Original Article

A Study of Meat consumption on Cardio-metabolic risk factors in Pre-menopausal type-2 diabetic patients.

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ABSTRACT

Background: Type 2 diabetes and obesity have reached epidemic proportions all over the world. Women will account for the majority of diabetic cases by the year 2050. Diet plays an important role in causation, management and complications of obesity and type 2 diabetes which are inter related.

Objective: To compare the glycemic control, BMI and blood pressure in different meat consuming pre-menopausal patients of type 2 diabetes.

Materials & Methods: This is a retrospective study done from the medical records of the patients of type 2 diabetes. The study group consisted of 100 Female diabetic patients on treatment aged less than 40 years. 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 FBS, PPBS, BMI, Blood pressure and diet history were noted.

Statistics: Parameters between red meat & white meat consumers were compared by unpaired *t*-test. All tests were two-tailed and $p< 0.05$ is considered as significant.

Results - The data when analysed statistically revealed that red meat consumption was positively associated with poor glycemic control in terms of both FBS and PPBS ($p < 0.0005$). There was a significant association of red meat consumption with BMI and blood pressure ($p <0.0005$ and $p=0.0001$ respectively.

Conclusion - Our study indicates that consumption of red meat may aggravate indices of glycemic control, Obesity and blood pressure in pre-menopausal patients with type 2 diabetes. Hormonal protection provided by estrogen is overridden by the consumption of red meat. Moderation of red meat consumption should be advocated to patients of type 2 diabetes.

KEY WORDS: Red meat, White meat, Type 2 Diabetes, Blood Pressure, Body Mass Index, Pre-menopausal women

Introduction

According Obesity and diabetes mellitus are fast emerging as the leading cause of morbidity in developing nations. India accounts for 31 million diabetes affected persons in 2000 and which is expected to flare up to 79.4 million by 2030 according to the Diabetes prevalence predictions.[1]

In metabolic syndrome, Insulin resistance is a major constituent - characterized by central fat, hyperglycemia, hyperinsulinemia and dyslipidemia.[2] Good glycemic control is important for the prevention of renal and metabolic complications of diabetes as well as for the prolongation of the development of major cardio-vascular disease in long term.

One in ten women aged 45 years and over had diabetes in North Carolina in 2007. The prevalence of diabetes increased as women aged, with the highest prevalence among aged 75 years and over. The North Carolina diabetes prevention and control fact sheet of February 2009 projected that women will account for the majority of diabetic cases by the year 2050.[3]

The management and prevention of various metabolic disorders such as insulin resistance, obesity, type 2 diabetes mellitus (DM) and resultant cardiovascular diseases[4] are linked to dietary patterns. High intake of red meat, sweets and oily foods are associated with the increased incidence of DM worldwide.[5] Diet rich in vegetables, fruits, whole grains, limited consumption of dairy products, fish (white meat) and lesser red meat can reduce cardio metabolic disorders.[6] Red meat (beef, mutton) consumption may lead to insulin resistance and hyper-insulinemia in susceptible persons.[7] Other studies have suggested that a high fish and seafood white meat consumption may reduce the risk of DM in populations with a prevalence of obesity[8] and hypertension.[9]

Diabetics hence have to monitor their diet patterns to control their blood glucose, blood pressure (BP) and body weight. Since the meat consumption can alter their diabetic status, we sought to evaluate the association of meat consumption and glycemic control, Body Mass Index (BMI), Blood Pressure in pre-menopausal patients of DM.

Materials and Methods

This is a retrospective study done from the medical records of the patients of DM attending the Medicine department of Yenepoya Medical College hospital, Mangalore, Karnataka, India living in and around Mangalore. Ethical clearance was obtained from Institute's Ethical Clearance review board. Written informed consent was obtained. The findings of the study were shared with the patients.

The study group consists of 100 pre-menopausal Female patients aged less than 40 years. These were divided into two groups based on their predominant food habits with respect to type of meat consumed. (Viz. red meat consumers, white meat consumers). One group consisted of 50 subjects consuming predominantly red meat for at least 5 days a week. The other group had 50 age matched subjects; exclusively white meat consumers for at least 5 days a week. The cases were chosen randomly for the red meat consuming group. Their diet histories were collected from the Dietician's record that included the amount of food consumed everyday for one week for individual patients. We have plotted the average of different food items consumed along with meat intake (grams/week).

Their anthropometric measurements, Blood Pressure (BP) recordings, Fasting Blood Sugar (FBS), Post Prandial Blood Sugar (PPBS), duration of diabetes and hypertension were noted. 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/m^2 were defined as overweight and those with a BMI greater than 29.9 kg/m^2 were defined as obese. Patients were considered as hypertensive based on JNC 7 criteria. (Normal BP: SBP<120, DBP <80 mmHg; Stage I hypertension: SBP 140-159, DBP 90-99 mmHg; Stage II hypertension: SBP□≥160, DBP ≥100 mmHg.[10,11]

Statistics:

The statistical software SPSS ver17 & MS Excel (2007) was used for analysis. The data were analysed for normal distribution and descriptive statistics were used. FBS, PPBS, BMI and BP between red meat and white meat consumers were compared by unpaired *t*-test. All tests were two-tailed and conducted at the 0.05 significance level.

Results

Table 1 shows Mean± SD of Age of patients and Duration of diabetes.

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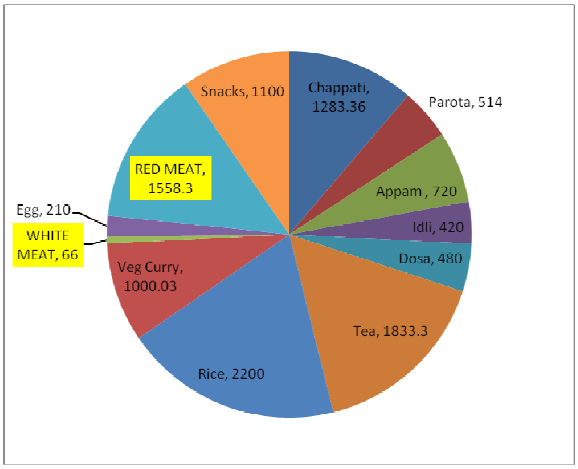
Mean± SD of age of patients and duration of diabetes.

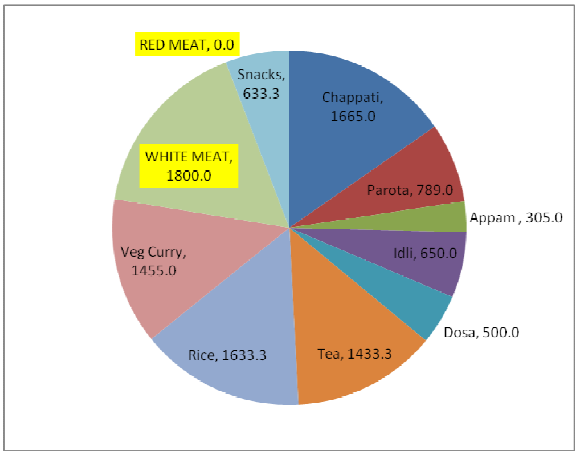
Parameters	Red Meat consumers (n=50)	White meat consumer (n=50)
Age in Years (Mean +SD)	33.68 ± 4.34	35.05 ± 4.45
Duration of Diabetes in years (Mean ± SD)	5.28 ± 4.53	7.54 ± 5.30

Graph 1 depicts the average diet patterns of predominantly red meat consumers. This group also consumes a small amount of white meat.



Graph 1: Average Diet patterns of predominantly red meat consumers. (Grams/week)

Graph 2 shows the average diet patterns of exclusively white meat consumers.



Graph 2: Average Diet patterns of exclusively white meat consumers. (Grams/week)

Table 2 shows Mean± SD of fasting blood sugar (FBS) & post-prandial blood sugar (PPBS), BMI, systolic blood pressure (SBP), diastolic blood pressure (DBP) of the two groups. FBS (p=0.0005) PPBS (p=0.0005) BMI (p=0.0005), SBP (p=0.0001) and DBP (p=0.0001) were significantly higher in the red meat diet group in comparison with white meat diet group.

Parameters	Red meat consumers n =50	White meat consumers n=50	p value
FBS (mg/dl)	187.12 ± 78.14	111.44 ± 11.14	<0.0005
PPBS (mg/dl)	278.16 ± 93.75	177.16 ± 16.85	<0.0005
SBP (mm Hg)	151.00 ± 18.21	126.54 ± 11.82	0.0001
DBP (mm Hg)	93.0 ± 8.89	81.2 ± 7.98	0.0001
BMI (kg/m^2)	25.94 ± 3.95	22.86 ± 2.57	<0.0005

Results on perceptions of students on CAL

The results from the feedback questionnaire are shown in bar charts as in Figures 1, 2 and 3

The outcomes of CAL in pharmacology experiments reveal that 83.3% of students felt that the overall simulations were good and written instructions for CAL were helpful. 75% claimed that their understanding had improved and had enjoyed using CAL. Nearly 70% felt that they had achieved the learning objectives and prefer simulations to live animal experiments and recommend CAL to others.

The advantages described by the students are shown in Figure 2. More than 80% of students felt that complicated procedures in live animals could be demonstrated and observed easily in virtual animals 90 % of the students felt that they could repeat, pause and resume the experiments without any loss of animals. > 70% expressed that the drugs' effects could be visualized clearly with no experimental errors.

The short comings of CAL as felt by the students are shown in Figure 3. More than 80% of students had pointed out that the actual hands-on experience with animals was lost, live interaction was absent and that biological variations seen in living tissues could not be observed. They have also said that the doses of drugs were prefixed in the experiments. 50% of them felt that computer expertise is needed to counter the technical snags. 30% thought that computer simulated experiments was an expensive way of learning.

Discussion

Our study indicates that a relatively higher consumption of red meat may aggravate indices of glycemic control, Blood Pressure and BMI in pre-menopausal Diabetes patients, which may lead to the insulin resistance-related development of complications.

The observed relationship between red meat and hyperglycemia has been consistent with the findings of other studies.[12] The total fat content of red meat, particularly saturated fat, is believed to be one of the main contributors to the increased prevalence of insulin resistance and DM.[13] In fact, results from the Nurses' Health Study showed that frequent chicken intake (white meat) was associated with a moderately decreased risk of DM.[14] In DM, fish consumption (white meat) would be linked with its prevention or control.[15] Some have suggested that fish consumption is associated with a decreased risk of DM and obesity and a lower incidence of both coronary heart disease and total mortality, due to its omega-3 fatty acid content, but others have not.[16]

Insulin resistance causes glycogenesis and increased glucose uptake in muscle cells. In adipocytes, increased lipolysis leads to elevated levels of circulating free fatty acids.[17] Increased saturated fatty acid content of dietary fat results in increased plasma membrane fatty acid levels. This causes more impairment of insulin action. [18]

Estrogens protect against insulin resistance and glucose intolerance in experimental mice.[19] Estrogen receptors ERalpha and ERbeta exist in beta-cells. ERalpha plays an important role in the regulation of insulin biosynthesis, insulin secretion and beta-cell survival. Activation of ERalpha by 17beta-estradiol (E2) and the environmental estrogen bisphenol-A (BPA) promotes an increase of insulin biosynthesis.[20] Hence those who are in menstruating phase of life i.e., our study group are generally protected against hyperglycemia. The elevated levels of blood glucose could be due consumption of red meat.

Obesity and insulin resistance might be the result of high fat consumption.[21] Animal studies have shown the connection between dietary lipids, lipid profiles and insulin resistance.[22] Insulin resistance was avoided in rats fed with a high sucrose and fat diet by replacing safflower oil with fish oil.[23] Insulin sensitive glucose uptake (ISGU) in isolated adipocytes is regulated by PUFAs.[24] Isocaloric saturated fat diet will increase the weight more than the unsaturated fats of white meat in animals.[25] Similar results are found in humans.[26] The increased BMI seen in the study group is not due to hormonal effects[27] but may be due to consumption of red meat.

In our study, females consuming red meat had higher blood pressure. Studies have shown that consumption of red meat was associated with increased blood pressure in black and white women.[28] Red meat may contain higher amounts of saturated fat, sodium, nitrates, or other food compounds that are detrimental to blood pressure.[28-30]Furthermore, the consumption of red meat 1–2times/d was associated with a 20–40% higher risk of developing elevated blood pressure than was the consumption of red meat 0.6 times/d. The mechanism through which higher meat intake may lead to higher blood pressure is unclear, except that intake of meat replaces other foods, such as whole grains, fruit, and vegetables, through a "substitution effect." [28]

Consumption of fish oil having PUFAs can decrease the blood pressure, including in non hypertensive persons, though effect is minimal. These effects are also confirmed by meta-analyses of randomized trials. Possible mechanisms whereby PUFAs may favourably influence BP are, based on animal experimental data: enhanced endothelial vasodilator function[31], reduced reactivity of resistant vessel vascular smooth muscle,[32] increased vascular compliance.[33]

Limitations of the study:

1. Retrospective study
2. Small study group
3. Limited variables

Conclusions:

In summary, our study indicates that a relatively higher consumption of red meat may override the hormonal benefits of oestrogen leading to hyperglycemia, hypertension and obesity in pre-menopausal diabetic patients. Consumption of white meat can give better glycemic control. It lowers the risk of development of obesity, hypertension and its complications in DM.

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Contribution:
For granting Permission to access Medical records.

Over view Box

What do we already know about the study?
Diet control is essential in the management of Diabetes mellitus.

What Information this study adds to the current knowledge available?
Consumption of red meat is associated with the aggravation of the cardio-metabolic risk factors in pre-menopausal diabetic patients.

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