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Relationship between Two Body Adiposity Estimating Methods: A Study in Bengalee Female Adolescents being Trained in Bharatnatyam Dance

Banerjee Neepa*, Chatterjee Surjani*, Chatterjee Ayan*, Kundu Srijeeta*, De Santanu, Mukherjee Shankarashis***

Abstract

India, the second most populous country in the world, is now considered as an emerging economy. It is undergoing a major nutrition and lifestyle transition in recent days. Consequently, obesity has often been found paradoxically coexisting with under nutrition in different parts of the country. Adolescents are important future human resources and their health must be ensured. Because any negative health impact in childhood and adolescence eventually leads to an adult onset of chronic disease that in turn reduces life expectancy and quality of the life. As unhealthy body composition is an established risk factor for many non communicable diseases, identifying accurate ways to assess body composition, in particular body fat, is very important. Anthropometry, widely used traditional technique and impedance, a relatively new one are such examples of body composition measurement techniques. Present study has focused to find out the association, if any, between the values of body fat obtained from anthropometric and impedance techniques in Bengalee adolescent females receiving Bharatnatyam type of Indian classical dance training. It has been found that the trainee adolescent dancers have favorable body composition values. It has also been found that no significant difference ($P > 0.05$) exists between body fat values obtained from anthropometry and impedance method. Moreover a significant ($P < 0.05$) positive correlation ($r=0.98$) has been found between the body fat values obtained from the two techniques. Based on the relationship a new regression equation was developed and test retest validity was carried out.

Keywords: Body composition; Traditional method; Under nutrition; Overweight; Physical activity.

Introduction

Maintaining a healthy body weight and level of body fatness is an essential prerequisite for a healthier and longer life. Overweight and underweight individuals with body fat levels falling at or near the extremes of the body fat continuum are likely to have serious health problems; that can reduce life expectancy and threaten the quality of life. Overweight individuals with a high fat mass have a higher risk of a range of adverse health outcomes, including type 2 diabetes, hypertension, stroke, impaired physical functioning and higher rates of mortality[13] on the other hand, underweight individuals with very low body fat levels tend to be malnourished and have a relatively high risk of fluid-electrolyte imbalances, renal and reproductive disorders, osteoporosis and muscle wasting.[23] For predisposition of overweight or underweight, generally body fat plays the crucial role; therefore not only the body weight, but also the body fat measurement technique plays an important

Author's Affiliations: *Human Performance Analytics and Facilitation Unit, Dept. of Physiology, University Colleges of Science and Technology, University of Calcutta, Rashbehari Shiksha Prangan, 92, Acharya Prafulla Chandra Road, Kolkata 700 009, **NRS Medical College and Hospital, Kolkata, WB, India.

Corresponding Author: Mukherjee Shankarashis, Ph.D, Human Performance Analytics and Facilitation Unit, Dept. of Physiology, University Colleges of Science and Technology, University of Calcutta, Rashbehari Shiksha Prangan, 92, Acharya Prafulla Chandra Road, Kolkata 700 009, WB, India.

E-mail: msasish@yahoo.co.in

role in determining the health status of any individual including children and adolescents. The measurement of change in adiposity in children is challenging because of the effects of maturation and growth on lean muscle mass, fat mass, and hydration status.[22] Adolescence, characterized by an exceptionally rapid rate of growth resulting in the transition from childhood to adulthood occupies a crucial period of life[31] and maintenance of good health in adolescence is of great importance. But unfortunately it that has been neglected for many years has attracted global attraction in the last decade only.[10] Generally from adolescence the level of physical activity decreases especially in females and they start to lead a more or less sedentary life. As obesity and under nutrition both have deleterious effect on the normal health, close and frequent monitoring by different practical methods to assess body composition in particular to estimate body fat and taking timely preventive measures will be an effective approach in dealing with the problem.[19] Body composition can be estimated by numerous techniques including hydrodensitometry, Air Displacement Plethysmography, dual-energy X-ray absorptiometry (DEXA)[2] etc; most of these methods are sophisticated, time consuming and are not easily accessible; therefore performing these techniques in large scale studies are difficult whereas anthropometric technique is a traditional and widely used method. On the other hand, impedance, a newer technique, is relatively rapid and suitable for field studies. Limited data describe the ability of the technique to accurately assess body fat, there is scarcity of information regarding pediatric cohort. Therefore, present study has been planned with objectives to find out the association between the values of body fat estimated by anthropometric and impedance techniques, the trend of relationship between body fat values and other body composition indices, develop new equation for body fat estimation and the study has been conducted in Bengalee adolescent females engaged in physical activity, specifically receiving training in Bharatnatyam dance, which is an enjoyable form of in physical activity in females.

Methods

Initially educational institutions of Hooghly district in the Indian state of West Bengal were approached for getting access to individuals for carrying out the study. Prior to the study, the head of the institutions, the individuals and their parents/guardians were informed about the aim of the study and the procedural requirement of the investigation before requesting them to permit the children to take part in the study. The present cross sectional study involved 54 Bengalee female adolescents constituting the Study Group (SG), selected by simple random sampling with the criteria for inclusion as residing in Hooghly District for at least 10 years with mother tongue being Bengali, presence of regular menstrual cycle since menarche (self reported) for at least 1 year, receiving Bharatnatyam dancing training for at least a period of three years with an average half an hour practicing time, and absence of any chronic illness (self - reported). The age of the individuals ranged between 14 to 16 years which falls within the WHO defined criteria for being considered as adolescents.[32] Adolescents were excluded if they had any physical impairment that precluded anthropometric evaluations or used any medication that might impact the body growth. On the scheduled day, arranged on mutual convenience, measurements were obtained. Initially the basic information like age in complete years, age at menarche, duration of daily activities (e.g. school hours, study time, TV viewing time, dance practicing time, sleeping time etc) and eating habits were recorded in the predesigned schedule. The information about number of family

members, parental education, occupation and monthly family income were also collected for determining socioeconomic status of the individuals.[30] Basic anthropometric measurements like body height, body weight, waist circumference, and hip circumference were taken. BSA, BMI[16] and waist to hip ratio were calculated. For defining overweight and obese WHO BMI classification for children was followed. Body fat percentage was estimated from anthropometric measurements using age and sex specific equation for children[11] and also following impedance technique.[7] Subjects removed socks, shoes, and any metal jewelry before measurement and were advised to refrain from exercise and food consumption one hour prior to testing. Procedure followed in the present study was in accordance with the ethical standards. From percentage values, fat mass was calculated; fat-free mass was also calculated. All measurements were taken in the morning hours with ambient temperature around 25Ú- 27ÚC. Standard descriptive statistics (arithmetic mean and standard deviation) were found out for directly measured and derived variables. One way ANOVA was performed to find out whether there is any significant difference exists between the fat mass values obtained from two methods of body fat estimation. Pearson's Correlation coefficient (r) was found out to measure the strength of association between the fat mass values obtained from two methods of body fat estimation. Prediction equation for body fat values from anthropometric scores was developed. 51 Bengalee female school students of comparable age, socioeconomic and ethnic background were similarly randomly selected to constitute the Validation group (VG). Body fat mass values of VG individuals were predicted using the prediction equation developed. Suitability of the prediction equation was studied using Test-retest correlation. Data were analyzed with significance set at $P < 0.05$.

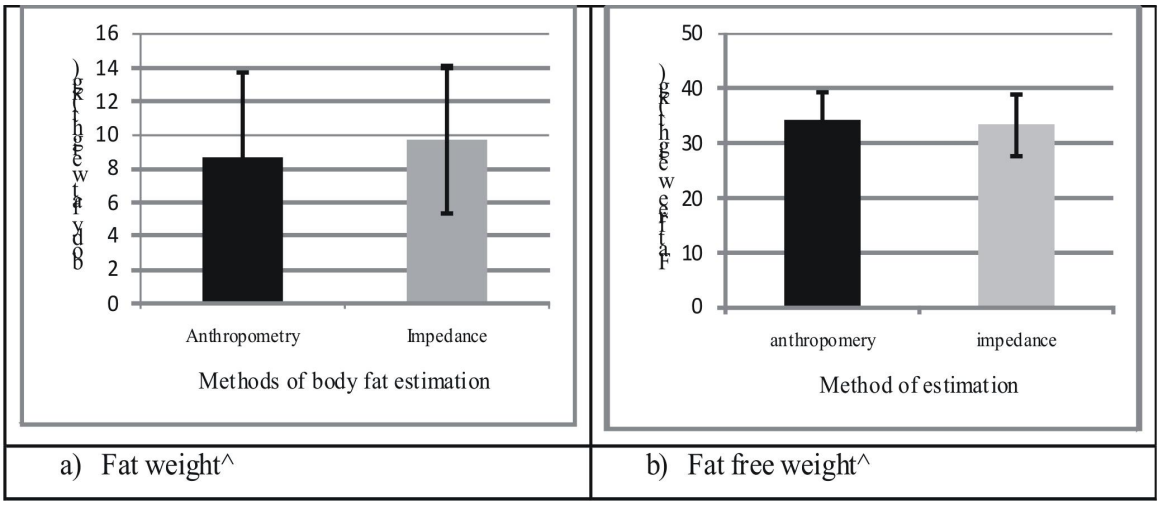
Table 1: Physical and Physiological characteristics of the Study group

Variables	Study Group
Body height (cm)	151.9 ± 5.87
Body weight (kg)	43.0 ± 9.65
BSA (m^2)	1.3 ± 0.14
BMI ($kg.m^{-2}$)	18.5 ± 3.95
WC (cm)	64.2 ± 9.12
WHR	0.77 ± 0.056

Results

Present study was conducted on 54 Bengalee adolescent females constituting Study Group (SG); the physical and

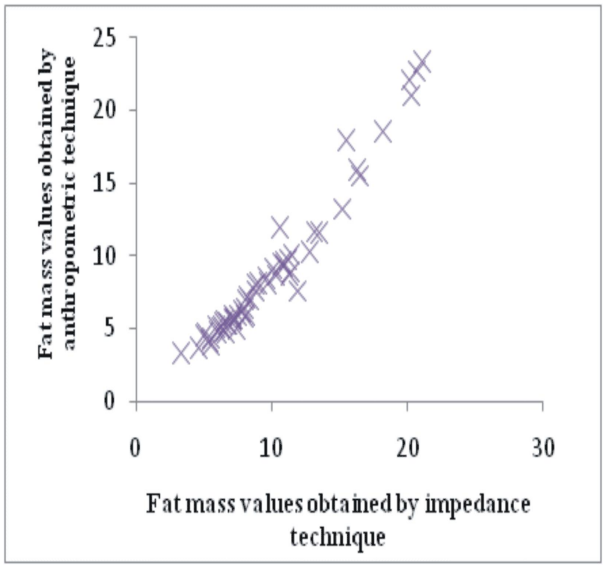
Figure 1: Comparison between two methods of body fat estimation in adolescent females



a) Fat weight^ b) Fat free weight^

^ns

Figure 2: Scatter plot showing the relationship between fat mass values obtained from the two methods of body fat estimation



physiological characteristics have been presented in Table 1 .

The mean values of body height and body weight of the adolescent girls of the study group were 151.9 cm and 43.0 kg. Mean value of BMI of the adolescents girls of this group was18.5 $kg.m^{-2}$.

In figure 1, the mean value of absolute body fat weight (a) and fat free weight (b) of the individuals as estimated by anthropometric and impedance techniques have been presented;

The mean value of absolute body fat

Table 3: Physical and Physiological characteristics of the validation group participants

Variables	Validation Group
Body height (cm)	150.6 ± 6.77
Body weight (kg)	42.3 ± 6.74
BSA (m^{-2})	1.3 ± 0.12
BMI ($kg.m^{-2}$)	18.6 ± 2.54
WC (cm)	69.2 ± 7.58
WHR	0.85 ± 0.063

estimated from anthropometry and impedance of the individuals are 8.7 and 9.7 kg respectively whereas the mean value of fat free weight estimated from anthropometry and impedance of the individuals are respectively 34.3 and 33.3 kg.

The relationship between the body fat values estimated from impedance and anthropometry has been presented in Figure 2.

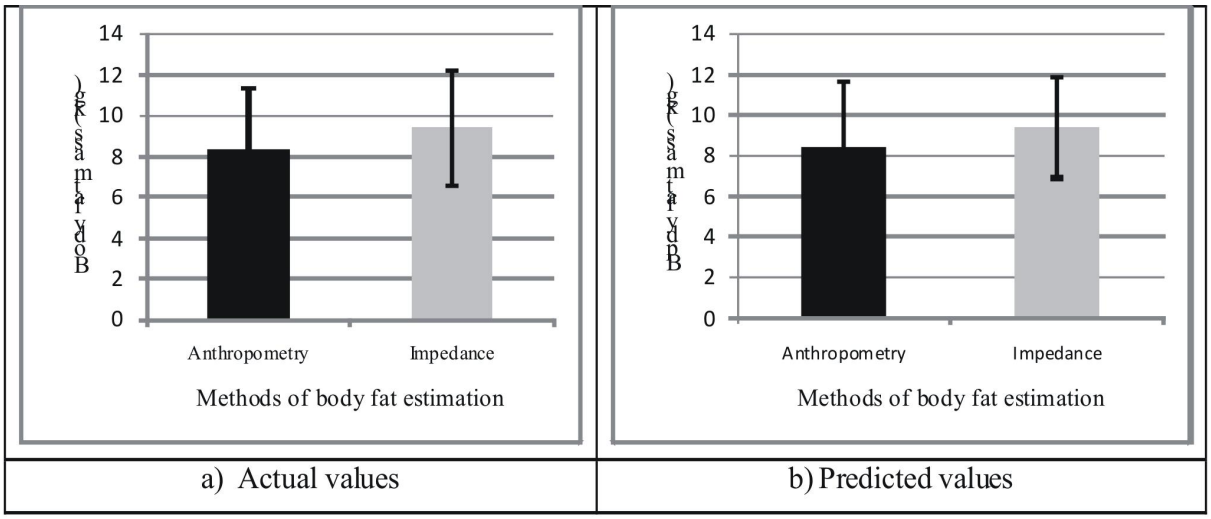
From Figure 2 it has been found that body fat mass weight obtained from the two methods of body fat estimation have a significant positive correlation ($r=0.98$, $P<0.05$). From the correlation values regression analyses was performed and new prediction equations were developed in which fat mass values from impedance technique could be predicted from the anthropometric scores (Equation 1) and alternatively fat mass values could be predicted from the impedance technique

Table 2: Selected socio-demographic characteristics of the study and validation group participants

Demographic features	Study Group	Validation Group
Residence	Rural area, Hooghly, West Bengal, India	Rural area, Hooghly, West Bengal, India
Religion	Hindu	Hindu
Community	General	General
Marital status	Unmarried	Unmarried
Nature of school being attended	Public funded	Public funded
Parental occupation	Agricultural, business	Agricultural, business, service
Socio economic status	Middle	Middle
Age (years)^	14.7 ± 0.79	14.5 ± 0.95
Age at menarche (years)^	11.0 ± 0.98	10.8 ± 0.97

^ns

Figure 3: Comparison between body fat mass values as estimated by two methods in the Validation group individuals: (a) actual values and (b) predicted values as obtained from the developed models



scores (Equation 2).

Developed prediction equations were,

$X_2 = 2.305 + 0.85X_1$..... (Equation 1) and

$X_1 = -2.358 + 1.14X_2$..... (Equation 2)

(where X_1 is body fat weight estimated by anthropometry and X_2 is body fat weight estimated by impedance technique)

New equations were validated in 51 female adolescents (VG) of comparable age and ethnic background. SG and VG individuals did not vary significantly in terms of their basic socio- demographic characteristics (Table 2).

In the present study the participating volunteers were adolescent girls from rural area of Hooghly district, West Bengal (WB), India. They were Hindu in religion and were from general community. All adolescent girls of study and validation group were post pubertal, unmarried and they belonged to middle class strata of the society.

Physical and physiological characteristics of the validation group subjects have been presented in Table 3.

The values of actual body fat mass along with the predicted values obtained from the developed model have been presented in Figure 3.

It has further been found that there is no significant difference between the values obtained from the two techniques in respect of fat weight. Comparison between the actual values of fat free weight as estimated by two methods in the validation group individuals are presented in Figure 4.

From figure 4, it has been found that like fat weight, no significant difference has been found for fat free weight estimated by two different techniques. A significant ($P < 0.05$) positive correlation ($r=0.97$) has been found between the actual values and the predicted scores of fat mass in the validation group subjects.

Figure 4: Comparison between two methods of fat free weight estimation in adolescent females

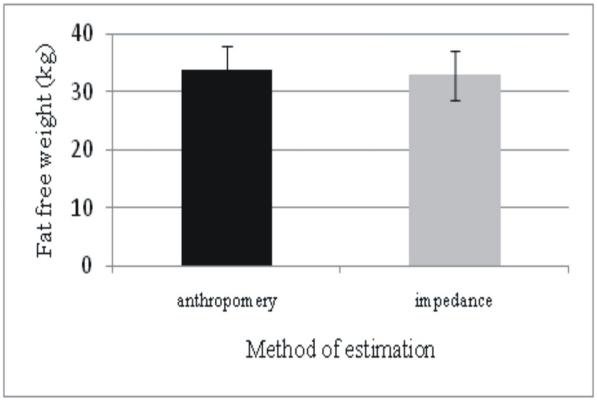
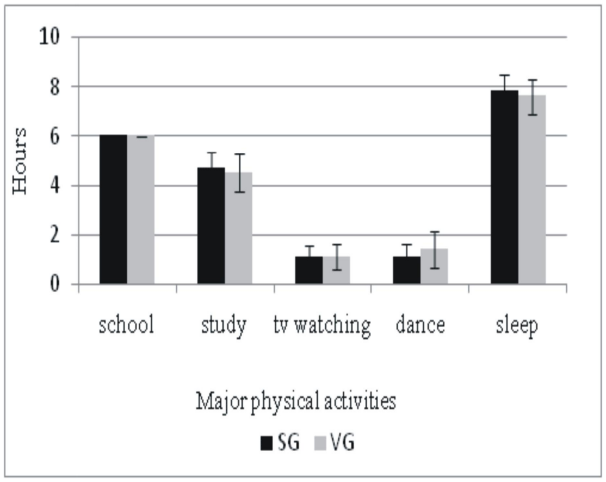


Figure 5: Comparison between SG and VG individuals in terms of daily activity profile



Discussion

Unhealthy lifestyle coupled with poor nutritional status resulting under-nutrition or over nutrition of adolescents, especially girls, has important implications in terms of physical work capacity and adverse reproductive outcomes. Therefore special attention should be given on body composition assessment of this particular population providing proper nutrition and encouraging in regular physical activity. In the present study, participants of SG and VG did not vary significantly in terms of their dietary pattern, socio economic status (Table 2) and daily activities (Figure 5).

Individuals of the present study practice Bharatnatyam dancing daily for at least half an hour period. Favorable values of obesity indices (body weight, BMI, WC, WHR) have been found which is probably due to regular practicing of Bharatnatyam dance; earlier studies have also found that low intensity regular practicing of dancing is beneficial for achieving and maintaining favorable body composition[29], prevents from being obese[9,25] and also enhancing fitness status.[18,26,17,4,20,6] The trend of result is similar in adults[1,28], teenagers[3] and children[27] as well; a negative relation has been found with body fat and playing duration in agreement with the study of Mukherjee *et al*[24] where a positive correlation has been found with TV watching time. The mean BMI of the study group and validation group individuals were 18.5 $kg.m^{-2}$ and 18.6 $kg.m^{-2}$ respectively. According to WHO BMI chart, the age specific normal BMI for female individuals is 19.5; so both SG and VG individuals are slightly below the normal weight category.

Although various body adiposity indices are used now a days, still at present, in large scale epidemiological studies, the BMI is used to identify persons as overweight, obese and underweight and it has been found that BMI has a strong correlation with body fat; more specifically it has been found that BMI was better correlated with body fat mass (kg) than with body fat percentage[15] present study has found similar result (BMI and body fat mass $r = 0.97$, $P < 0.05$, BMI and body fat percentage $r = 0.92$, $P < 0.05$). As assessment of body composition with BMI has limitation, estimating body fat plays crucial role in identifying those at risk for diseases. In the present study, mean values of body fat percentage obtained from anthropometry and impedance technique of SG individuals were 21.8 and 19.1 respectively and for VG individuals the values were 21.9 and 19.4 respectively. Individuals of both the groups belonged to average or median category in terms of body fat percentage classification proposed by Lohman *et al.*[22] No significant difference exists between the fat mass values obtained by anthropometry and impedance methods; rather a significant positive correlation ($r = 0.98$, $P < 0.05$) exists between them. The advantages of predicting and estimating body fat from BMI is less dependent on intra - and inter - observer errors than skinfold measurement, which is another popular anthropometric method for body fat estimation. On the other hand, the values obtained following impedance technique may be subjected to variation due to alteration in hydration status[21] if the experimental protocol is not strictly

followed during the measurement process. Body impedance has to be measured under strictly standardized conditions to obtain reproducible results[8,12] and is largely determined by the impedance of the extremities[5,14] thus any inaccurate placement of the electrodes will cause relatively large errors. The high degree of correlation between the values obtained following two different experimental technique that is anthropometry and impedance not only indicate that the experimental protocol has been followed accurately but also affirm that the relatively newer impedance analysis is also a reliable and dependable technique for obtaining body fat values. The retesting of the developed equation with new set of subjects of comparable background also reaffirms the validity of the technique. In the present population, the prediction formula obtained, predicted the body fat quite well. However, different methods of body composition assessment have their own advantages and limitations and therefore the study based on comparison between different methods can be useful for the interpretation of results.

In conclusion, results of the present study elucidate that adolescent individuals receiving training on Indian classical dance, specifically Bharatnatyam type, have favorable body composition parameters in particular body fat and central obesity parameters. No significant difference exists between the body fat values estimated from the anthropometric and impedance technique in Bengalee adolescent females and body fat values estimated from the two methods has a significant positive correlation.

The prediction equations, newly developed, for predicting the body fat values has a significant ($P < 0.05$) test-retest correlation and thus these two methods could also be used interchangeably as valid methods. Developed predictive models could be useful as rapid screening tool for body composition assessment in large scale population study and for taking timely preventive measures. Further studies with a larger number of subjects of different populations will increase the applicability of the prediction model developed.

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This book has been addressed to young doctors who take care of children, such as postgraduate students, junior doctors working in various capacities in Pediatrics and private practitioners. Standard Pediatric practices as well as diseases have been described in a nutshell. List of causes, differential diagnosis and tips for examination have been given to help examination-going students revise it quickly. Parent guidance techniques, vaccination and food have been included for private practitioners and family physicians that see a large child population in our country. Parents can have some understanding of how the doctors will try to manage a particular condition in a child systematically. A list of commonly used pediatric drugs and dosage is also given. Some views on controversies in Pediatrics have also been included. Few important techniques have been described which include procedures like endotracheal intubations, collecting blood samples and ventilation. I hope this book helps young doctors serve children better.

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Dietary Influence on the Cardio-Metabolic Parameters among Geriatric Patients of Type 2 Diabetes

Aswini Dutt R.*, Shobith Bangera**

Abstract

Background: Advancement in health care facility has increased the geriatric population across the globe. It is expected to shoot up by 360% by 2050. India has 7.7% of its population with more than 60 years old. Elderly people suffer from social, medical and psychological problems. Geriatric people of middle and higher income groups are prone to develop obesity and its related complications due to a sedentary lifestyle and decreased physical activity. There is increased prevalence of diabetic patients in this age group. Nutrition status plays a vital role in maintenance of good functional status among the elderly. **Aims and Objectives:** 1. To analyze the obesity parameters on geriatric diabetic patients. 2. To study the effects of diet on Blood Pressure (BP) blood glucose levels and various Obesity markers. **Methods:** 104 geriatric male diabetic patients in the age group of 60 years and above were included in the study. They were divided into two groups based on their food habits with respect to type of meat consumed (viz. red meat consumers, white meat consumers). Their age, BP, Fasting Blood Sugar (FBS), Post Prandial Blood Sugar (PPBS), obesity parameters; Body Mass Index (BMI), Waist-Hip (W/H) ratio, A Body Shape Index (ABSI), Body Fat%, Body Adiposity Index (BAI) were calculated. These parameters were compared between two groups by unpaired *t*-test. **Results and Conclusions:** Consumption of red meat has aggravated obesity parameters, blood glucose and blood pressure in geriatric patients with type2 diabetes. Moderation of red meat consumption should be advocated to such patients.

Keywords: Geriatric; Obesity; Red meat; White meat; Type 2 diabetes; Blood pressure.

Introduction

Advancement in health care facility has increased the geriatric population across the globe. India is in a phase of demographic transition. In 1991 census with 57 million geriatric population it has been projected that by the year 2050, this number would rise to about 324 million, an increase by 360%. People aged over 80 years are expected to shoot up by sevenfold.[1] Hence India has 7.7% of its population being more than 60 years old. Decreasing fertility and decreased mortality rates due to the better health care facilities. There is greater reduction in mortality than fertility.[2]

Aging is associated with decrease in efficiency of physiological system. Elderly people suffer from social, medical and psychological problems. Decline in their immune status, normal ageing process, changed lifestyles make them more prone for communicable and non communicable diseases. Age-related complications like cardiac, neurological, dental problems, altered gastrointestinal absorption of nutrients, declining kidney function, functional disability due to osteoporotic changes, malignancy, dementia and other psychiatric disturbances, acute or chronic

Author's Affiliations: *Associate Professor, **Assistant Professor, Dept of Physiology, Yenepoya Medical College, Deralakatte, Mangalore, 575018. Karnataka, India.

Corresponding Author: Dr. Aswini Dutt R., Associate Professor, Dept of Physiology, Yenepoya Medical College, Yenepoya University, Deralakatte, Mangalore-575018. Karnataka, India.

E-mail: drdutt23@yahoo.com

debilitating diseases, drug induced complications and many other compound the scenario.[3,4] Many elderly experience social, domestic, and economic changes.[5]

Nutrition status and lifestyle play a vital role in maintenance of good functional status among the elderly.[6] These two interventions are considered as the integral part of management of diseases and their related complications for better outcome of the elders' health condition. Altered lifestyle, eating habits, decreased physical activity make the geriatric people of middle and higher income groups to develop obesity and its related complications.[7] There is increased prevalence of obesity and diabetic patients in this age group. Highest incidence of diabetes is seen in the age group of 60 years and above. Existence of metabolic syndrome adds to the severity of their condition that worsens their ability to carry out daily self-care activities. It is very important to recognize the nutrition related health hazards among the elderly using relevant screening methods so that appropriate preventive measures or intervention methods to the needy can be taken up at the earliest.

Elderly diabetic patients are usually advised to maintain strict dietary pattern blended with accepted exercise regime. Proper dietary management can help in treatment obesity linked insulin resistance, and resultant cardiovascular diseases.[8] This eating pattern in diabetic elderly includes the type of diet, selection of food, distribution of diet along with eating behavior. Various factors affect their dietary choices based on their environment, social status and cultural practices.

High intake of red meat with rich saturated fat like beef and mutton, sweets, oily foods are associated with the increased incidence of hypertension, obesity and Diabetes Mellitus worldwide.[9] Diet rich in vegetables, fruits, whole grains, consumption of dairy products, chicken and fish (omega-3 fatty acid) can reduce cardio metabolic disorders.[10] Higher the red meat consumption more will be the insulin resistance, blood pressure and obesity due to its high saturated fat content.

Objectives

The present study was carried out

- To analyze the obesity parameters on geriatric diabetic patients.
- To study the effects of diet on Blood Pressure (BP), blood glucose levels and various Obesity markers.

Materials and Methods

Consenting male geriatric patients (age group of 60 years and above) diagnosed with type 2 Diabetes attending department of General Medicine, of a Medical College Hospital, Karnataka, India and residing in old age home were enrolled in the study. Ethical Approval was obtained for this study from the University Ethics review committee. Written informed consent was taken from each participant after describing in full detail the procedure and purpose of the study.

Their diet histories were collected with respect to the amount of daily food intake for one week for individual patients. This also includes the type of meat consumed; red meat or white meat and vegetables. They were divided into three groups based on their food habits with respect to type of food consumed (viz. red meat consumers, white meat consumers). One group had subjects consuming predominantly red meat for at least 5 days a week (not exclusive). The other group with exclusively white meat consumers for at least 5 days a week (vegetables were also included). All groups were age matched. Patients with any disability, neurological disorders, renal failure, hepatic failure or psychological disorders were excluded.

Their age, anthropometric

measurements, Blood pressure (BP), Body Mass Index (BMI) and Weight-Hip ratio (W/H), Fasting Blood Sugar (FBS), Post Prandial Blood Sugar (PPBS), duration of diabetes and hypertension were recorded. Other obesity parameters like BMI Prime, A Body Shape Index (ABSI), Body Fat%, Body Adiposity Index (BAI) were calculated. General physical examination, vital signs, complete systemic examinations were done. A detailed history which included the diabetic history, personal history, drug history and family history was taken.

Quantification of the diet with respect to different food items consumed along with meat intake in Grams/week will be plotted. Body mass index (BMI) was calculated as weight (in kilograms) divided by standing height (in meters squared). Those with a BMI greater that 24.9 kg/m2 were defined as overweight and those with a BMI greater than 29.9 kg/m2 were defined as obese. People with systolic/diastolic blood pressure levels >/= 140/90 mmHg were defined as having hypertension as per JNC 7 criteria. Waist girth was measured as the smallest horizontal girth between the costal margins and the iliac crests at minimal respiration. Hip circumference measured at the level of trochanters. As per the WHO guidelines, abdominal obesity is defined as a waist–hip ratio above 0.90 for males.

Other Obesity parameters studied

1. BMI Prime is the ratio of actual BMI to upper limit BMI. BMI Prime is useful clinically because individuals can tell, at a glance, by what percentage they deviate from their upper weight limits.[11]

2. A Body Shape Index (ABSI) based on Waist Circumference adjusted for height and weight: $\mathbf{ABSI} \equiv \frac{\mathbf{WC}}{\mathbf{BMI}^{2/3}\mathbf{height}^{1/2}}$.

Body shape, as measured by ABSI, appears to be a substantial risk factor for premature mortality in the general population derivable from basic clinical measurements. ABSI expresses the excess risk from high WC (waist circumference) in a convenient form that is complementary to BMI and to other known risk factors. [12]

3. Body Fat% = body fat % = (1.20 × BMI) + (0.23 × Age) " (10.8 × sex) " 5.4

The body fat percentage of a human or other living being is the total mass of fat divided by total body mass; body fat includes essential body fat and storage body fat.

Body fat can be estimated from body mass index (BMI), a person's weight in kilograms divided by the square of the height in meters; if weight is measured in pounds and height in inches, the result can be converted to BMI by multiplying by 703.[13]

4. Body Adiposity Index (BAI) given by $\frac{100 \times \text{hip circumference in m}}{\text{height in m} \times \sqrt{\text{height}}} - 18$ were calculated.

The BAI is a good tool to measure adiposity due, at least in part, to the advantages over other more complex mechanical or electrical systems and weight is not needed to measure it.[14] m: meters

Blood sample was collected under all aseptic conditions and FBS, PPBS were measured by Glucose oxidase peroxidase end point by Trinder's method using glucose reagent.(Transasia Bio-Medicals Ltd, Solan, Himachal Pradesh, India).

Age, BP, BMI, BMI Prime, Waist-Hip ratio, ABSI, Body Fat%, BAI, FBS, PPBS parameters among the participants were analyzed statistically by using the statistical software SPSS and MS Excel. All tests were two-tailed and $p < 0.05$ is considered as significant.

Results

Table I shows the baseline parameters Mean±SD of Age of patients, SBP, DBP,

Table I: Basic characteristics of the study group

Parameter	Red meat Consumers (n=50)	White meat Consumers (n=54)	P
Age in Years	62.92± 2.76	62.63± 3.30	0.003**
SBP(mm Hg)	146.8± 19.52915	133.7± 12.48	0.000***
DBP(mm Hg)	92.2± 8.40068	87.85± 6.27486	0.629
BMI	1.67± .06684	21.80± 3.17959	0.000***
W/H	0.95± .03955	0.93± .05993	0.018*
Hypertension(Years)	14.20± 3.46	14.02± 3.43396	0.789
Diabetes duration (Years)	13.90± 3.69	15.15± 3.20617	0.068

Values are expressed as Mean±SD Student's paired *t* test
* P<0.05; ** P<0.01; *** P<0.001

Fig I: Obesity parameters among the study group

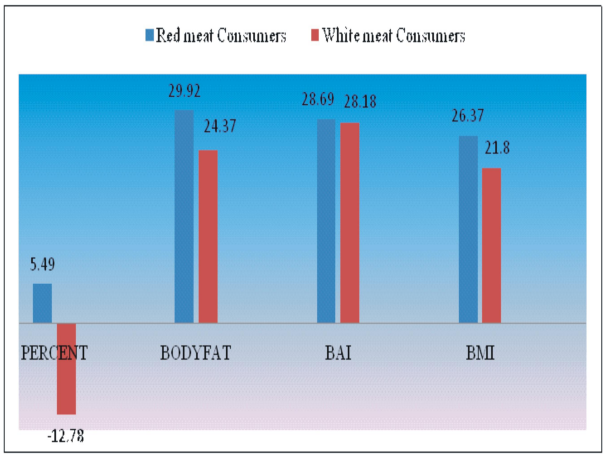


Fig II: BMI Prime and ABSI parameters among the study group

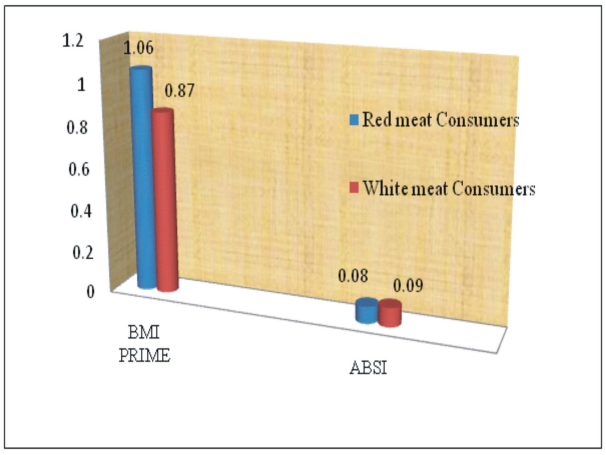


Fig III: Blood glucose levels among the study group

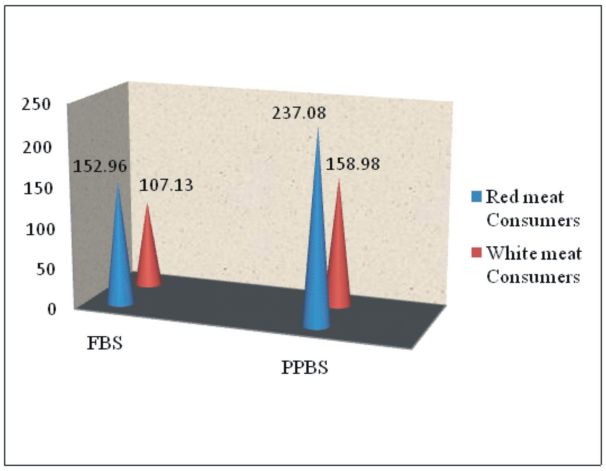
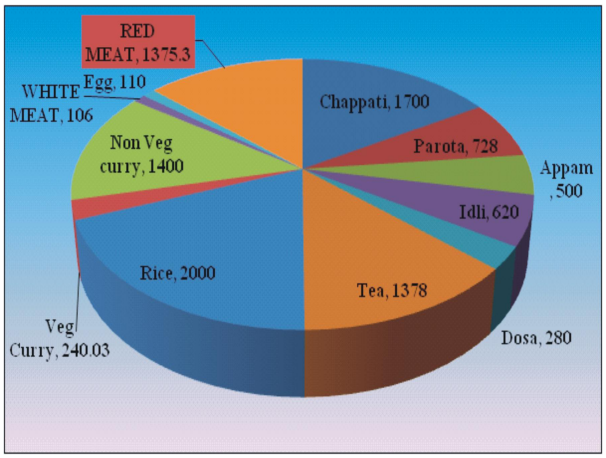
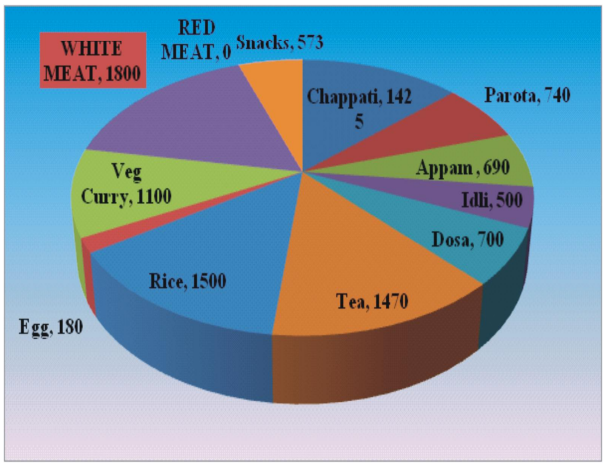


Fig IV: Average diet pattern of predominantly red meat consumers. (Grams/week)



Duration of diabetes, Hypertension, BMI and W/H Ratio of the study group. Out of 105 participants, 50 were red meat consumers and 54 were white meat consumers. Systolic BP was significantly more in red meat consumers. Fig I depicts the obesity parameters like BMI, BAI, Body fat and % of fat. It was observed that BMI, Body fat and % of fat were increased in red meat consumers. Similarly Fig II shows the BMI Prime and ABSI among the study

Fig V: Average diet pattern of exclusively white meat consumers. (Grams/week)



group.

All these parameters were elevated among those red meat consuming geriatric diabetic patients. We found that FBS and PPBS levels were more in the same group (Fig III). Fig IV depicts the average diet pattern of predominantly red meat consumers. In a week, there was a consumption of 1375 grams of red meat that included beef and mutton amidst other regular food of costal Karnataka. This group also consumed a small amount of white meat (106grams/week). Fig V shows the average diet pattern of exclusively white meat consumers. This group consumed 1800 grams of white meat in the form of fish and chicken exclusively in a week's duration.

Discussion

This study shows that a relatively higher consumption of red meat may aggravate blood glucose, blood pressure and many obesity parameters in elderly patients of Diabetes Mellitus.

Diet, drugs, physical activity, illness and mental stress are the important modifiable factors of glycemic levels. The presence of metabolic syndrome in geriatric population makes it more difficult to manage due to the physiological process of ageing impairing the body's immune system, composition and metabolic processes.

A systemic review of cohort studies showed that diet rich in red meat increases blood glucose levels coinciding with our result.[15] Emergence of insulin resistance in DM has been blamed to the saturated fat content of the red meat as the principle causative factor.[16] Nurses' Health Study had shown a moderately decreased risk of DM in regular chicken eaters (white meat).[17] Consumption of diet containing regular servings of fish, the white meat can prevent or control the emergence of DM.[18] The presence of omega-3 fatty acid present in fish can decrease the occurrence of DM and heart diseases.[19]

The prevalence of obesity is increasing worldwide even in the older population. Third national health and nutrition examination survey (NHANES III) has shown that majority of individuals aged 50 years and above with type 2 diabetes were overweight, practiced sedentary lifestyle, and not adhering to strict dietary guidelines for fat, fruit, and vegetable consumption.[20] As the age advances, fat mass increases. This increased deposition of fat in skeletal muscle, liver, pancreas results in further impaired glucose tolerance in the elderly diabetic.[21]

Obesity parameters - BMI, BMI Prime, W/H Ratio, ABSI BAI, Body fat and % of fat were increased in red meat consumers. BMI can classify some elderly into obese category even though their body fat is less. Added to this are the changes in body composition with age, loss of muscle mass and more visceral fat, may not be reflected in the BMI,[22] It is also limited by differences in body fatness for a given BMI across age, sex, and race.[23] To address this limitation, Bergman et al,[24] developed the body adiposity index (BAI) calculated as hip circumference in centimeters divided by height in meters to the 1.5 power minus 18

Insulin resistance associated with obesity and cardiovascular abnormality is known as 'the metabolic syndrome'. Elderly diabetic

are at higher risk of development of cardiovascular complications, as a result of elevations of plasma glucose concentrations which trigger endothelial dysfunction and oxidative stress.[25] As disease progresses, there is decrease response of tissue, even to high levels of insulin. There will be accumulation of triglycerides in muscle tissue and free fatty acids finally resulting in cessation of insulin production.[26]

High fat consumption is known to cause obesity and insulin resistance.[27] Lack of insulin action leads to increased circulating free fatty acid concentration as a result of increased lipolysis.[28] The combined effect of high intake of saturated fatty acid , in the form of dietary fat and increasing free fatty acid levels in blood, results in higher plasma membrane fatty acid profiles, leading to further impairment of insulin action.[29] Thus, there exists a clear association between dietary fats, lipid profiles and insulin resistance.[30]

Fish oil rich in omega-3 fatty acid prevents the development of insulin resistance in experimental rats which were earlier fed with safflower oil.[31] It is seen that Poly unsaturated fatty acids(PUFAs) can regulate insulin sensitive glucose uptake (ISGU) in isolated adipocytes.[32] In animals, isocaloric saturated fat diet will enhance the weight more than the unsaturated fats present in white meat.[33] Similar results are found in humans [34] demonstrated by increasing waistline measurements.[35] Waist-Hip ratio has been shown to be a better measure of obesity in the elderly due to different distribution of visceral fat in them.

Decreased blood pressure levels in hypertensives who consumed fish oil having PUFAs, has been seen in a meta-analyses of randomized trials. Studies done in animals, testing for the beneficial effects of PUFA, have shown major changes in vascular functions. The changes could be due to enhanced endothelial vasodilator function, reduced reactivity of resistance vessel vascular smooth muscle and increased vascular compliance. This alteration of vascular functions can be stated as one of the causes for blood pressure lowering effects of PUFA, mainly in hypertensives.[36]

In the recent years, with the increased incidence of non-communicable disorders , many research are directed towards effect of life style modifications. Many Studies on modification of diet pattern, mainly giving emphasis to prevention of Hypertension and DM are undertaken. Previous research data indicate that multiple improvements in food intake like decreased salt in diet and limited consumption of fat rich food, lower BP levels of adults, both pre hypertensive and hypertensive. But with recent studies, PUFAs have shown to offer benefits more than the known benefits of reduced sodium chloride, increased potassium and prevention of obesity and excess alcohol intake in reducing BP. It is consistent with meta-analytic data of RCTs. Thus, these results on a major coronary vascular disease risk factor lend good support to current recommendations for increased ingestion of PUFAs from marine and vegetable sources.[37] Limitation of not including female geriatric diabetic patients due to lesser available sample size forms the future scope of the study.

Conclusions

Proper dietary regime, healthy lifestyle practices along with drug therapy have a profound influence on the quality of life of elderly diabetic patients. Red meat consumption can aggravate the obesity due to high saturated fat levels leading to further insulin resistance accelerating their diabetic profile, BP, Cholesterol levels and related complications, Whereas those consuming vegetarian diet and white meat can have limited occurrence of high blood pressure, obesity or dyslipedemia. Hence moderation of red meat consumption needs to be advocated to elderly diabetic patients

to improve their complications free diabetic life.

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A Cross-Sectional Study of the Impact of Sleep Deprivation on Academic Performance in Medical Students of Dakshina Kannada

Thalanjeri Padmini*, Karanth Harish, Dutt Aswini R.***, Bhat Shankar K.****, B. Grrishma*, Bangera Shobith***

Abstract

Background: First year medical students are burdened with a huge study load in a short span of time. They are under tremendous stress during assessment times and often they go without sufficient sleep during examinations. **Objectives:** To determine the number of hours of sleep of all study participants on the night before Physiology internal assessment and the marks obtained by them and thus try to find a correlation between the duration of sleep and exam performance. **Methods:** Study included 146 first year medical students of a private deemed University. The number of hours of sleep obtained by the study participants on the night before the Physiology internal examination was recorded. Then their marks obtained in it exams were tabulated accordingly. Pearson's correlation was applied to determine if there is a significant correlation between the exam performance and duration of sleep. Results: There was a significant positive correlation between duration of sleep and exam marks obtained showing that lesser the duration of sleep, lesser is the performance in the exams. **Conclusion:** This study concludes that adequate sleep is essential for optimum performance during exams and deprivation of sleep is an added stress and is detrimental to student performance. Revising the method of assessing the students must be considered as the study reveals the shortcomings of the current pattern.

Keywords: Academic Performance,Cognition, Sleep

Introduction

Medical profession is a very vast field with ever increasing inflow of knowledge and information. Medical students are crammed with a lot of information which they are expected to know and since this is a field which deals with life and death, no errors are acceptable. The syllabus to be covered is very vast. Narrowing down the scenario, first year medicos who are fresh out of school are burdened with a huge study load in a short span of time. Hence they are under tremendous stress especially during assessment times and often they go without sufficient sleep just before exams. As exam approaches the students try to cram in the subject as much as possible at the cost of other routine activities, most importantly sleep in particular.

Studies have shown that a body requires six to eight hours of sleep in a 24 hour cycle.[1] Less than 8 hours of sleep and the body's efficiency begins to decline.[2] New memories are formed within the brain when a person engages with information to be learned for example, memorizing a list of

Author's Affiliations: *Assistant Professor, Dept of Physiology, Yenepoya Medical College, Mangalore, **Assistant Professor, Dept of Anaesthesia, AJ Institute of Medical Sciences, Mangalore, ***Associate Professor, ****Professor, Dept of Physiology, Yenepoya Medical College, Mangalore, Karnataka, India.

Corresponding Author: Dr. Harish Karanth, Assistant Professor, Department of Anaesthesiology, AJ Institute of Medical Sciences, Mangalore, Karnataka, India.

E-mail: harishkrnth@gmail.com

words.[3] However these memories are initially very vulnerable and in order to make them permanent they must be improved and solidified. This is called memory consolidation and it occurs when connections between brain cells as well as between different brain regions are strengthened. It was believed for many years that it develops merely with passage of time. More recently, however, it has been demonstrated that time spent asleep also plays a key role in preserving memory.[4] Thus sleep plays a major role in learning and memory.[5]

Hence there is a need to study the effect of duration of sleep on exam performance among our student population and thereby spread the awareness and importance of adequate sleep.

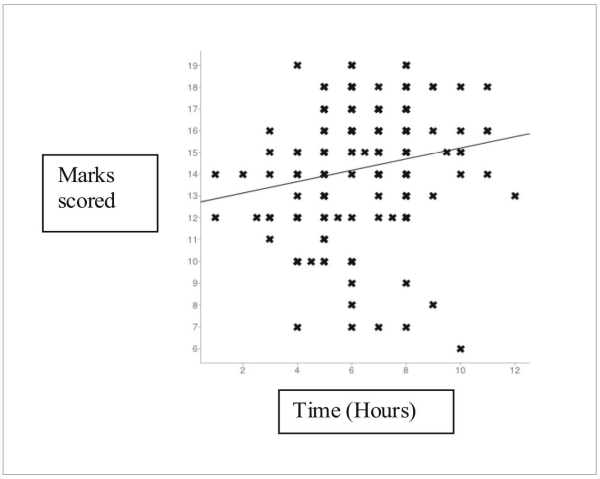
Aim of the study

To determine the number of hours of sleep obtained by 146 medical students on the night before Physiology theory internal assessment examination and the corresponding marks obtained by them and to find a correlation between the two variables.

Material and Methods

This cross sectional study included 146 medical students studying in first year of a private medical college of a deemed University who appeared for Physiology theory first internal assessment examination. Written informed consent was obtained from the study participants. Ethical clearance was also obtained from the Institutional Ethics Committee. Information regarding age, gender and the number of hours of sleep obtained on the night before the theory exam was recorded by self report method. Later, the marks scored by the students in that particular exam were tabulated correspondingly.

Figure 1: Correlation of exam performance with duration of sleep in hours



Pearson's correlation coeffficient was applied to determine if there is any significant correlation between the hours of sleep and the marks obtained by the students. Pearson's correlation coefficient was done using statistical software SPSS 21 and MS Excel. All tests are two-tailed and $p< 0.05$ was considered as significant.

Results

The mean age of the study group was 18.5 years (Standard Deviation [SD] = 1.4) ranges from 18 to 20 years**.** Mean duration of sleep on the night before the exam was 6.4 $\pm$ 2 hours. Mean marks scored by the student was 14.28 $\pm$ 2.8 out of a maximum of 20 marks. Pearson's correlation coefficient value was (r) 0.19 which was found to be highly significant with a p value of 0.02.

Figure 1 revealed a strong positive correlation between the two parameters signifying that more the duration of sleep obtained by the students, more was the marks scored by them in the assessment.

Discussion

Sleep is essential to existence of life and

normal functioning of daily activities. Sleep deprivation affects mood, leads to low energy levels and hampers the ability to focus, concentrate and learn.[6,7,8] Studies have shown that memory recall and ability to maintain concentration are enhanced when an individual is well rested.

Our study demonstrated that the academic performance had a significant positive correlation with the amount of sleep obtained on the night before the examination. Thus, more the number of hours of sleep the student got on the night before the exam better was the score obtained in the assessment. A recent study observed that following one night of total sleep loss there was increased blood concentration of neuron-specific enolase (NSE) and S100 calcium binding protein B (S-100B). These are brain molecules which are known to be elevated in blood following brain damage.[9] Hence, there arises the hypothesis that sleep deprivation can result in neurodegenerative diseases. Sean Drummond in 2009 observed the effect of total sleep deprivation on cognitive performance tasks such as selective attention, sensory inattention, working memory, verbal encoding and retrieval in young and old adults. He found that older adults (59 to 82 years) showed more resilience than young adults (19 to 38 years) whose performance in all three cognitive tasks was significantly less. Studies done on sleep deprived animal models showed that following five hours of sleep deprivation there was increased levels and activity of PDE_4 and reduced levels of cAMP in mice. cAMP signalling in hippocampus is known to play a crucial role in formation and strengthening of new connections which helps in the process of learning. Further, following inhibition of PDE_4 enzyme there was reduction in the effects of sleep deprivation thus concluding that PDE_4 which rises following sleep deprivation probably blocks the action of cAMP.[10] Prolonged sleep deprivation is said to contribute in the development of debilitating conditions like diabetes, hypertension and heart disease. There are studies showing an increased association of depression and obesity linked to sleep deprivation.[11]

Thus, sleep is critical for learning, memory and enhanced academic performance in general.[12,13] Limitation of study was that the duration of sleep of only one night was recorded. Also this study was done for internal assessment and more studies need to be done during semester/ final examinations.

Conclusion

Sleep is integral to existence of life and adequate sleep is essential for normal physical and mental functioning of a human body. Healthy sleep routine is very essential especially during student life in order to maximize the academic performance. Here, an attempt is being made to determine the impact of quantity of sleep on the exam performance and hence later on, enhance the awareness among students to start a study routine from the very beginning of the course and not to overburden themselves at the very end of a course session at the cost of their normal sleep pattern. Also, the current pattern of assessment of medical students should be examined more thoroughly and appropriate actions for putting in place a more accurate assessment pattern should be considered.

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Role of Polyol Pathway in Pathophysiology of Diabetic Peripheral Neuropathy: An Updated Overview

Kumar Senthil P.*, Adhikari Prabha, Jeganathan*****

Abstract

The aim of this short communication article was to enlighten the role of polyol pathway in pathophysiology of diabetic peripheral neuropathy (DPN) through an evidence-informed overview of current literature. Findings from experimental models of DPN suggest that altered glutathione redox state, with exaggerated NA(+)-K(+)-ATPase activity, increased malondialdehyde content, decreased red blood cell 2,3-diphosphoglycerate concentration, reduced cyclic adenosine monophosphate, reduced myo-inositol and excessive sorbitol in peripheral nerves were indicative of polyol metabolic pathwayin producing pathophysiological changes of DPN, and treatments using aldose reductase inhibitors were found to reverse those changes.

Keywords: Polyol pathway; Myo-inositol; Sorbitol; Neurophysiology; Endocrinology.

The aim of this short communication article was to enlighten the role of polyol pathway in pathophysiology of diabetic peripheral neuropathy (DPN) through an evidence-informed overview of current literature.

Calcutt *et al*[1] measured motor nerve conduction velocity (MNCV), Na(+)-K(+)-ATPase activity, polyol-pathway metabolites, and myo-inositol in sciatic nerves from control mice, galactose-fed (20% wt/wt diet) mice, and galactose-fed mice given the aldose reductase inhibitor ponalrestat (300-mg/kg diet). Their data showed that exaggerated flux through the polyol pathway can cause an MNCV deficit that is unrelated to either myo-inositol levels or NA(+)-K(+)-ATPase activity.

Carroll *et al*[2] examined the effect of streptozocin (STZ) diabetes and aldose reductase inhibition on reduced (GSH) and oxidized (GSSG) glutathione levels in crude homogenates of rat sciatic nerve. The study concluded that altered glutathione redox state played no detectable role in the pathogenesis of this defect in diabetic peripheral nerve.

Finegold *et al*[3] studied the effect of polyol pathway blockade with sorbinil, a specific inhibitor of aldose reductase, on nerve myo-inositol content in acutely streptozotocin-diabetic ratswhich completely prevented the fall in nerve myo-inositol.

Mizuno *et al*[4] investigated the effects of three aldose reductase (AR) inhibitors, fidarestat, epalrestat and zenarestat, on the slowing of sensory nerve conduction velocity (SNCV), motor nerve conduction velocity (MNCV), and minimal F-wave latency prolongation in streptozotocin (STZ)-induced diabetic rats. “Fidarestat

Author’s Affiliations: *Professor, Maharishi Markandeshwar Institute of Physiotherapy and Rehabilitation (Maharishi Markandeshwar University), Mullana- Ambala, Haryana, **Professor, Dept. of Medicine, ***Professor, Dept. of Physiology, Kasturba Medical College (Manipal University), Mangalore, Karnataka, India.

Corresponding Author: Senthil P. Kumar, Professor, Maharishi Markandeshwar Institute of Physiotherapy and Rehabilitation (Maharishi Markandeshwar University), Mullana- Ambala, Haryana, India.

E-mail: senthilparamasivamkumar@gmail.com

suppressed sorbitol accumulation remarkably and continuously until 24 h after administration. On the other hand, the inhibitory effect by zenarestat declined in a time-dependent manner, and epalrestat did not decrease sorbitol content."

Nakamura *et al*[5] compared the effect of a transition metal chelating agent, trientine (TRI), on diabetic neuropathy with that of an aldose reductase inhibitor, NZ-314 (NZ).Platelet hyperaggregation activities in diabetic rats were prevented by NZ, but not by TRI. Increased concentrations of malondialdehyde in diabetic rats were partially but significantly ameliorated by either TRI or NZ.

Nakamura *et al*[6] investigated the relationship between polyol pathway hyperactivity and altered carnitine metabolism in the pathogenesis of diabetic neuropathy, the effects of an aldose reductase inhibitor, [5-(3-thienyl) tetrazol-1-yl]acetic acid (TAT), and a carnitine analog, acetyl-L-carnitine (ALC), on neural functions and biochemistry and hemodynamic factors were compared in streptozotocin-diabetic rats. The observations suggested that there was a close relationship between increased polyol pathway activity and carnitine deficiency in the development of diabetic neuropathy and that an aldose reductase inhibitor, TAT, and a carnitine analog, ALC, had therapeutic potential for the treatment of diabetic neuropathy.

Nakamura *et al*[7] studied relationship between the 2,3-diphosphoglycerate concentration in red blood cells as a biological indicator of tissue hypoxia and diabetic neuropathy, and the effect of a potent aldose reductase inhibitor, (2S,4S)-6-fluoro-2'5'-dioxospiro [chroman-4,4'-imidazolidine]-2-carboxamide (SNK-860),streptozotocin-induced diabetic rats. The study findingssuggested that a decrease in the red blood cell 2,3-diphosphoglycerate concentration was one of the factors contributing to tissue hypoxia, which resulted in diabetic neuropathy, and that this decrease was mediated through an aldose reductase inhibitor-sensitive pathway.

Oates[8] described the concept of the polyol pathway and its role inpathogenesis of diabetic peripheral neuropathy as follows:"metabolic flux through aldose reuctaseoccurred through the polyol pathway, rather than nerve concentration of sorbitol, acting as apathogeneic factor in diabetic peripheral nerve. Also, inhibition of metabolic flux through the polyol pathway should be a therapeutic goal in DPN..

Shindo *et al*[9] studied the effects of a stable prostacyclin analog, Iloprost, and aldose reductase inhibitors (ONO-2235 and isoliquiritigenin) to elucidate the role of cyclic Adenosine monophosphate (cAMP) in diabetic neuropathy in relation to polyol metabolism. The study findings suggested that polyol pathway activation resulted in cAMP reduction in sciatic nerves and that the reduction of cAMP in peripheral nerves might in turn be related to the pathogenesis of diabetic neuropathy.

Findings from experimental models of DPN suggest that altered glutathione redox state, with exaggerated NA(+)-K(+)-ATPase activity, increased malondialdehyde content, decreased red blood cell 2,3-diphosphoglycerate concentration, reduced cyclic adenosine monophosphate, reduced myo-inositol and excessive sorbitol in peripheral nerves were indicative of polyol metabolic pathway in producing pathophysiological changes of DPN, and treatments using aldose reductase inhibitors were found to reverse those changes.

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