledgement

The author thanks the anonymous referees for their valuable suggestions which led to the improvement of the manuscript.

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