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

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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

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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

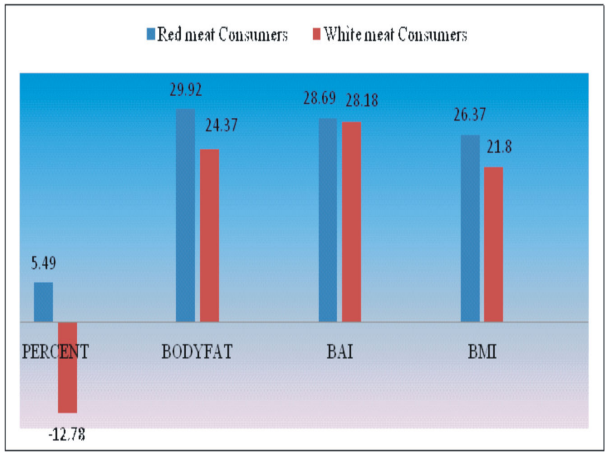


Fig II: BMI Prime and ABSI parameters among the study group

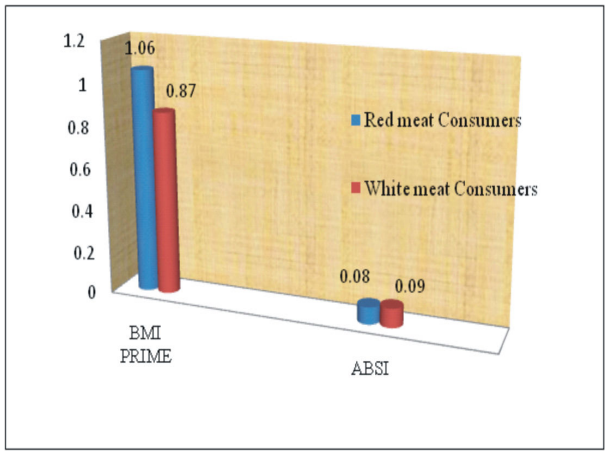


Fig III: Blood glucose levels among the study group

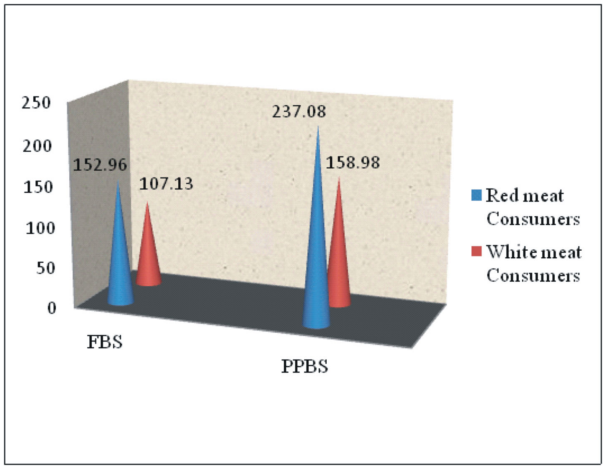
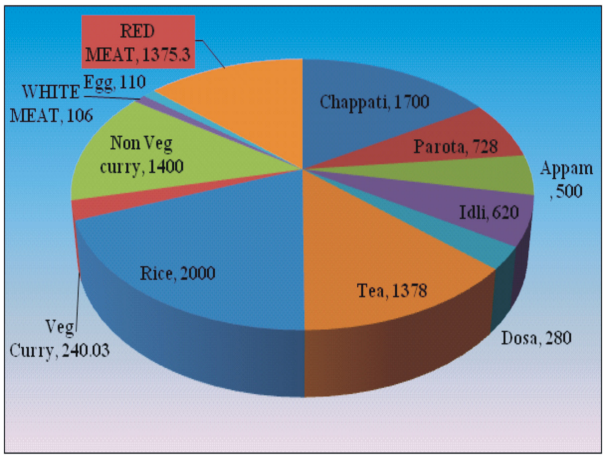
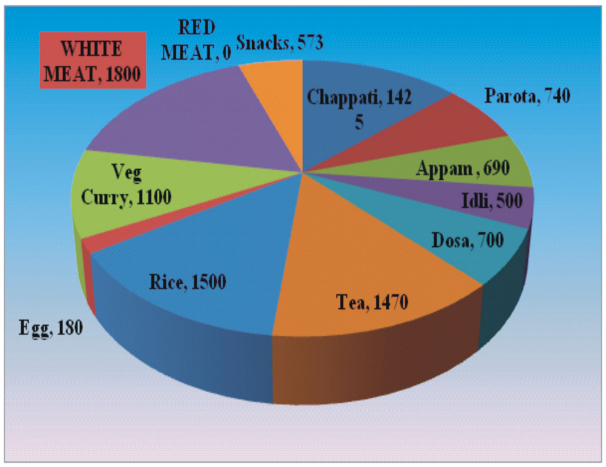


Fig IV: Average diet pattern of predominantly red meat consumers. (Grams/week)



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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