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A Study on Biochemistry and Biology of Prehypertension and the Risk of the Cardiometabolic Syndrome

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Key Words:
Cardiometabolic Syndrome, Biochemistry, Biology, Prehypertension, Risk

Abstract:
Having a systolic BP between 120 and 139 mmHg and a diastolic BP between 85 and 89 mmHg classifies as prehypertension. Prehypertension is a new and growing risk factor for cardiovascular disease, and it exists on a continuum with hypertension. Abdominal obesity, high blood pressure, abnormal lipid profiles, and insulin resistance are all components of the cardiometabolic syndrome. Most people who have metabolic syndrome are very vulnerable, thus it's best to prevent the condition by changing their lifestyle and treating its particular symptoms. Several trials using dietary interventions have shown their efficacy in halting the development of hypertension and improving metabolic abnormalities. There are now many large-scale studies investigating antihypertensive medications for their potential to halt the progression of hypertension. Traditional risk factor evaluation is not as useful as early detection of cardiovascular disease in asymptomatic persons in determining the need for tailored preventive treatment.

1. Introduction:

Prehypertension occurs when a person's systolic blood pressure is between 120 and 139 millimeters of mercury and/or diastolic blood pressure is between 80 and 89 millimeters of mercury [1].

Hypertension, irregular blood lipid levels (dyslipidemia), insulin resistance, and obesity all contribute to the cardiometabolic syndrome. Cardiometabolic syndrome is associated with an increased risk of both cardiovascular disease and type 2 diabetes [2, 3].

The biochemistry and biology of prehypertension and its connection to the cardiometabolic syndrome have been the subject of several investigations. Prehypertension and the cardiometabolic syndrome have a common risk factor: insulin resistance. Increased blood glucose levels, dyslipidemia, and hypertension [3] are all potential outcomes of insulin resistance, a disease in which cells in the body become less receptive to insulin.

Prehypertension and the cardiometabolic syndrome share another crucial factor: inflammation. Hypertension and other cardiovascular disorders are linked to inflammation, which in turn may cause endothelial dysfunction [4-6].

Other possible causes that have been investigated include hormonal imbalances and genetic factors [7-10], as well as oxidative stress, which may damage blood vessels and raise the risk of hypertension and cardiovascular disease.

Prehypertension and the cardiometabolic syndrome are complicated conditions with complex underlying physiological and metabolic mechanisms. However, knowledge of these mechanisms is crucial for the creation of efficient preventative and therapeutic measures.

2. Methodology

In order to determine the different biochemical and biological markers for the early diagnosis of Cardio Metabolic Syndrome in people with Prehypertension, a case-control research design was employed for the current investigation.

All experimental and control volunteers filled out standardized forms with information about their backgrounds, medical histories, and other relevant factors.

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To evaluate BMI and obesity, anthropometric data including weight, height, and waist circumference have been recorded. Under sterile conditions, blood was drawn from a vein (both aliquots with and without anti-coagulant) and processed in a lab for analysis of DNA damage and biochemical measurements.

SPSS version 16 was used to keep track of data and conduct analyses on the gathered information. Prehypertensive patients were recruited from the Outpatient and Inpatient Clinics at the Hospital in Delhi based on their clinical diagnosis.

3. Data Analysis and Results:

Subjects Distribution

Figure 1 shows the breakdown of the study population, which consisted of 180 young individuals, aged 18–39 with a clinical diagnosis of hypertension and 140 age- and sex-matched healthy volunteers.

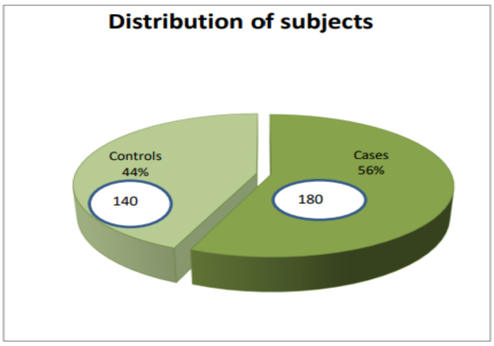

Figure 1: Subjects Distribution

Demographic characteristics

Figure 2 shows the demographic breakdown of the sample population by age and gender. The participants in this research are young individuals aged 18 to 39. Sixty-four percent of the 180 hypertensive patients (N= 116), 15.5% (N= 28) are between the ages of 31 and 35, 13.3% (N= 24) are between the ages of 26 and 30, and 6.6% (N= 12) are younger than 25. Between the ages of 36 and 39, young individuals with hypertension are the most numerous.Four-hundred-and-forty people (44%), with 70% (N=98) in the age range 36–39, 17% (N=25) in the age range 31–35, 9% (N=11) in the age range 26–30, and 4.2% (N=6) in the age range <25, made up the control group.

Ninety-three (51.6%) of the 180 cases were male and eighty-seven (48.3%) were female. Of the total number of controls (140), 79 (56%) were male and 61 (44%) were female. Between the ages of 36 and 39, both male and female hypertensives are at their peak.

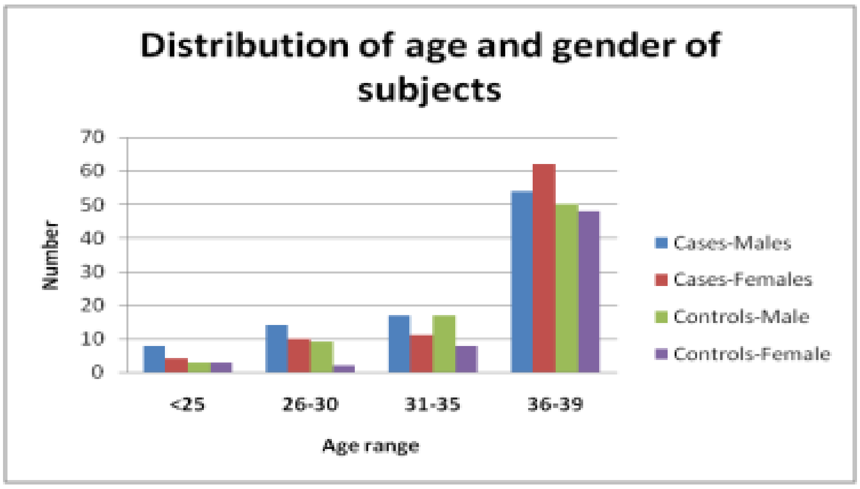

Figure 2: Age and gender Distribution of subjects

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Figure 3 provides a summary of chi-square test comparisons of cases and controls by Area of residence, Education, and Type of profession. Both the patients (52%) and controls (61%) in this research were mostly urban dwellers. In the experimental group, about 52% of people and in the control group, around 36% of people were classified as having sedentary jobs. The current study's control group had a higher level of education (37%) than the test individuals (63%). There was a statistically significant difference ($p<0.05$) in the sociodemographic characteristics between cases and controls, including education and profession.

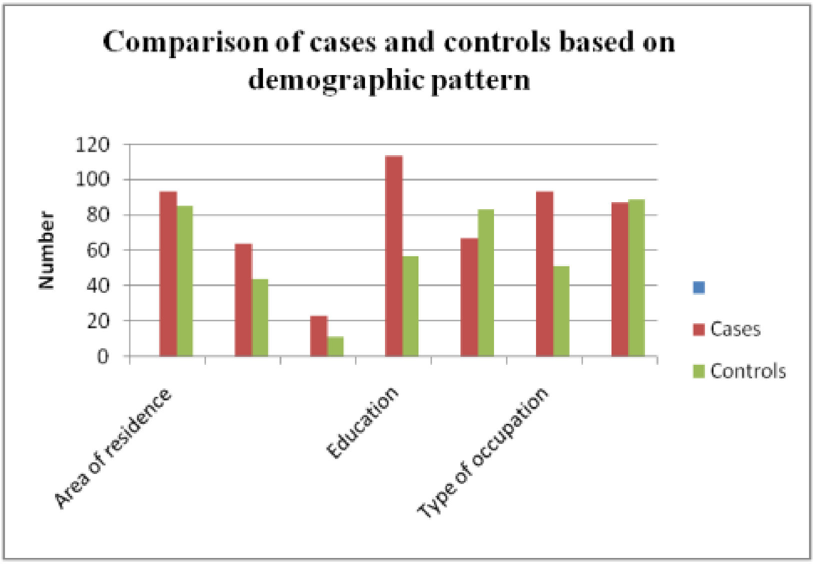

Figure 3: Cases and controls based Comparison on Demographic pattern

Anthropometric parameters

The Adult Treatment Panel defines an abnormal waistline as one that is more than or equal to 102 centimeters in men and greater than or equal to 88 centimeters in women. This information was used to categorize participants, and Figure 4 shows the prevalence of abdominal obesity in the case and control groups. In the experimental group, 52% of males and 21% of females had waist circumferences of less than 102 centimeters (105 ±18.6 inches), respectively. Eighty-five percent of male control participants (93.5± 8.7) had a waist circumference of less than 102 centimeters, but only 22 percent of female control subjects (104.6 ±19.6) did so. In this research, most of the women in both the experimental and control groups were overweight.

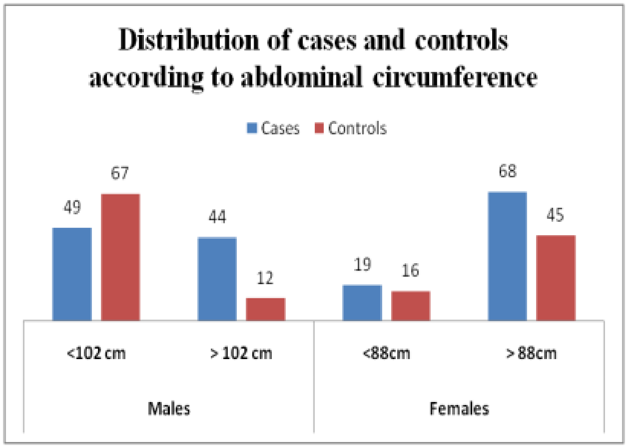

Figure 4: Cases and controls distribution according to abdominal circumference

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Lifestyle characters

In Figure 5, we see Chi-square test comparisons of lifestyle factors including nutrition, regular exercise, physical activity, and obesity. Lifestyle characteristics such as nutrition, frequent exercise, physical activity, and obesity were shown to vary significantly (p <0.05). For the purpose of evaluating the significance of the aforementioned categorical factors' connection with hypertension, odds ratios were computed. For the aforementioned factors, the odds ratios are 0.233, 0.34, 2.48, and 8.03, in that order.

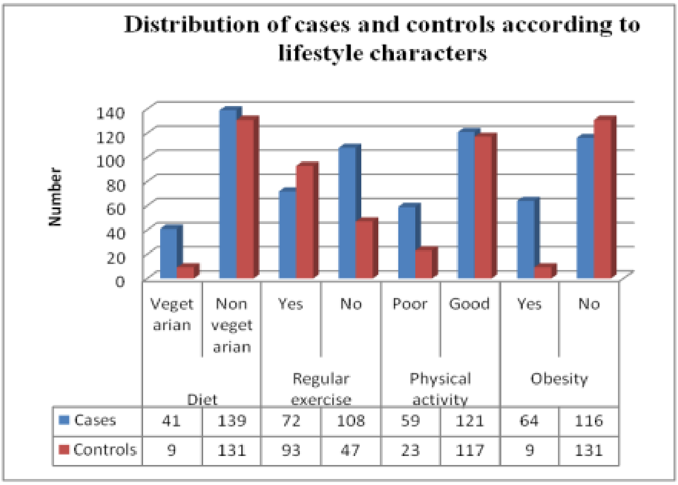

Figure 5: Cases and controls Distribution according to lifestyle characters

Biochemical parameters

Figure 6 compared biochemical data between cases and controls, including fasting blood sugar, total cholesterol, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, triglycerides, urea, and creatinine. Subjects' mean FBS, TC, LDL-C, TG, urea, and creatinine readings are all greater than those of the controls' (p<0.05).

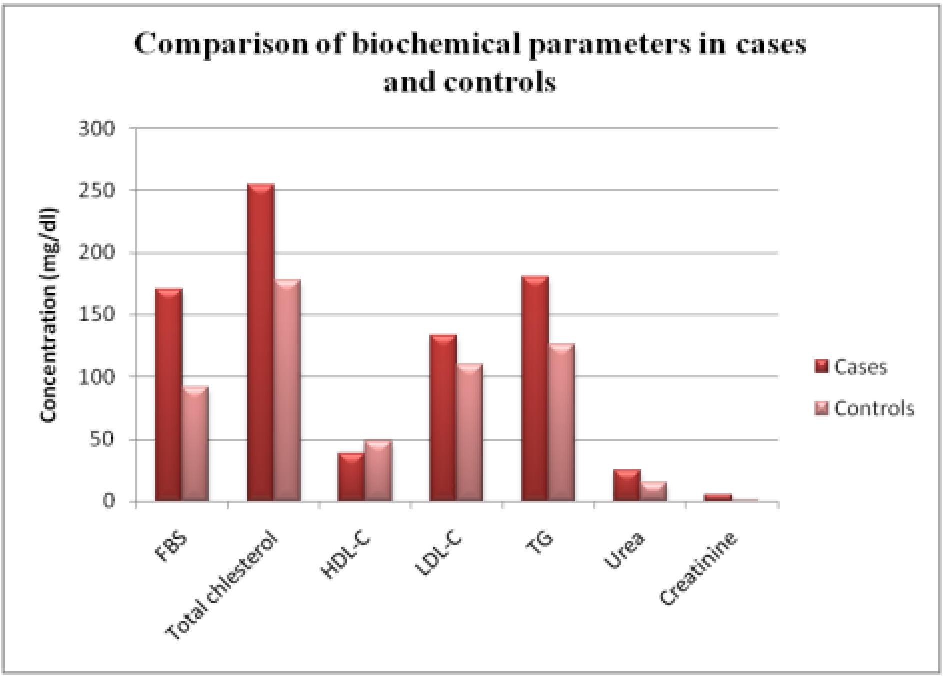

Figure 6: Biochemical parameters comparison in Cases and controls

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Figure 7 shows a comparison of MDA levels between patients and controls. It is statistically significant ($p<0.05$) that the cases have higher mean values than the controls.

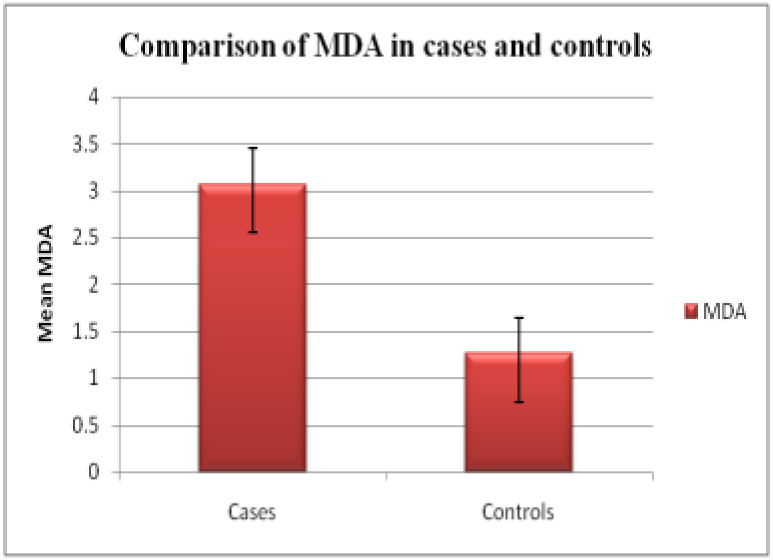

Figure 7: MDA comparison in cases and controls

Molecular markers

Figure 8 displays a comparison of the mean break per cell (b/c) value of patients and controls. There is a statistically significant ($p<0.05$) increase in the mean number of chromatid break cell values in cases compared to controls.

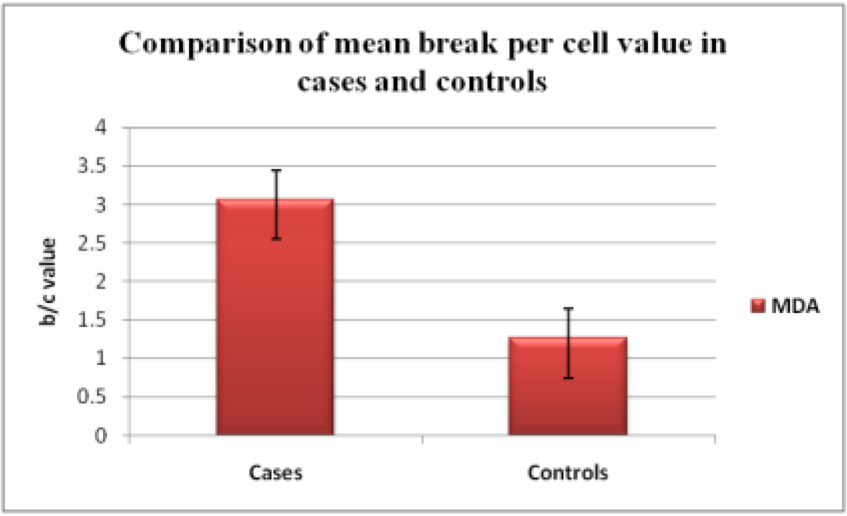

Figure 8: Mean break per comparison cell value in Cases and controls

Emerging risk markers

Figure 9 shows a comparison of oxidized LDL cholesterol between patients and controls. When comparing Ox-LDL-C between patients and controls, a statistically significant ($p <0.05$) difference was found.

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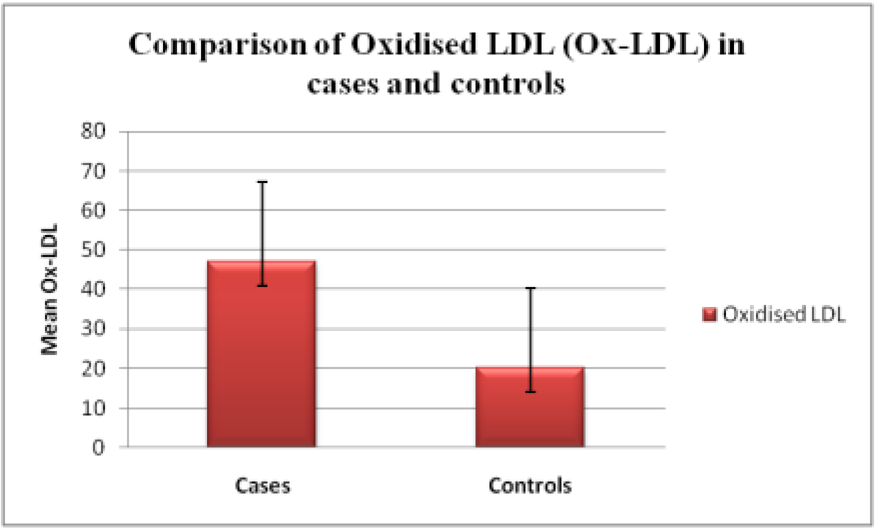

Figure 9: Oxidised LDL (Ox-LDL) comparison in Cases and controls

4. Conclusion:

It may be inferred that the risk of CMS can be reduced among prehypertensive people by food adjustment, changes in life style features, and adequate treatment. CMS may be predicted with a high degree of accuracy from the traditional risk factors alone. CMS incidents may be avoided with the use of new risk indicators like adiponectin and interleukin-6, but only if they are detected and treated quickly.

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