DISSERTATION SUBMITTED FOR THE MASTER'S DEGREE IN MEDICAL BIOCHEMISTRY

TITLE

ANALYSIS OF SERUM LIPID PROFILE IN BENIGN PROSTATIC HYPERPLASIA PATIENTS AND CONTROL SUBJECTS

SUBMITTED

BY

RAMASHISH KUSHWAHA

2023

DEPARTMENT OF BIOCHEMISTRY

INTEGRAL INSTITUTE OF MEDICAL SCIENCES AND RESEARCH

FACULTY OF HEALTH & MEDICAL SCIENCES

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DISSERTATION

SUBMITTED

In partial fulfillment of the requirement for the award of degree of

Master of Science

In

Medical Biochemistry

By

RAMASHISH KUSHWAHA

Enrolment No: 2000101532

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CERTIFICATE

This is to certify that **Mr**. **Ramashish Kushwaha** student of **M.Sc. Medical Biochemistry**. Integral University has completed his dissertation titled **"Analysis of Serum Lipid Profile in Benign Prostatic Hyperplasia Patients and Control Subjects"** successfully. He has completed this work in the department of Biochemistry, Integral institute of Medical Sciences and Research, Integral University under my supervision. The dissertation was a compulsory part of his M.Sc. degree.

I wish him good luck and a bright future

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Ramashish Kushwaha

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Date:

Place: *Lucknow* ***Ramashish Kushwaha***

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LIST OF ABBREVIATIONS

BPH	Benign Prostate Hyperplasia
LUTS	Lower urinary tract symptoms
UTI	Urinary Tract Infection
LDL	Low Density Lipoprotein
HDL	High Density Lipoprotein
TG	Triglycerides
VLDL	Very Low Density Lipoprotein
T. CHOL	Total cholesterol
DHT	Dihydrotestosterone
KGF	Keratinocyte Growth Factor
IGF	Insulin-like Growth Factor
BMI	Body Mass Index

SYMBOLS

mg	Milligram
dl	Deciliter
cm	Centimeter
kg	Kilogram
mmol/l	Millimoles per liter
kg/m^2	Kilogram per meter square
%	Percentage
Lt	Liter
≥	Greater than or Equal
<	Less than

INTRODUCTION

A typical prostate is a walnut-sized gland that is part of the male reproductive system **(Young et al., 2013).**

The prostate weighs an about of eleven grams in adults, with an average difference of between 7 and 16 grams. The prostate gland is situated in the rectum's forehead, directly behind the bladder, in the pelvis. This surrounds the urethra, the duct that empties the large amount the pee through the urinary tract. **(Leissner et al., 1979)**.

Anatomically, The frontal lobe, distal lobe, two side lobes (right & left), together with the median lobes, are the five different areas of the prostate gland. This division is commonly described in various anatomical textbooks. However, in clinical settings, it is more commonly referred to as having two lateral lobes (right and left) and a median lobe.

Histologically, the prostate gland consists of different zones, which in turn divide it into three distinct anatomical zones. This division is based on the histological characteristics of the gland.

The central zone constitutes the lower part of the gland, enveloping the ejaculatory ducts.
The peripheral zone is the predominant zone, accounting for approximately 70% of the gland's volume. It surrounds the majority of the middle area as well as a section of a prostate urethra's outermost end.

The transition regions are a little glandular area that surrounds a circumstance of the urethra located between the urinary bladder and verumontanum**(McNeal et al., 1984)**.

The transition zone is where benign hyperplasia of the prostate (BPH) typically develops. The only location in the gland of the prostate where BPH can develop is thereBPH, or benign prostatic hyperplasia, pertains to the enlargement of the prostate gland and does not encompass the potential symptoms it may induce. Lower urinary tract symptoms (LUTS), which are the common name for these symptoms. **(Kapoor A., 2012)**.

BPH is a common illness that usually affects men as they become older.The prostate glands are elongated in a non-cancerous manner. There are several methods to characterize BPH, including the elongation of the prostate, histological hyperplasia, lower urinary tract symptoms, reduced urine outflow, or obstructive urodynamic patterns.BPH has a substantial impact on quality lifestyles and, finally, when untreated, can result in serious problems that could be fatal. It is a widespread, persistent, and developing illness that places an economic stress on those who are afflicted.**(Parsons et al., 2008)**.

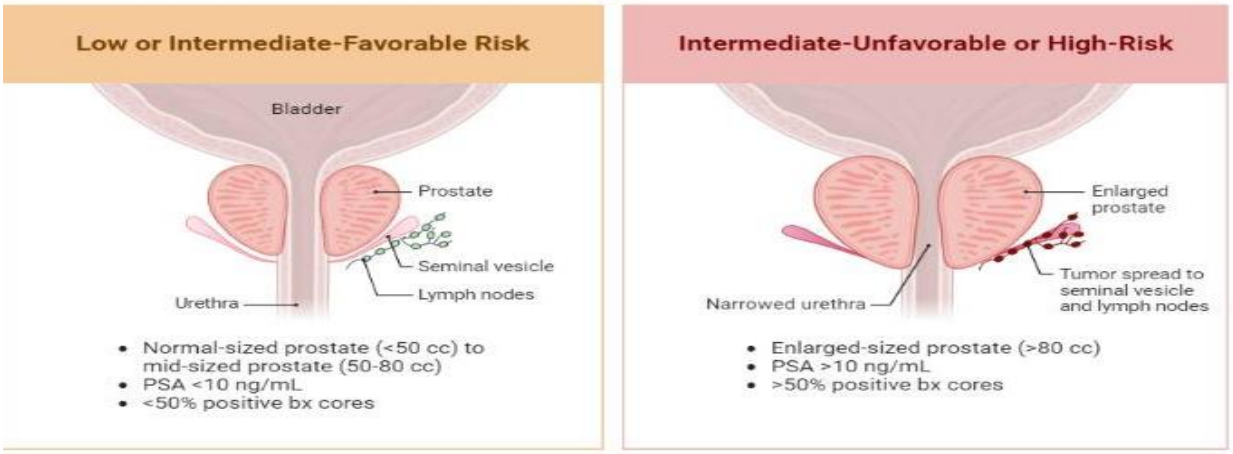

Fig. 1. Normal and abnormal prostate size.

Numerous research studies have consistently indicated that men who are obese have an increased likelihood of developing benign prostatic hyperplasia (BPH). Various criteria, such as patients' BMI and waist circumference, have been employed to establish standards for diagnosing obesity based on individual characteristics. Across all these studies, a consistent consensus has been reached, demonstrating that both central (abdominal) and general (overall) Obesity raises the risk of BPH and contribute to the worsening of urinary symptoms **(Parkesit et al., 2016)**.

Obesity is a severe condition linked to elevated levels of serum lipids, such as Triglycerides, low-density lipoproteins (LDL), overall cholesterol, as well as low amounts of high-density lipoproteins (HDL). If obesity or a diet rich in fatty foods raises the likelihood of developing BPH, high levels of serum lipids could potentially serve as indicators of benign prostatic enlargement. Lowering these lipid levels to normal values may help in managing BPH **(Lekili et al., 2006)**.

Usually, a lipid profile or lipid panel consists of the: -

(a) Total cholesterol

(b) Triglycerides

(c) High density lipoprotein (HDL) cholesterol

(d) Low- density lipoprotein (LDL) Cholesterol

TOTAL CHOLESTEROL

A measurement of the overall quantity of cholesterol in the bloodstream is called total cholesterol. A waxy, fatty molecule resembling fat, cholesterol is created by your liver naturally and is found in meals. It is important for various bodily functions, such as the production of hormones, vitamin D, and substances that help with **digestion (Yeast et al., 2013)**.

The major sites of cholesterol synthesis in the body include: - liver, adrenal cortex, testes, ovaries and intestine **(Craig et al., 2022)**.

As per the most recent statement fromNIH Consensus meeting,the levels of cholesterol are categorized in accordance are as follows: Cholesterol concentrations below 200 mg/dl tend to be "desirable blood cholesterol," values between 200 and 239 mg/dl are referred to as "borderline cholesterol," and concentrations of 240 mg/dl or higher are referred to as "high blood cholesterol."" **(Lekili et al., 2006)**.

TRIGLYCERIDES

A triglyceride (TG), commonly referred to as a triacylglycerols (TAG), is a substance created when glycerol is esterified with three fatty acids.. This process involves bonding of three fatty acid molecules to each of the three hydroxyl groups of glycerol, resulting in the formation of a triglyceride molecule **(Svennerholm L., 1977).**

Triglycerides are synthesized by the liver from carbohydrates and free fatty acids. Subsequently, these triglycerides are released into the bloodstream as the core component of VLDL (very low-density lipoprotein) **(Cox et al., 2011)**.

NORMAL REFERENCE VALUES: Normal= <161 mg/dl

High: 161 to 199 mg/dl

Extremely High = >200 mg/dl

HIGH DENSITY LIPOPROTEIN (HDL)

Cholesterol in the high-density lipoprotein (HDL), often referred to as "good cholesterol," is a type of cholesterol that plays a beneficial role in the body. Low-density lipoprotein (LDL) cholesterol, frequently referred to as "bad cholesterol," is eliminated from the bloodstream by HDL cholesterol, which then transports them once again to the liver for degradation and removal. This procedure can help to decrease the chance of heart attack and stroke by reducing the accumulation of bad cholesterol (LDL) in the arteries. **(Eren et al., 2012)**.

HDL is made up of cholesterol, triglycerides, and different apolipoproteins. Its synthesis occurs in the liver and the intestines **(Bailey et al., 2022).**

NORMAL REFERENCE VALUES: Male: 35.5-79.mg/dl

Female: 42-88 mg/dl

LOW DENSITY LIPOPROTEIN

LDL is a form of lipoprotein which transports triglycerides as well as cholesterol from the bloodstream to hepatocytes. Low density lipoprotein is frequently referred as the "bad cholesterol" as it can help promote atherosclerosis, which is a disorder marked by the accumulation of plaque within the blood vessels, when levels of LDL are high. LDL receptor is present in various tissues throughout the body, including the liver. This receptor plays a critical role in regulating cholesterol levels by binding to low-density lipoprotein (LDL) particles in the bloodstream and facilitating their uptake into cells.

NORMAL REFERENCE VALUES: - Normal= 100 to130 mg/dl

Borderline= 130 to 159 mg/dl

High: >160 mg/dl.

PATHOGENESIS

Cholesterol serves like the building block for the production of testosterone. Testosterone then enters both stromal cells and epithelial cells. Within the stromal cells, the enzyme 5-alpha-reductase2 that is attached to a nuclear membrane to produces DHT, or dihydrotestosterone, from a considerable part of testosterone. Approximately 90% of the total androgen concentration in the prostate is accounted for by the main androgen, DHT.**(Roehrborn et al., 2008).**

DHT interacts with the androgen receptor (AR), and when they bind together, the complex moves into the nucleus. Inside the nucleus, the DHT-AR complex attaches to specific regions called androgen responsive elements (AREs) on the DNA.

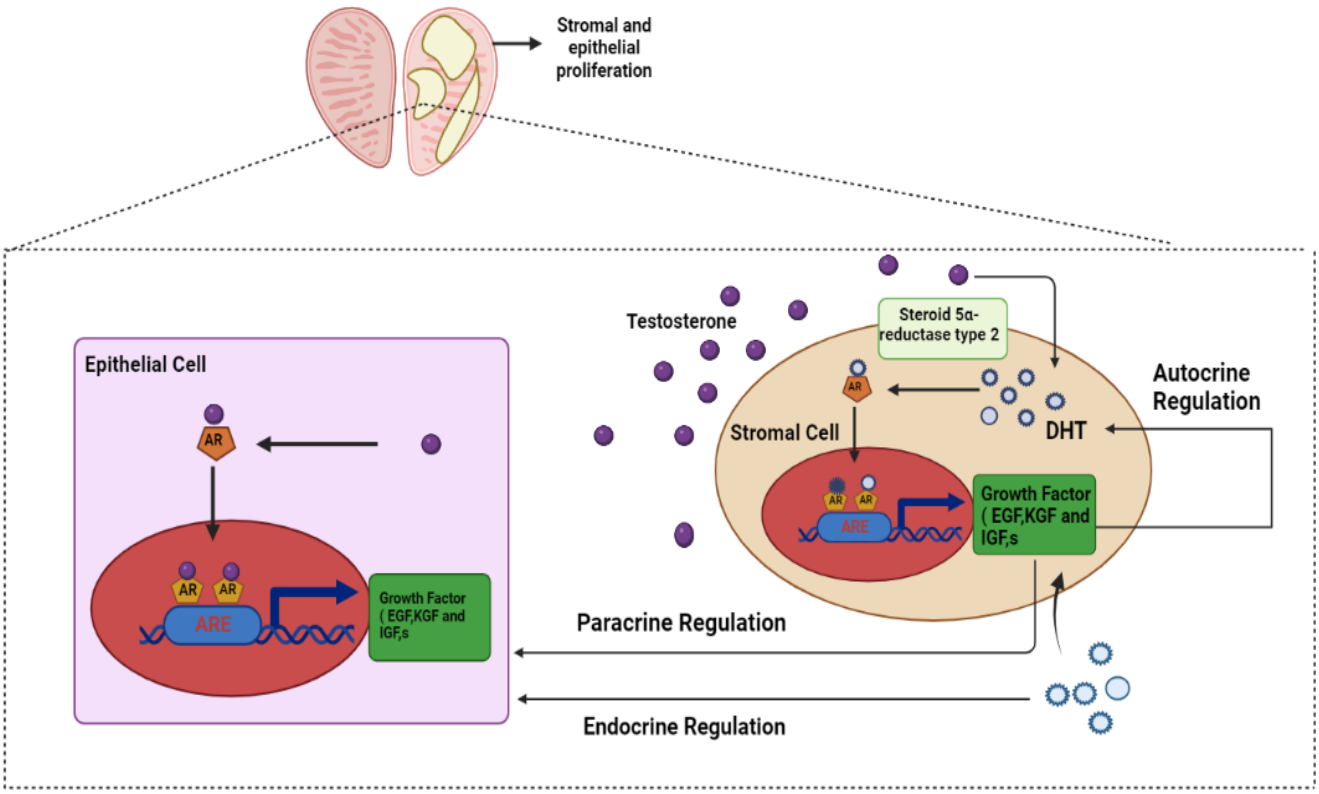

Fig.2. (a) Role of testosterone in BPH

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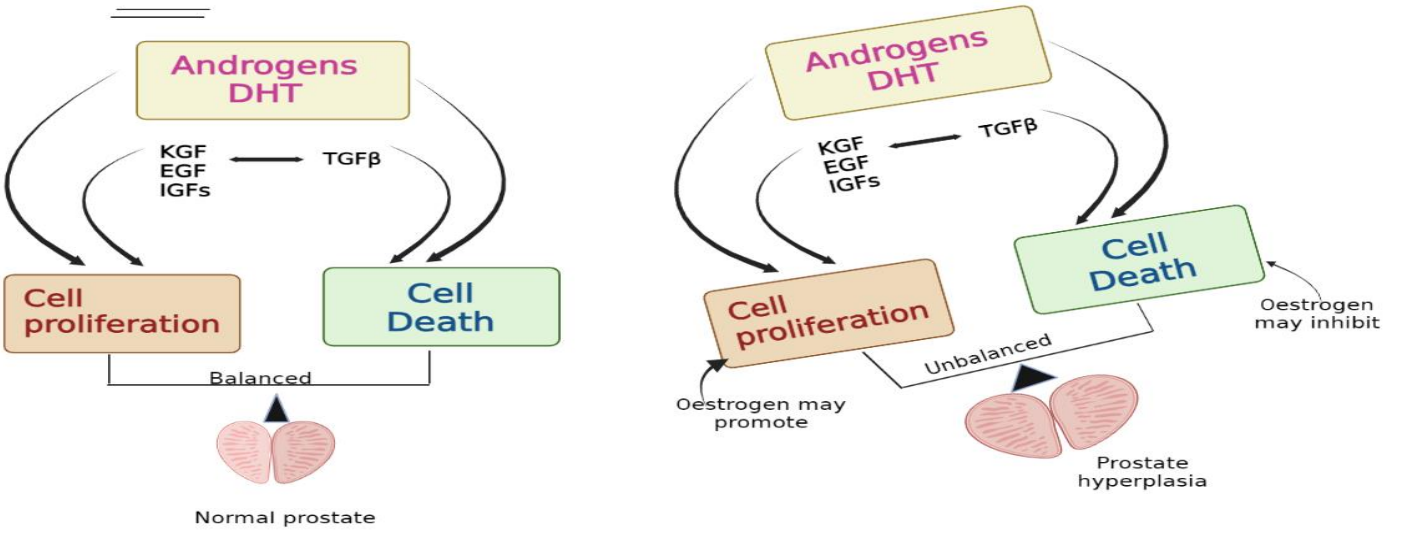

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Fig.2. (b) Molecular control of prostate growth

This binding process facilitates the activation of genes responsible for producing different growth factors, such as the insulin-like growth factors (IGFs), the epidermal growth factor (EGF), and Keratinocyte growth factor (KGF). These factors for growth are essential for controlling cell growth in the human prostate gland. **Fig. 2 (Carson III et al., 2003).**

Obesity can lead to an elevation in intra-abdominal pressure, resulting in an increase in both bladder pressure and intravesical pressure. These elevated pressures can contribute to the deterioration and exacerbation of symptoms associated with benign prostatic hyperplasia (BPH) **(Wang et al., 2012).**

Obesity causes a rise in the flow of fatty tissue, which increases the liver's production of triglycerides. Consequently, hypertriglyceridemia, a condition marked by a metabolic imbalance that causes excessive triglyceride levels in the blood, develops as a result. **(Klopet al., 2013).**

When an excessive amount of fatty acids starts to build up in the liver, it triggers a process called lipotoxicity, which leads to an increase in overall insulin resistance throughout the body. As a result of this insulin resistance, there is a condition called hyperinsulinemia, where there are more insulin molecules in the blood than usual. This occurs because our body does not respond properly to the effects of insulin. Consequently, this improper response prompts the pancreas to produce more insulin to compensate for the reduced effectiveness of insulin **(Unger et al., 2003).**

Insulin communicates through the insulin receptor, while the IGF-I receptor also transmits signals to the androgen receptor, resulting in cellular growth in both stromal and epithelial cells. Thus, promoting the development of BPH **(Yaker et al., 2002).**

REVIEW

OF

LITERATURE

BPH, a disorder that frequently affects elderly men, is a serious threat to the public's health. In the United States in the year 2000, which marks latest comprehensive data available, BPH resulted in more than 4.4 million visits to medical clinics, around 117,000 visits to emergency rooms, and approximately 105,000 cases requiring hospitalization **(Wei et al., 2005)**.

Among men in the United States aged 60-69 years, the estimated prevalence of benign prostatic hyperplasia (BPH) exceeds 70%. This condition affects approximately 6.5 million white men between the ages of 50 and 79 **(Parsons J.K., 2010).**

The occurrence of benign prostate hyperplasia (BPH) significantly increases with advancing age. BPH is observed in 70% of men in the United States aged between 60 and 69, while the figure rises to 80% for those aged 70 or above. Between 1994 and 2000,Both the incidence and the prevalence of BPH elevated slowly in the US. **(Parsons J.K., 2010).**

By the year 2030, In the United States, projections indicate that elderly people will make about 20% of the population, with over 20 million individuals being men aged 65 or above **(Wei et al., 2005).**

In India, approximately half of men aged 60 or above are affected by benign prostatic hyperplasia (BPH). Several studies conducted in India have shown that the prevalence of BPH ranges from 25% to 50% across different age groups. Specifically, prevalence percentages between the ages of 40 and 49, 50 to 59, 60 to 69, and 70 to 79 are approximately 25%, 37%, 37%, and 50% respectively. This means that by the time men reach the age of 60, more than 50% of them will have some signs of the condition. On a global scale, the prevalence of BPH in men over 50 years old generally ranges from 20% to 62% **(Bhat et al., 2021).**

In older men, having BPH is directly related to the development of lower urinary symptoms (LUTS) that have a variety of symptoms.

SYMPTOMS: -

1. Difficulty starting urinating
2. Weak or slow urine flow
3. Dribbling after urinating
4. Sudden, uncontrolled urge to urinate
5. Nocturia
6. Difficulty emptying the bladder,
7. Feel pain or a burning sensation during urination **(Parsons J.K., 2010).**

FACTORS AT RISK FOR BPH AND LUTS

From a population-based perspective, there are mainly two primary groups of health risks associated with BPH and LUTS: non-modifiable factors (such as ageing, geomorphology, and family history) along with modifiable factors (such as testosterone, the metabolic syndrome progression, fat, type 2 diabetes, regular exercise, nutrition, and irritation). Table.1

Table 1:FACTORS AT RISK FOR BPH AND LUTS

Non-modifiable	Modifiable
1. Ageing 2. family history 3. Geography	1. Testosterone 2. Dihydrotestosterone 3. Obesity 4. Type 2 diabetesDiet 5. Irritation 6. Nutrition

AGE: -The frequency of benign prostatic hyperplasia (BPH) significantly increases with advancing age. Postmortem examinations have revealed that the histological occurrence of In the 4th decade of daily life, BPH is 8%, in the 6th decade it is 50%, and in the 9th decade it is 80%. **(Barry et al., 1997).**

Numerous observational studies carried out in the United States, Europe, and Asian countries have consistently demonstrated that increasing age is linked to an increased chance of getting BPH, and experiencing its clinical progression, as indicated by various criteria.

Results from the Krimpen and Baltimore Longitudinal Study of Ageing (BLSA) cohorts show that men's prostate size similarly tends to increase with age. These studies suggest that In elderly males, the prostate expands at a rate of between 2.0 percent to 2.5 per cent each year (Bosch et al., 2007).

While the size of the prostate does not have a direct correlation with the severity of symptoms, Lower Urinary Tract Symptoms (LUTS) progression is at risk due to prostate enlargement. Additionally, greater chances of Benign Prostatic Hyperplasia (BPH) clinical development, urine retention, and the need of prostate surgery are associated with bigger volume prostates**(Bosch et al., 2008).**

GENETICS: -Research findings indicate a lot of evidence exists to suggest that both BPH (benign prostatic hyperplasia) and symptoms of the lower urinary tract (LUTS) are influenced by hereditary factors.

This investigator additionally calculated that benign prostatic hyperplasia (BPH) surgical treatment is performed on 50% of male patients.Before the age of 60 possess a hereditary variant of the condition **(Sanda et al., 1994).**

BPH and LUTS have been found that exhibit concordance rates of 63% and 26% among monozygotic twins, respectively. Certain rates imply that inherited factors might be quite important

in the onset of certain illnesses. In fact, according a single study, hereditary variables may account for up to 72% of the chance for high-moderate or serious LUTS in elderly males. **(Parsons et al., 2013).**

OBESITY: -Research consistently indicates a positive correlation between higher levels of body fat and an enlarged prostate. In various study populations, studies have repeatedly demonstrated that more adiposity, comprising elements like obesity, a body mass index (BMI), and circumference of the waist, is linked to a higher prostatic volume. **(Kristal et al., 2008).**

Baltimore in his Longitudinal Study of Aging, It was found that there was a 0.41 mL raised the volume of the prostate for every 1 kg/m2 rise in BMI. Additionally, When compared to persons who were not obese (BMI 25 kg/m2), obese people (BMI > 35 kg/m2) were shown to have a 3.5-fold greater risk of enlarged prostates.**(Maserejian et al., 2011).**

Epidemiological data also indicates that being overweight or obese raises the chances of undergoing BPH surgery, experiencing the advancement of urinary symptoms, and beginning BPH medical treatment **(Parsons et al., 2011).**

DIET: -The risk of BPH and LUTS may be influenced via both micronutrients as well as macronutrients, according to some studies, though the outcomes are not always in accordance. In terms of macronutrients, consuming more total calories, energy-adjusted protein intake, red meat, fats, milk and other dairy products, grains, bread, chicken, and starches may raise the risks of developing symptoms of BPH and having BPH surgery. On the other hand, consumption of fruits, vegetables (especially those high in carotenoids), polyunsaturated fatty acids, linoleic acid, the antioxidant vitamin A, and vitamin D may lower the risk of developing LUTS and symptomatic BPH. **(Kristal et al., 2008).**

Regarding micronutrients, studies have indicated an inverse association between BPH and LUTS and blood levels of the antioxidant vitamin E, lycopene, the element selenium and

carotene.As for zinc andvitamin C, their association with the risk is inconsistent, as they have been linked to both increased and decreased risks **(Maserejian et al., 2011).**

Lastly, an extensive review of 19 research papers indicated conflicting relationships with alcohol use. It discovered that drinking alcohol was associated with both reduced and elevated chances of BPH & LUTS, respectively. **(Parsons et al., 2009).**

OTHER RISK FACTOR

Additional risk factors that can be changed include cigarette smoking, elevated blood pressure, serum lipids, and lipoproteins have not yet shown clear and consistent patterns of risk in relation to BPH and LUTS **(Parsons J.K., 2011).**

DIAGNOSIS OF BPH

Blood Tests: -In people with chronic high-pressure retention or acute retention, blood tests, such as renal function tests, are critical in assessing the initial level of kidney function and can help confirm the diagnosis of renal failure or acute kidney injury, as examples.

Urine examination: -examination of urine samples is valuable in identifying various conditions, including infection, non-visible blood in urine (haematuria), and metabolic disorders such as glycosuria. By examining urine samples, healthcare professionals can detect these abnormalities and gather important diagnostic information.

Prostate specific Antigen (PSA): - Research has demonstrated that prostate-specific antigen (PSA) testing can serve as a predictive indicator of prostate volume. Increased PSA levels can be seen in a variety of situations, such as prostate carcinoma, infection, and an enlarged prostate.**(Bohnen et al., 2007).**

Ultrasound: -Urinary tract stones and cases of haematuria (blood in the urination) are both investigated using ultrasound imaging.

TREATMENT/ MANAGEMENT

Table 2: Current BPH treatment modalities and therapies

Management Modality	Treatment Type	Treatment Description
1. 5-alpha reductase inhibitor	Medical	Preventing the conversion of testosterone to DHTand reducing the growth effect of androgens on the prostate.
2. Alpha blocker	Medical	Relaxes smooth muscle of the prostate and bladder neck by inhibiting sympathetic exertion.
3. TURP	Surgical	Resection of the prostate through the urethra applying monopolarelectrocautery.
4. Green light laser therapy	Surgical/laser	High-powered KTP 532-nm wavelength photoselective vaporization system.
5. Robot-assisted simple prostatectomy	Surgical	Minimally invasive removal of the enlarged prostate.

LIPID PROFILE AND BPH

Significant amounts of cholesterol are produced and stored by the prostate gland, and prostatic tissues may be especially vulnerable to changes in the metabolism of cholesterol. BPH risk is further elevated by hypercholesterolemia, a major factor in risk for cardiovascular disease (CVD). In this review, we're look at the evidence pointing to a possible link between cholesterol metabolism and the development of benign prostate illness.**(Freeman et al., 2011).**

Triglycerides, also known as triacylglycerols, serve as the primary storage form of fatty acids. Elevated triglyceride levels lead to a condition called hypertriglyceridemia. The frequency of hypertriglyceridemia, which is indicated by triglyceride levels that are higher than 200 mg/dl, is approximately 10% among males aged over 30 years and females aged over 55 years **(Karanchi et al., 2017).**

Recent research suggests that hypertriglyceridemia and an increased risk of cardiovascular disease may be related, especially when combined with low levels of HDL-C (high-density lipoprotein cholesterol) & higher levels of LDL-C. These abnormalities in the levels of lipids are linked to BPH additionally. **(Yuan et al., 2007).**

The production of high-density lipoprotein, or HDL, takes place in the liver and intestines. Transmitting extra cholesterol back to the liver for processing and excretion, HDL-C levels aids in removing it through the circulation. Reverse cholesterol transfer is this procedure. Myocardial infarction and cardiovascular disease, two disorders associated with BPH, are more likely in people with HDL-C levels below 35 mg/dl. **(Bailey A. &Mohiuddin., 2022).**

LDL, or low-density lipoprotein, levels of cholesterol are known to be correlated with an increased risk for coronary artery disease. LDL cholesterol, which is sometimes referred to as "bad" cholesterol because it may lead to atherosclerosis, a condition in which plaque accumulates in the blood vessels. The risk of coronary artery disease, heart attacks, as well as other cardiovascular issues might increase as a result of this plaque formation because it can reduce blood flow to the

heart and other organs. Several studies have found a link between cardiovascular disease and BPH (benign prostatic hyperplasia) **(Bailey A. &Mohiuddin., 2022).**

Different authors in their studies found an association of serum total cholesterol, TG, HDL,& LDL in patients of benign prostate hyperplasia (BPH) in different populations. However, very few studies have been conducted on the association between lipid profile & BPH in the Indian population. Prostate cancer, a major cause of deaths in elderly men, can develop from BPH over time. Therefore, research linking BPH with serum lipid profile will be very interesting in the future since we can considerably lower mortality and morbidity by altering lipid levels.

Therefore the purpose of this study is to find out association of lipid profile in BPH patient & control subjects in the Indian population.

AIM

&

OBJECTIVES

Aim

To find an association between lipid profiles (total cholesterol, triglycerides, HDL & LDL) in diagnosed cases of benign prostatic hyperplasia (BPH) & Control subjects.

Objectives

1. To determine serum concentration of total cholesterol level in patients of benign prostatic hyperplasia & control subjects.
2. To determine serum concentration of triglyceride level in patients of benign prostatic hyperplasia & control subjects.
3. To determine serum concentration of HDL-C level in patients of benign prostatic hyperplasia & control subjects.
4. To determine serum concentration of LDL-C level in patients of benign prostatichyperplasia & control subjects.
5. To find the correlation between lipid profile in patients of benign prostatic hyperplasia & control subjects, if any.

MATERIALS

&

METHODS

Research Question

Is there any significant difference in the levels of serum total -cholesterol, TG, HDL, & LDL in diagnosed cases of BPH and control subjects?

Hypothesis: -

Null hypothesis (H_o): There is no significant association in the levels of serum total cholesterol, TG, HDL, & LDL in patients of BPH & control subjects.

Alternate hypothesis (H_1): There is a significant association in level of serum total cholesterol, TG, HDL, & LDL in patients of BPH & control subjects.

METHODOLOGY

Types of Study: -Case-control study.

Study Design: -Prospective

PLACE OF STUDY:

Department of Biochemistry, Integral Institute of Medical Science and research, Lucknow (U.P).

COLLABORATING DEPARTMENT –

Department of General Surgery, OPD at IIMS&R, Integral University, Lucknow.

SUBJECTS SELECTION

Selection for Controls

1. Apparently healthy individuals
2. Age of 40 years and above

Selection for Cases

Inclusion criteria

1. Diagnosed cases of BPH
2. Subjects with the age of 40 years & above **(Lekili et al., 2006).**

Exclusion criteria

1. Neurogenic bladder dysfunction
2. 5-alpha reductase inhibitor therapy
3. Liver disease

Enrollment of participants:

Cases were enrolled from the benign prostatic hyperplasia attended the Integral Hospital.

Data collection

A detailed clinical history including age, occupation, socio-economic status, and any associated risk factors contributing to the illness was elicited from BPH patients and control subjects.

Sampling Method: Purposive sampling

Collection of samples: -

Under the aseptic condition, 3 ml of venous blood was collected in the red top (plain vial) from the subjects.

1. 1 ml of blood was taken for the determination of serum total cholesterol.
2. 1 ml of blood was taken for the determination of serum triglycerides.
3. 1 ml of blood was taken for the determination of serum high density lipoprotein (HDL).

LDL was calculated by using formula-

- **LDL-C (mg/dl) = TC (mg/dl) − HDL-C (mg/dl) − TG (mg/dl)/5**
- **VLDL** was calculated by using formula- **TG (mg/dl)/5**

The sample was then centrifuged at 3500 rpm/min for 10 minutes to separate the serum.

Storage of samples: -The serum samples for the estimation of total cholesterol, triglyceride, high density lipoprotein (HDL), & low density lipoprotein (LDL) was stored at -20C until testing in Central Clinical Laboratory, Department of Biochemistry, IIMS&R, Lucknow (U.P).

Sample size

The sample size is calculated using the formula

$$n = \left(\frac{r+1}{r}\right)\frac{\sigma^2(Z_\beta + Z_{\alpha/2})^2}{(d\text{ifference})^2}$$

n = sample size

(r+1)/r = ratio of case to control

Sigma = standard deviation (taken from previous studies)

Zβ = represent the desired power & Zα/2 = represent the desired level of statistical significance

Difference = effect size (difference in means of study group comparison group taken

From the previous studies), for 80% power, Zβ = (0.84)

For 0.05 significance level, Zα/2=1.96

r = 1 (equal to number of case and control) & σ = 31.9

d = 205.7 - 189.2 **(Gokce et al., 2010)**

d = 16.5

$$n = \frac{2(31.9)^2(0.84 + 1.96)^2}{(16.5)^2}$$

Therefore, n = 58.8 ≈ 60

The study included 30 cases and 30 controls.

Reference- Charan, J., & Biswas, T. (2013). How to calculate sample size for different study designs in medical research? Indian journal of psychological medicine, *35*(2), 121-126.

LABORATORY INVESTIGATION:

a) Determination of serum total cholesterol by using Erba chem-7 Biochemistry Analyzer.

Methodology: -Modified Roeschlau'sMethod.

PRINCIPLE

The estimation of cholesterol involves the following enzyme catalyzed reactions.

- Cholesterol ester $\xrightarrow{\text{Cholesterol esterase}}$ cholesterol + fatty acid
- Cholesterol + O_2 $\xrightarrow{\text{CHOD}}$ cholest-4-en-3-one + H_2O_2(CHOD-Cholesterol Oxidase)
- $2H_2O_2$ + 4- aminoantipyrine $\xrightarrow{\text{POD}}$ $4H_2O$ + Quinoneimine (POD- Peroxidase)

NORMAL REFERENCE VALUES: - Desirable= <200 mg/dl

Borderline= 200-239 mg/dl

High level= >239 mg/dl

Assay Procedure for Total Cholesterol

Pipette into tubes marked	**Blank (B)**	**Standard (S)**	**Test (T)**
Working Reagents	1000µl	1000µl	1000µl
Distilled Water	20µl	–	–
Standard	–	20µl	–
Test	–	–	20µl

Mix well and incubate at 37^0C for 10 minutes. Aspirate Blank followed by Standard and Tests. Read the absorbance of standard and each test tube against blank at 505 nm or 505/670 nm on bichromatic analyzer **(Roeschlau et al., 1974).**

b) Determination of serum triglycerides by using Erba chem-7 Biochemistry Analyzer.

Methodology: - this reagent is based on the method of Wako and the modifications by McGowan et al and Fossati et al.

Principal

- Triglyceride + H_2O —LPL→ Glycerol + Free fatty acids
- Glycerol + ATP —Glycerol Kinase→ Glycerol-3-phosphate + ADP
- Glycerol-3-phosphate + O_2 —GPO→ DAP + H_2O_2
    - (Glycerol phosphate Oxidase)
- H_2O_2 + 4-aminoantipyrine + 3, 5-DHBS* —Peroxidase→ Quinoneimine Dye + $2H_2O$

*DHBS- 3,5-Dichloro-2-hydroxybenzene sulfonate

The intensity of quinoneimine formed is proportional to the triglycerides concentration in the sample when measured at 505 nm.

NORMAL REFERENCE VALUES: Normal= <161 mg/dl

High= 161-199 mg/dl

Very High= >200

Assay Procedure for Triglycerides

Pipette into tubes marked	**Blank (B)**	**Standard (S)**	**Test (T)**
Working Reagents	1000µL	1000µL	1000µL
Distilled Water	10µL	–	–
Standard	–	10µL	–
Test	–	–	10µL

Mix and incubate for 10 min at 37^0C. Read the absorbance of standard and each test at 505 nm (500- 540 nm) or 505-670 nm on bichromatic analyzers against reagent blank.

c) Determination of serum HDL-Cholesterol by using Erba chem-7 Biochemistry Analyzer.

Principle

The assay is based on a modified polyvinyl sulfonic acid (PVS) and polyethylene glycol-methyl ether (PEGME) coupled classic precipitation method with the improvements in using optimized quantities of PVS/PEGME and selected detergents. LDL, VLDL and chylomicron (CM) react with PVS and PEGME and the reaction results in inaccessibility of LDL, VLDL and CM by cholesterol oxidase (CHOD) and cholesterol esterase (CHER). The enzymes selectively react with HDL to produce H2O2 which is detected through a tinder reaction.

HDL+ LDL VLDL + CM $\xrightarrow{\text{PVS, PEGME}}$ HDL+(LDL+VLDL+CM)*PVS/PEGME

HDL $\xrightarrow{\text{CHOD, CHER}}$ Fatty Acid + H_2O_2

$2H_2O_2$ + 4- aminoantipyrine $\xrightarrow{\text{Peroxidase}}$ Quinone + $5H_2O$

NORMAL REFERENCE VALUES: Male: 35.5-79.5 mg/dl

Female: 42-88 mg/dl

Assay Procedure for HDL-Cholesterol

Pipette into tubes marked	**Reagent Blank (B)**	**Sample / Calibrator**
Reagent 1	375µL	375µL
Distilled Water	5 µL	–
Sample / Calibrator	–	5 µL
Mix and incubate at 37°C for 5 min**.**		
Add Reagent 2	125 µL	125 µL
Mix and incubate at 37°C for 5 min		

Read final absorbances at the specified wavelength against reagent blank.

d) Determination of serum LDL-Cholesterol by using Erba chem-7 Biochemistry Analyzer.

Principle

The assay is based on a modified polyvinyl sulfonic acid (PVS) and polyethylene glycol methyl ether (PEGME) coupled classic precipitation method with the improvements in using optimized quantities of PVS/PEGME and selected detergents. LDL, VLDL, and chylomicron (CM) react with PVS and PEGME and the reaction results in inaccessibility of LDL, VLDL and CM by cholesterol oxidase (CHOD) and cholesterol esterase (CHER), whereas HDL reacts with the enzymes. Addition of R2 containing a specific detergent releases LDL from the PVS/PEGME complex. The released LDL reacts with the enzymes to produce H2 O2 which is quantified by the trinder reaction.

(LDL + VLDL + CM) • PVS/PEGME $\xrightarrow{\text{Detergent}}$ (LDL + VLDL +CM)*PVS/PEGME

LDL $\xrightarrow{\text{CHOD, CHER}}$ Fatty Acid + H_2O_2

$2H_2O_2$ + 4-Aminoantipyrine + TODB $\xrightarrow{\text{Peroxidase}}$ Quinone + $4H_2O$

NORMAL REFERENCE VALUES: - Normal= 100-130 mg/dl

Borderline= 130-159 mg/dl

High= >160 mg/dl

ETHICS REVIEW

Permission from the Integral University ethics committee was taken (**IEC/IIMS&R 2023/69**)

STATISTICAL ANALYSIS PLAN

Statistical analysis was performed using IBMSPSS software (version 16), Graph Pad software (version 6.0) and Microsoft – Excel (2007). All the data was expressed as mean ± standard deviation. An unpaired t-test was performed to compare the study parameters between cases and controls. Karl Pearson's correlation analysis was employed to determine the relationship between variables. p-value<0.05 was considered statistically significant.

OBSERVATIONS

&

RESULTS

OBSERVATION:-

Table 3.
Means and standard deviations of evaluated parameters in BPH patients & control subjects.

Parameters	BPH (n=30)	Control (n=30)	p-value	Significance
Age	50.66± 6.69	50.4± 3.78	0.853	Not statistically significant
BMI	27.53± 3.72	27.43± 3.54	0.915	Not statistically significant
Total cholesterol	205.99 ± 16.44	188.37 ± 19.07	**0.0003**	statistically significant
Triglyceride	161.65±38.35	119.99±34.79	**0.0001**	statistically significant
HDL-cholesterol	35.39±3.13	37.20± 3.03	**0.0268**	statistically significant
LDL-cholesterol	137.42± 17.77	126.38±18.94	**0.0234**	statistically significant

n=Cases or controls in number, p-value <0.05 is regarded as statistically significant.

AGE

In this study, 30 control Subjects aged 40 years and above along with 30 benign prostatic hyperplasia (BPH) patients were included. The mean age of control subjects (50.4 ±3.78) and BPH patients (50.66 ±6.69) have been found.

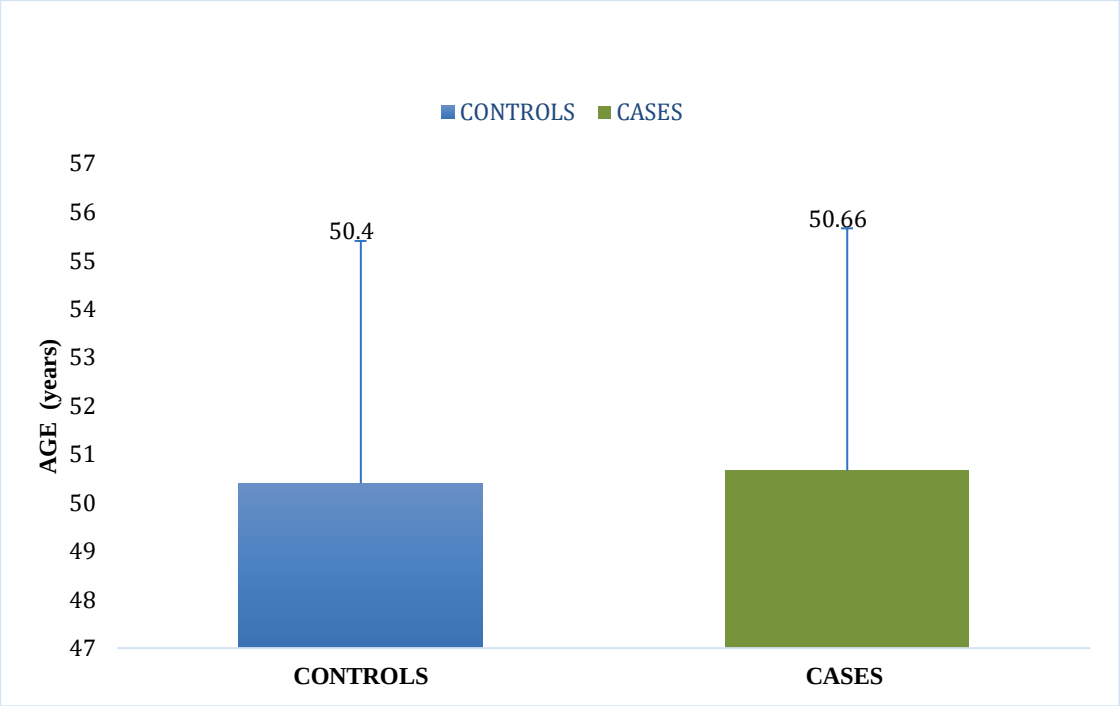


Figure.3. Comparison of ages (years)in cases & controls

BODY MASS INDEX (BMI)

Anthrpometric parameter body mass index (BMI)were not significant in BPH,comparing patients to control subjects, p=0.915 shown in table 3.

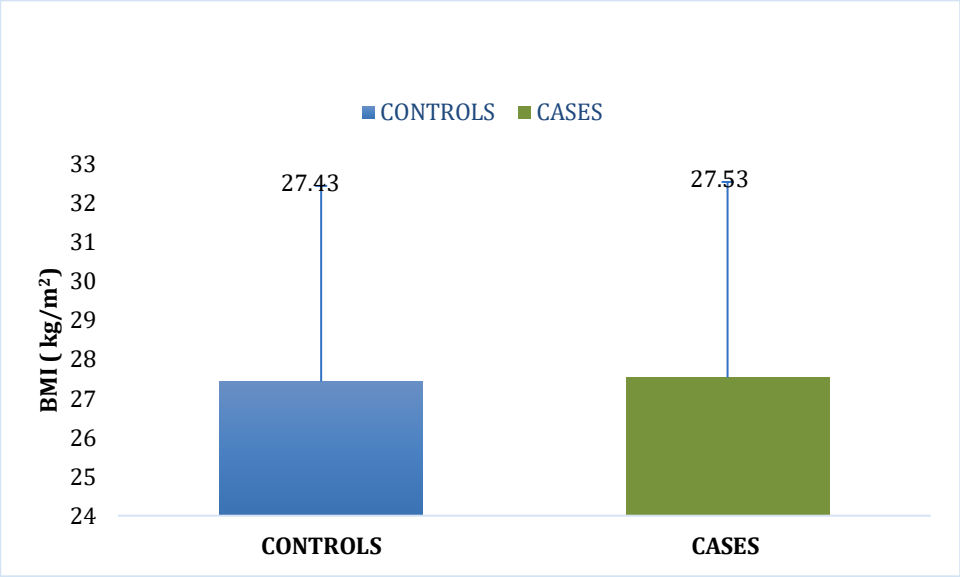


Fig. 4 Comparison of BMI in cases and controls

Total Cholesterol

Serum total cholesterol is significantly increasedin BPH, comparing patients to control subjects, p= 0.0003 shown in table. 3.

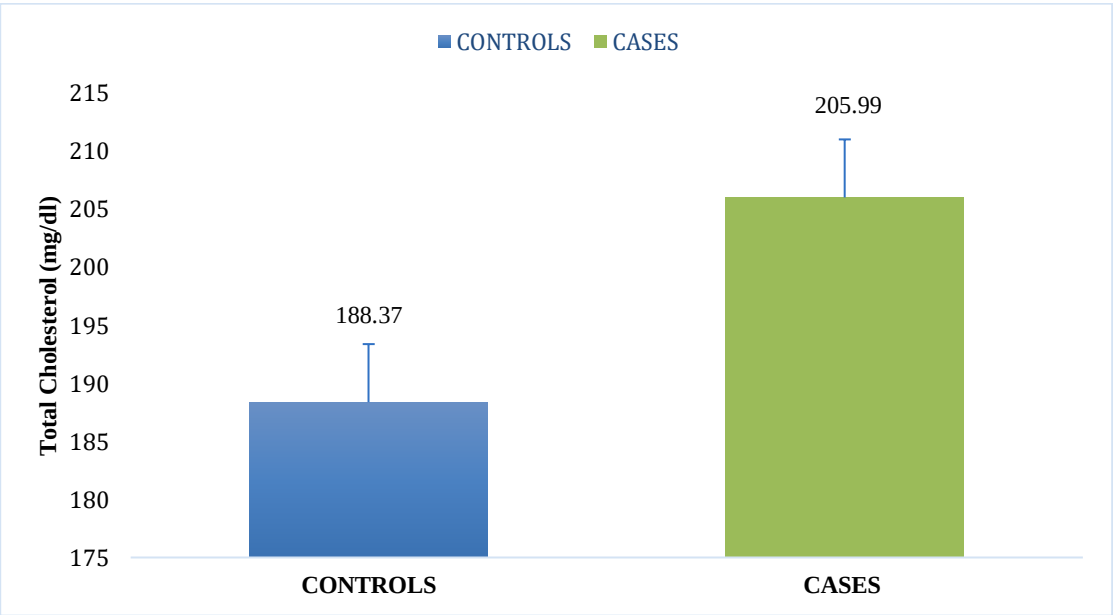


Fig. 5. Comparison of total cholesterol in cases and controls

Serum triglycerides

In BPH patients compared to control subjects, serum triglycerides are considerably higher (p= 0.0001) shown in table.3.

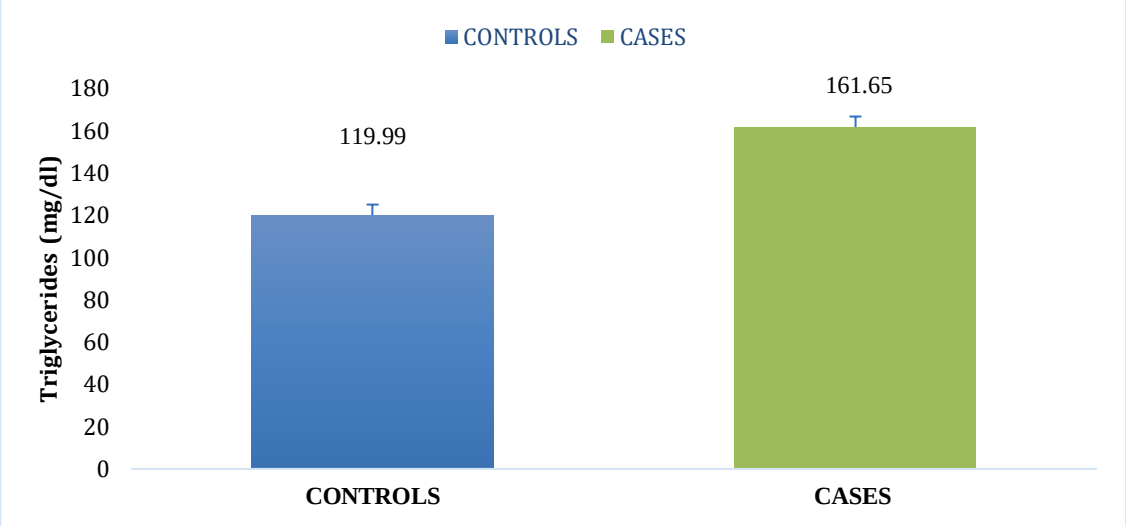


Fig.6 Comparison of triglycerides in cases and controls

Serum HDL

Compared to control persons, BPH patients' serum HDL-C is considerably lower (p=0.0268) shown in table.3.

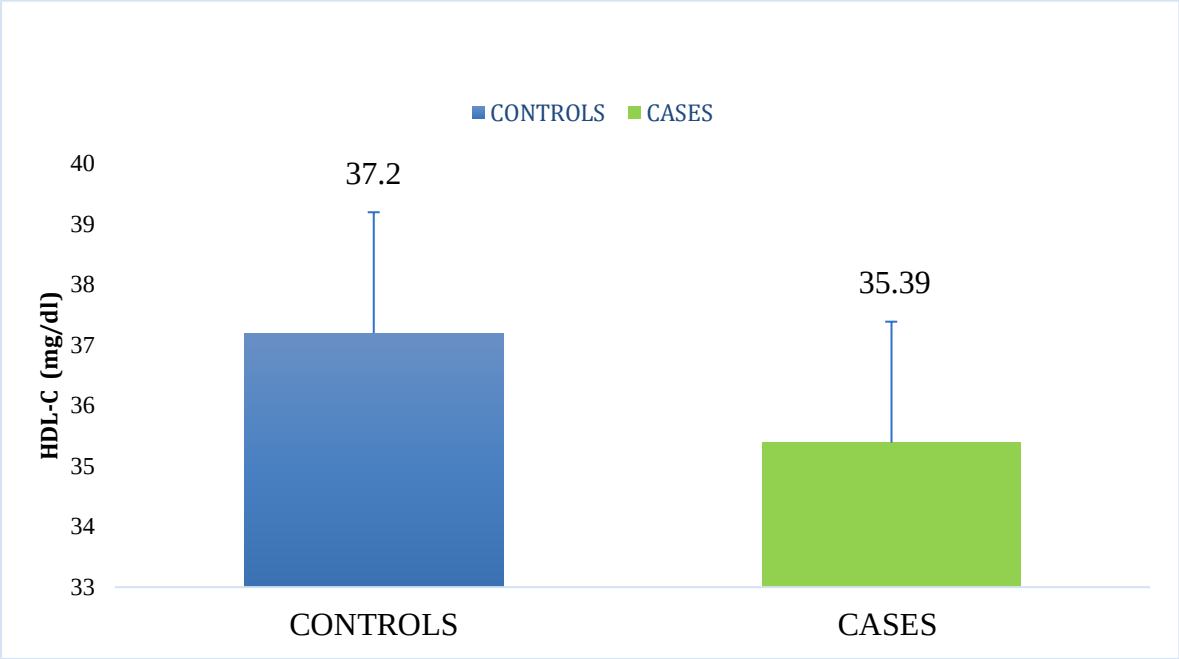


Fig.7. Comparisonof HDL-C in cases and controls

Serum LDL

When compared to control persons, BPH patients' serum LDL-C is considerably higher (p=0.0234) shown in table.4.

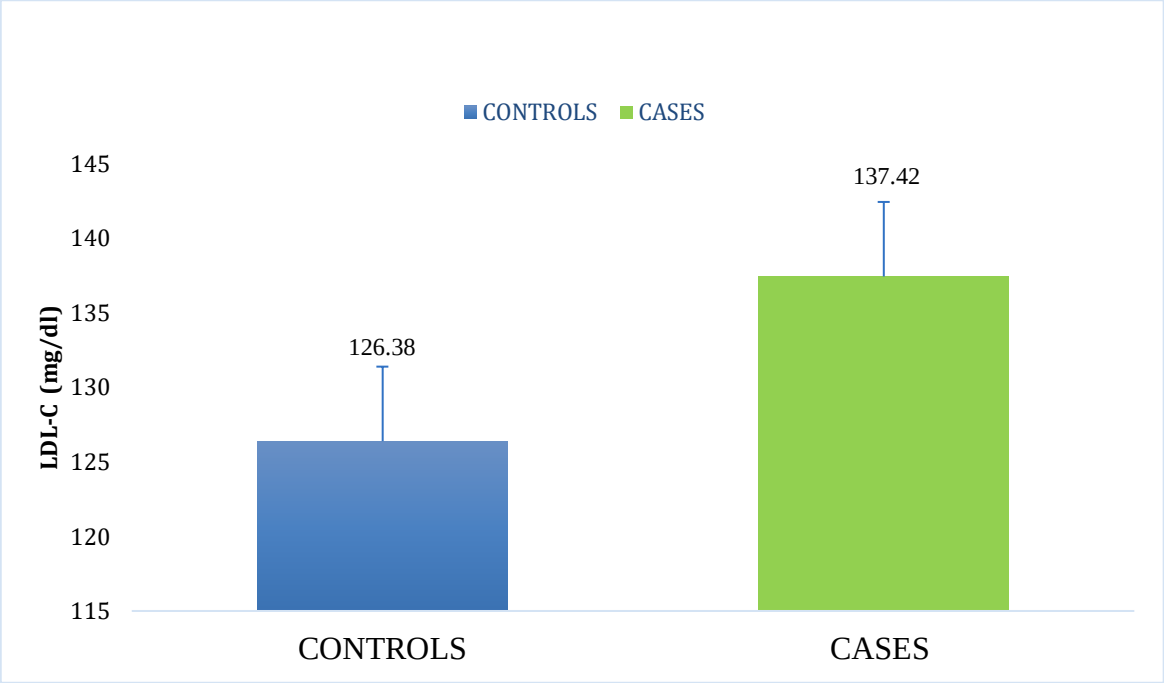


Fig.8. Comparison of LDL-C in cases and controls

KARL PEARSON'S CORRELATION

Significant correlations between serum total cholesterol, triglycerides, HDL, and LDL-C have been found.

Table: 4–Pearson's correlationcoefficient between total cholesterol & LDL.

Correlations					
		T.CHOL (mg/dl)	**TG (mg/dl)**	**HDL (mg/dl)**	**LDL (mg/dl)**
T.CHOL (mg/dl)	Pearson Correlation	1	0.083	0.102	.888**
	Sig. (2-tailed)		0.661	0.590	0.000
	N	30	30	30	30
TG (mg/dl)	Pearson Correlation	0.083	1	-0.010	-0.337
	Sig. (2-tailed)	0.661		0.960	0.068
	N	30	30	30	30
HDL (mg/dl)	Pearson Correlation	0.102	-0.010	1	-0.072
	Sig. (2-tailed)	0.590	0.960		0.707
	N	30	30	30	30
LDL (mg/dl)	Pearson Correlation	.888**	-0.337	-0.072	1
	Sig. (2-tailed)	0.000	0.068	0.707	
	N	30	30	30	30

** Significant correlation at the 0.01 level (2-tailed).

* Significant correlation at the 0.05 level (2-tailed).

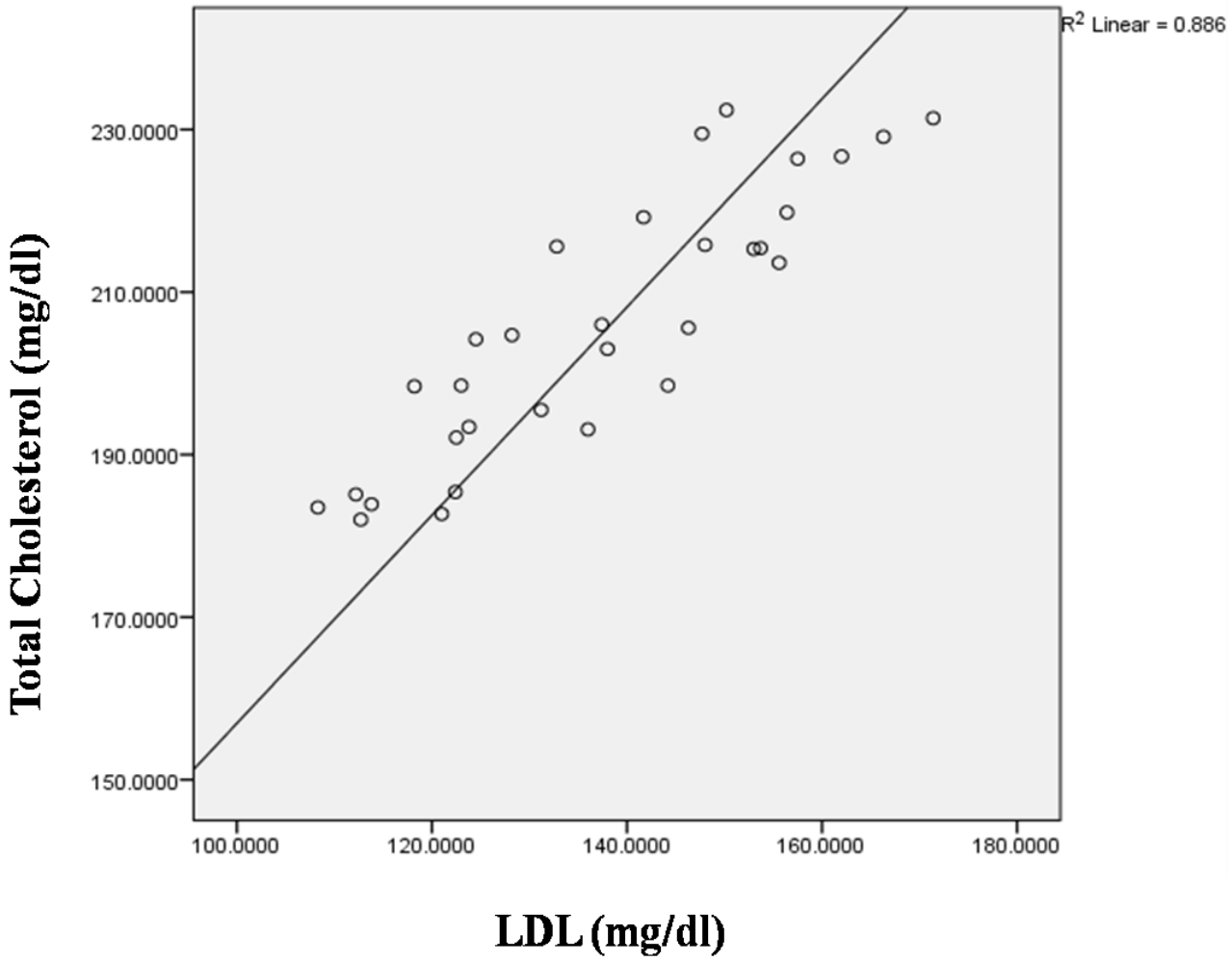


Fig.9. LDL-C levels and total cholesterol levels are shown in a scatter plot.

RESULT

The purpose of this study was to evaluate the lipid profile of patients with benign prostatic hyperplasia & apparently healthy controls.

The parameters estimated were:

1) Total cholesterol
2) Triglycerides
3) HDL, or high density lipoprotein,
4) LDL, or low density lipoprotein

The parameter levels were compared with control levels, who are apparently healthy individuals.

The study observations were as follows-:

1) When compared to control subjects, the level of total cholesterol was considerably higher in cases (p=0.0003) (Table.3 & Fig.5).

2) When compared to control subjects, the level of triglycerides was considerably higher in cases (p=0.0001) (Table.3 & Fig.6).

3) When compared to control subjects, the level of HDL-C was considerably lower in cases (p=0.0265) (Table.3 & Fig.7)

4) When compared to control subjects, the level of LDL-C was considerably higher in cases (p=0.0234) (Table.3 & Fig.8).

DISCUSSION

A frequent age-related illness in males known as BPH, which stands for benign prostatic hyperplasia, causes the prostate gland to expand non-malignantly, causing symptoms of incontinence and the possibility of urethral blockage. **(Michael et al., 2020).**

We included BPH patients and controls that appeared to be in good health in our case-control study to reduce the impact of variables that caused confusion. Lipid profiles and BPH patients have been shown to be strongly correlated. Several studies have shown that age, BMI & abnormalities of various risk factors are associated with BPH.

The mean age of BPH is (50.66 ± 6.69) and apparently healthy controls are (50.4 ± 3.78) have been found.

Clinical factors that affect lipid profiles such as total cholesterol, triglycerides, LDL &HDL were found to be considerably higher in our current study's participants compared to control people.

These findings were highly consistent with earlier research that suggests that BPH may be accompanied with elevated levels of total cholesterol, triglycerides, LDL-C & HDL-C.

Dahle et al., (2002) also noted that males with higher waist-to-hip ratios and age were more likely to undergo BPH surgery. **Nandeesha et al. (2006)** reported that BPH patients have significantly elevated levels of total cholesterol levels, TG & LDL and lower levels of HDL-C.

According to**Nandeesha et al.,(2006)** dyslipidemia in BPH can arise as a result of insulin resistance. It is thought that insulin, which is well known for its capacity to stimulate growth, aids in the growth of the prostate. Itindicates that insulin may contribute to the enlargement of the prostate gland in BPH.

Published evidence suggests an increasingly strong correlation between BPH progression and obesity. Obesity, characterized by increasing Triglyceride and reduced HDL concentration in serum, has been observed in our results. This suggests that the patients sampled for this study were at a risk of obesity, probably due to BPH. According to **Parsons, J. K., et al., (2013)**It has been

suggested that obesity raises arterial pressure because to obstruction, and this has had a negative effect on the prostate. It was observed that the arterial pressure contributed to marked prostatic growth as observed in ultrasounds taken from BPH patients. If this be, then our data agrees to this, that there is an association between BPH progression and obesity.

Previous research has provided evidence that an abnormal lipid profile can contribute to the development of prostatism**(Lee et.al., 1997).** Furthermore, there is a theory that suggests dyslipidemia is an indicator of risk for the development of BPH. The present study's findings align with previous research, further supporting this notion **(Hostedt et al., 1999).**

An increased total cholesterol concentration as observed in our case sample pool can be a signal of hormonal dysregulation. As discussed earlier, cholesterol is directly involved in the biosynthesis of steroid hormone testosterone. This hormone has a causal relationship with BPH disease **(Holst et al., 2004).**

In view of this, there could be an increase in the synthesis of testosterone hormone from the androgens, and its subsequent conversion to DHT, the active form that has been found to cause prostatic hyperplasia.

SUMMARY

AND

CONCLUSIONS

SUMMARY

A common disorder known as a benign form of prostate (BPH) causes the prostate gland to expand in a non-cancerous manner in males. The incidence of BPH increases with age, with a substantial number of men experiencing symptoms by their 60s and 70sBPH is thought to impact up to 90% of men in their 70s and 80s, and more than half of those in their 60s. Although the specific origins of BPH are not entirely understood, it is thought that hormonal changes and age-related variables play a role in its onset. Urinary symptoms brought on by BPH include frequent urination, poor urine flow, and trouble clearing the bladder.

In this study, 30 patients of BPH aged 40 years & above along with 30 control subjects were included.

The average age of BPH patients is (50.66 ± 6.69) and control subjects of (50.4 ± 3.78) have been found.

Total cholesterol has significantly elevated in patients with BPH versus control subjects ($p=0.0003$). Triglycerides have significantly elevated BPH patients in comparison to control subjects ($p=0.0001$). As compared to control subjects, the HDL levels of BPH patients were lower ($p=0.0265$).

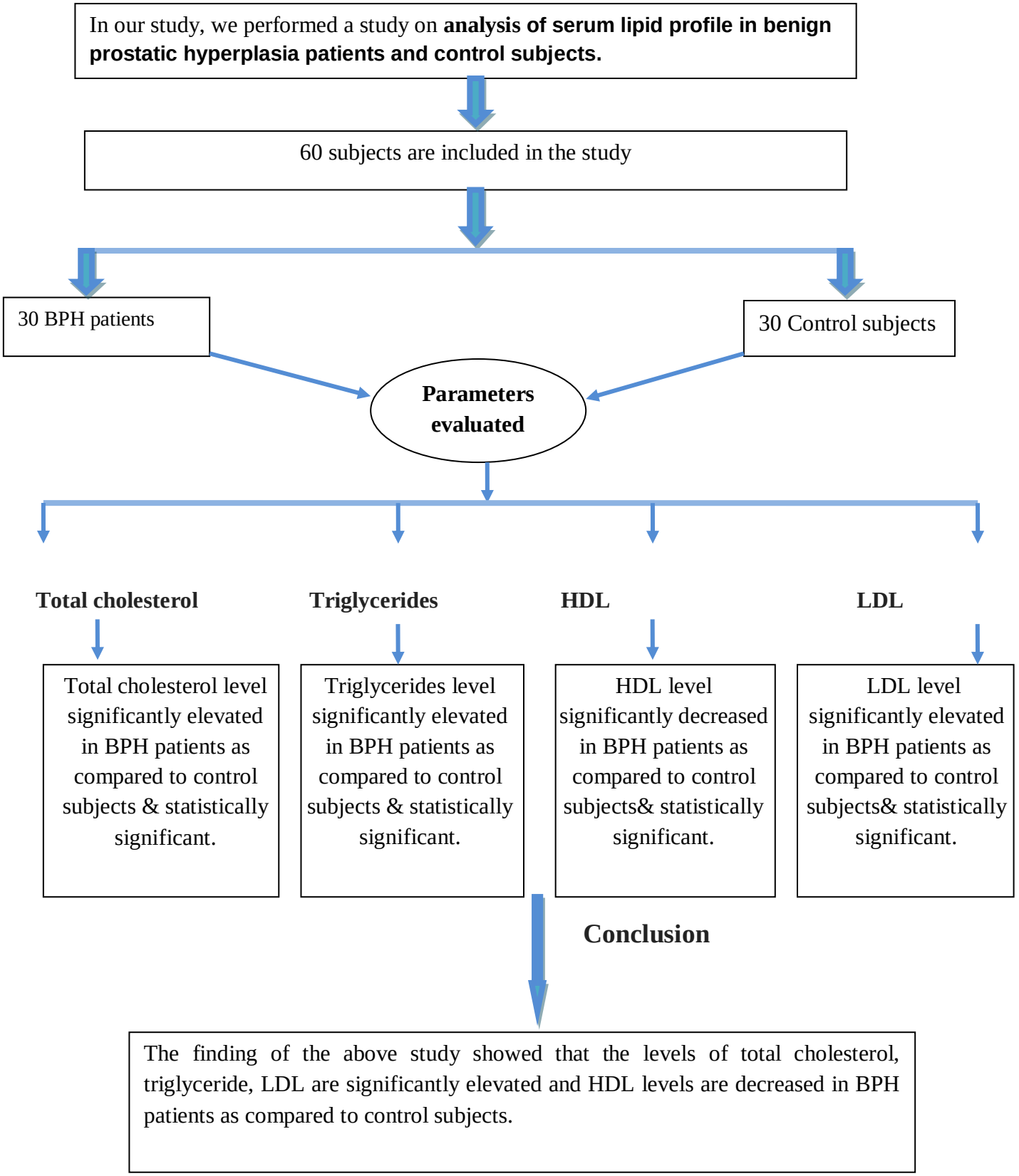
The level of low-density lipoprotein or LDL values is higher in BPH patients compared to control people. Evaluation of lipid profile and follow-up of BPH patients are important to understanding the causes of BPH and other abnormalities that might help in better understanding in management of BPH, or benign prostatic hyperplasia.

CONCLUSION

In the current study, it was found that BPH patients had considerably higher levels of total cholesterol, triglycerides, LDL-C, & HDL-C, compared to the apparently sound control.Numerous researches looked at the relationship between BPH patients and their age, obesity, and cardiovascular disease. Therefore, increased levels of total cholesterol, triglycerides, , and lower HDL indicate the presence of BPH, making it crucial to look at the lipid profile in BPH patients, including total cholesterol, triglycerides, HDL, and LDL.

The findings of this study may be useful in understanding how lipid profiles contribute to the pathophysiology of BPH (Benign Prostate Hyperplasia).

FLOW CHART OF RESEARCH PROJECT



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Unique Identification No:

INTEGRAL INSTITUTE OF MEDICAL SCIENCES AND RESEARCH LUCKNOW - 226026

INCLUSION AND EXCLUSION CRITERIA – FOR CASES

Inclusion Criteria

S.N.	Criteria	YES	NO
1.	Diagnosed with BPH		
2.	age of 40 years & above		

Exclusion Criteria

S.N.	Criteria	YES	NO
1.	Neurogenic bladder dysfunction.		
2.	History of any chronic diseases.		

Subject is eligible for the study, if all **INCLUSION** criteria are **YES** and all **EXCLUSION** criteria are **NO**. **INVESTIGATOR STATEMENT**

I have verified the data entered in the case report form and have determined that it is complete, accurate and compatible with the source documents

Investigator's name Investigator's signature Date

Unique Identification No:

IDENTIFIERS- FOR CASES

Registration No:

Contact No:

Name:

Father's Name /Husband's Name:

Address:

DEMOGRAPHICS- CASES

Age:

Sex: Male ☐ Female ☐

Place of Residence: Urban ☐ Rural ☐

Social / Economical Status: a) Upper b) Upper Middle c) Lower Middle
d) Upper Lower e) Lower

Education: a) Illiterate b) Primary c) Middle d) High School e) Intermediate
f) Graduation g) Post-graduation & above

ANTHROPOMETRIC PARAMETERS- CASES

Height (mts) ☐

Weight (kgs) ☐

Body Mass Index (kg/ m^2) ☐

Unique Identification No:

INTEGRAL INSTITUTE OF MEDICAL SCIENCES AND RESEARCH LUCKNOW - 226026

SELECTION CRITERIA-- FOR CONTROLS

S.N.	Criteria	YES	NO
1.	Apparently healthy individuals		
2.	Age of 40 years & above		

Subject is eligible for the study, if all **INCLUSION** criteria are **YES** and all **EXCLUSION** Criteria are **NO**. **INVESTIGATOR STATEMENT**

I have verified the data entered in the control report form and have determined that it is complete, accurate and compatible with the source documents

Investigator's name Investigator's signature Date

Unique Identification No:

IDENTIFIERS- FOR CONTROL

Registration No:

Contact No:

Name:

Father's Name /Husband's Name:

Address:

DEMOGRAPHICS- CONTROL

Age:

Sex: Male ☐ Female ☐

Place of Residence: Urban ☐ Rural ☐

Social / Economical Status: a) Upper b) Upper Middle c) Lower Middle
d) Upper Lower e) Lower

Education: a) Illiterate b) Primary c) Middle d) High School e) Intermediate
f) Graduation g) Post-graduation & above

ANTHROPOMETRIC PARAMETERS- CONTROL

Height (mts) ☐

Weight (kgs) ☐

Body Mass Index (kg/ m^2) ☐

Unique Identification No:

ANNEXURE I

INFORMED CONSENT FORM (FOR CASES)

1. I am Ramashish Kushwaha MSC Medical Biochemistry 3rd year student, IIMS&R Lucknow.

2. For this study, I will take your 2 ml blood sample for the estimation of serum total cholesterol, triglycerides, HDL-C and LDL-C.

3. The blood is only subjected for estimation of serum total cholesterol, triglyceride, HDL, & LDL and not for any other purpose.

4. There will be no charges /fees/any consideration will be given or taken for the study.

5. Your identity will be confidential and information and the result of your blood test will not be revealed to any other except you if you desire.

6. This study has nothing to do with your treatment nor is it going to hamper the same if you refuse to participate.

7. The study has nothing to do with your current treatment but may improve the knowledge and understanding of the disease process and that knowledge may or may not be helpful in future.

8. After knowing all the above details, would you like to participate in our study? YES / NO

CONSENT FORM

I……..…age.....W/OD/OS/O.....

..R/O.....……. here with state that I have been duly informed about the study Titled: "**ANALYSIS OF SERUM LIPID PROFILE IN BENIGN PROSTATIC HYPERPLASIA PATIENTS AND CONTROL SUBJECTS**" its prospects and consequences.

I hereby give informed and written consent for the collection of my blood sample for the above said study only.

Signature/thumb impression of the patient:

Signature/thumb impression of the witness Signature of research scholar:

Unique Identification No:

ANNEXURE II
INFORMED CONSENT FORM (FOR CONTROLS)

1. I am Ramashish Kushwaha MSC Medical Biochemistry 3rd year student, IIMS&R Lucknow.

2. For this study, I will take your 2 ml blood sample for the estimation of serum total cholesterol, triglycerides, HDL-C and LDL-C.

3. The blood is only subjected for estimation of serum total cholesterol, triglyceride, HDL, & LDL and not for any other purpose.

4. There will be no charges /fees/any consideration will be given or taken for the study.

5. Your identity will be confidential and information and the result of your blood test will not be revealed to any other except you if you desire.

6. This study has nothing to do with your treatment nor is it going to hamper the same if you refuse to participate.

7. The study has nothing to do with your current treatment but may improve the knowledge and understanding of the disease process and that knowledge may or may not be helpful in future.

8. After knowing all the above details, would you like to participate in our study? YES / NO

CONSENT FORM

I……..…age.....W/OD/OS/O.....

RO.....……. here with state that I have been duly informed about the study Titled:

"**ANALYSIS OF SERUM LIPID PROFILE IN BENIGN PROSTATIC HYPERPLASIA PATIENTS AND CONTROL SUBJECTS**" its prospects and consequences.

I hereby give informed and written consent for the collection of my blood sample for the above said study only.

Signature/thumb impression of the patient:

Signature/thumb impression of the witness Signature of research scholar:

विशिष्टपहचानसंख्या:

अनुलग्नक I

सूचित सहमति पत्र (FOR CASES)

1 मैं रामाशीष कुशवाहा एमएससी मेडिकल बायोकेमिस्ट्री तृतीय वर्ष, आईआईएमएस एंड आर लखनऊ का छात्र हूं।

2. इस अध्ययन के लिए, मैं सीरम कुल कोलेस्ट्रॉल, ट्राइग्लिसराइड्स, एचडीएल-सी और एलडीएल-सी के आकलन के लिए आपका 2 मिलीलीटर रक्त का नमूना लूंगा।

3. रक्त का परीक्षण केवल सीरम कुल कोलेस्ट्रॉल, ट्राइग्लिसराइड, एचडीएल और एलडीएल के आकलन के लिए किया जाता है, किसी अन्य उद्देश्य के लिए नहीं।

4. अध्ययन के लिए कोई शुल्क / शुल्क नहीं दिया जाएगा या कोई विचार नहीं किया जाएगा।

5. आपकी पहचान गोपनीय रहेगी और यदि आप चाहें तो जानकारी और आपके रक्त परीक्षण का परिणाम आपके अलावा किसी अन्य को नहीं बताया जाएगा।

6. इस अध्ययन का आपके उपचार से कोई लेना-देना नहीं है और न ही यदि आप भाग लेने से इनकार करते हैं तो यह इसमें बाधा डालने वाला है।

7. अध्ययन का आपके वर्तमान उपचार से कोई लेना-देना नहीं है, लेकिन यह रोग प्रक्रिया के ज्ञान और समझ में सुधार कर सकता है और वह ज्ञान भविष्य में सहायक हो भी सकता है और नहीं भी।

8. उपरोक्त सभी विवरण जानने के बाद, क्या आप हमारे अध्ययन में भाग लेना चाहेंगे? हां नहीं

सहमतिपत्र

मैं.....उम्र.....W/OD/OS/O.....आर/ओ.....

..... यहां यह बताते हुए कि मुझे अध्ययन के बारे में विधिवत जानकारी दी गई है जिसका शीर्षक है: "सौम्य प्रोस्टेट हाइपरप्लासिया रोगियों और नियंत्रण विषयों में सीरम लिपिड प्रोफाइल का विश्लेषण" इसकी संभावनाएं और परिणाम।

मैं इसके द्वारा केवल उपरोक्त अध्ययन के लिए अपने रक्त के नमूने के संग्रह के लिए सूचित और लिखित सहमति देता हूं।

रोगी के हस्ताक्षर/अंगूठे का निशान:

गवाह के हस्ताक्षर/अंगूठे का निशान शोध छात्र के हस्ताक्षर:

विशिष्टपहचानसंख्या:

अनुलग्नक II

सूचित सहमति पत्र (FOR CONTROLS)

1 मैं रामाशीष कुशवाहा एमएससी मेडिकल बायोकेमिस्ट्री तृतीय वर्ष, आईआईएमएस एंड आर लखनऊ का छात्र हूं।

2. इस अध्ययन के लिए, मैं सीरम कुल कोलेस्ट्रॉल, ट्राइग्लिसराइड्स, एचडीएल-सी और एलडीएल-सी के आकलन के लिए आपका 2 मिलीलीटर रक्त का नमूना लूंगा।

3. रक्त का परीक्षण केवल सीरम कुल कोलेस्ट्रॉल, ट्राइग्लिसराइड, एचडीएल और एलडीएल के आकलन के लिए किया जाता है, किसी अन्य उद्देश्य के लिए नहीं।

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5. आपकी पहचान गोपनीय रहेगी और यदि आप चाहें तो जानकारी और आपके रक्त परीक्षण का परिणाम आपके अलावा किसी अन्य को नहीं बताया जाएगा।

6. इस अध्ययन का आपके उपचार से कोई लेना-देना नहीं है और न ही यदि आप भाग लेने से इनकार करते हैं तो यह इसमें बाधा डालने वाला है।

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8. उपरोक्त सभी विवरण जानने के बाद, क्या आप हमारे अध्ययन में भाग लेना चाहेंगे? हां नहीं

सहमतिपत्र

मैं.....उम्र.....W/OD/OS/O.....

.....आर/ओ..... यहां यह बताते हुए कि मुझे अध्ययन के बारे में विधिवत जानकारी दी गई है जिसका शीर्षक है: "सौम्य प्रोस्टेट हाइपरप्लासिया रोगियों और नियंत्रण विषयों में सीरम लिपिड प्रोफाइल का विश्लेषण" इसकी संभावनाएं और परिणाम।

मैं इसके द्वारा केवल उपरोक्त अध्ययन के लिए अपने रक्त के नमूने के संग्रह के लिए सूचित और लिखित सहमति देता हूं।

रोगी के हस्ताक्षर/अंगूठे का निशान:

गवाह के हस्ताक्षर/अंगूठे का निशान शोध छात्र के हस्ताक्षर:

INSTITUTIONAL ETHICS COMMITTEE (IEC)

IIMS&R INTEGRAL UNIVERSITY, LUCKNOW

IEC/IIMS&R/2023/69

CERTIFICATE

This is to certify that research work entitled "**Analysis of Serum Lipid Profile in Benign Prostatic Hyperplasia Patients and Control Subjects**" submitted by **Ramashish Kushwaha, Dr.Saba Khan** for ethical approval before the Institutional Ethics Committee IIMS&R.

The above mentioned research work has been approved by Institutional Ethics Committee, IIMS&R with consensus in the meeting held on **30th December 2022**.

Dr.Q.S.Ahmed
(Member Secretary)
IRC/IEC
IIMS &R

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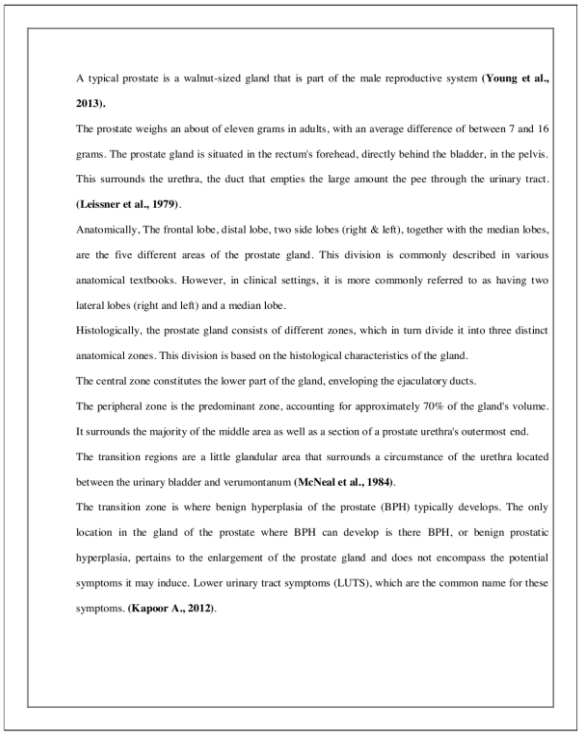

A typical prostate is a walnut-sized gland that is part of the male reproductive system **(Young et al., 2013).**

The prostate weighs an about of eleven grams in adults, with an average difference of between 7 and 16 grams. The prostate gland is situated in the rectum's forehead, directly behind the bladder, in the pelvis. This surrounds the urethra, the duct that empties the large amount the pee through the urinary tract. **(Leissner et al., 1979)**.

Anatomically, The frontal lobe, distal lobe, two side lobes (right & left), together with the median lobes, are the five different areas of the prostate gland. This division is commonly described in various anatomical textbooks. However, in clinical settings, it is more commonly referred to as having two lateral lobes (right and left) and a median lobe.

Histologically, the prostate gland consists of different zones, which in turn divide it into three distinct anatomical zones. This division is based on the histological characteristics of the gland.

The central zone constitutes the lower part of the gland, enveloping the ejaculatory ducts.

The peripheral zone is the predominant zone, accounting for approximately 70% of the gland's volume. It surrounds the majority of the middle area as well as a section of a prostate urethra's outermost end.

The transition regions are a little glandular area that surrounds a circumstance of the urethra located between the urinary bladder and verumontanum **(McNeal et al., 1984)**.

The transition zone is where benign hyperplasia of the prostate (BPH) typically develops. The only location in the gland of the prostate where BPH can develop is there BPH, or benign prostatic hyperplasia, pertains to the enlargement of the prostate gland and does not encompass the potential symptoms it may induce. Lower urinary tract symptoms (LUTS), which are the common name for these symptoms. **(Kapoor A., 2012)**.

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Ramashish Kushwaha

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BPH is a common illness that usually affects men as they become older. The prostate glands are elongated in a non-cancerous manner. There are several methods to characterize BPH, including the elongation of the prostate, histological hyperplasia, lower urinary tract symptoms, reduced urine outflow, or obstructive urodynamic patterns. BPH has a substantial impact on quality lifestyles and, finally, when untreated, can result in serious problems that could be fatal. It is a widespread, persistent, and developing illness that places an economic stress on those who are afflicted. **(Parsons et al., 2008)**.

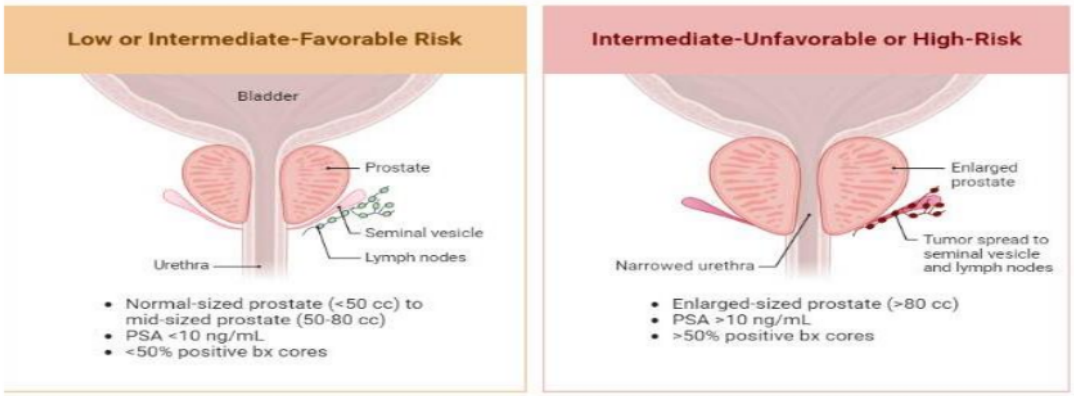

Fig. 1. Normal and abnormal prostate size.

Numerous research studies have consistently indicated that men who are obese have an increased likelihood of developing benign prostatic hyperplasia (BPH). Various criteria, such as patients' BMI and waist circumference, have been employed to establish standards for diagnosing obesity based on individual characteristics. Across all these studies, a consistent consensus has been reached, demonstrating that both central (abdominal) and general (overall) Obesity raises the risk of BPH and contribute to the worsening of urinary symptoms **(Parkesit et al., 2016)**.

Obesity is a severe condition linked to elevated levels of serum lipids, such as Triglycerides, low-density lipoproteins (LDL), overall cholesterol, as well as low amounts of high-density lipoproteins (HDL). If obesity or a diet rich in fatty foods raises the likelihood of developing BPH, high levels of serum lipids could potentially serve as indicators of benign prostatic enlargement. Lowering these lipid levels to normal values may help in managing BPH **(Lekili et al., 2006)**.

Usually, a lipid profile or lipid panel consists of the: -

(a) Total cholesterol

(b) Triglycerides

(c) High density lipoprotein (HDL) cholesterol

(d) Low- density lipoprotein (LDL) Cholesterol

TOTAL CHOLESTEROL

A measurement of the overall quantity of cholesterol in the bloodstream is called total cholesterol. A waxy, fatty molecule resembling fat, cholesterol is created by your liver naturally and is found in meals. It is important for various bodily functions, such as the production of hormones, vitamin D, and substances that help with **digestion (Yeast et al., 2013)**.

The major sites of cholesterol synthesis in the body include: - liver, adrenal cortex, testes, ovaries and intestine **(Craig et al., 2022)**.

As per the most recent statement from NIH Consensus meeting, the levels of cholesterol are categorized in accordance are as follows: Cholesterol concentrations below 200 mg/dl tend to be "desirable blood cholesterol," values between 200 and 239 mg/dl are referred to as "borderline cholesterol," and concentrations of 240 mg/dl or higher are referred to as "high blood cholesterol."" **(Lekili et al., 2006)**.

TRIGLYCERIDES

A triglyceride (TG), commonly referred to as a triacylglycerols (TAG), is a substance created when glycerol is esterified with three fatty acids.. This process involves bonding of three fatty acid molecules to each of the three hydroxyl groups of glycerol, resulting in the formation of a triglyceride molecule **(Svennerholm L., 1977).**

Triglycerides are synthesized by the liver from carbohydrates and free fatty acids. Subsequently, these triglycerides are released into the bloodstream as the core component of VLDL (very low-density lipoprotein) **(Cox et al., 2011)**.

NORMAL REFERENCE VALUES: Normal= <161 mg/dl

High: 161 to 199 mg/dl

Extremely High = >200 mg/dl

HIGH DENSITY LIPOPROTEIN (HDL)

Cholesterol in the high-density lipoprotein (HDL), often referred to as "good cholesterol," is a type of cholesterol that plays a beneficial role in the body. Low-density lipoprotein (LDL) cholesterol, frequently referred to as "bad cholesterol," is eliminated from the bloodstream by HDL cholesterol, which then transports them once again to the liver for degradation and removal. This procedure can help to decrease the chance of heart attack and stroke by reducing the accumulation of bad cholesterol (LDL) in the arteries. **(Eren et al., 2012)**.

HDL is made up of cholesterol, triglycerides, and different apolipoproteins. Its synthesis occurs in the liver and the intestines **(Bailey et al., 2022).**

NORMAL REFERENCE VALUES: Male: 35.5-79.mg/dl

Female: 42-88 mg/dl

LOW DENSITY LIPOPROTEIN

LDL is a form of lipoprotein which transports triglycerides as well as cholesterol from the bloodstream to hepatocytes. Low density lipoprotein is frequently referred as the "bad cholesterol" as it can help promote atherosclerosis, which is a disorder marked by the accumulation of plaque within the blood vessels, when levels of LDL are high. LDL receptor is present in various tissues throughout the body, including the liver. This receptor plays a critical role in regulating cholesterol levels by binding to low-density lipoprotein (LDL) particles in the bloodstream and facilitating their uptake into cells.

NORMAL REFERENCE VALUES: - Normal= 100 to130 mg/dl

Borderline= 130 to 159 mg/dl

High: >160 mg/dl.

PATHOGENESIS

Cholesterol serves like the building block for the production of testosterone. Testosterone then enters both stromal cells and epithelial cells. Within the stromal cells, the enzyme 5-alpha-reductase2 that is attached to a nuclear membrane to produces DHT, or dihydrotestosterone, from a considerable part of testosterone. Approximately 90% of the total androgen concentration in the prostate is accounted for by the main androgen, DHT. **(Roehrborn et al., 2008).**

DHT interacts with the androgen receptor (AR), and when they bind together, the complex moves into the nucleus. Inside the nucleus, the DHT-AR complex attaches to specific regions called androgen

responsive elements (AREs) on the DNA. This binding process facilitates the activation of genes responsible for producing different growth factors, such as the insulin-like growth factors (IGFs), the epidermal growth factor (EGF), and Keratinocyte growth factor (KGF). These factors for growth are essential for controlling cell growth in the human prostate gland. **Fig. 2 (Carson III et al., 2003).**

Obesity can lead to an elevation in intra-abdominal pressure, resulting in an increase in both bladder pressure and intravesical pressure. These elevated pressures can contribute to the deterioration and exacerbation of symptoms associated with benign prostatic hyperplasia (BPH) **(Wang et al., 2012).**

Obesity causes a rise in the flow of fatty tissue, which increases the liver's production of triglycerides. Consequently, hypertriglyceridemia, a condition marked by a metabolic imbalance that causes excessive triglyceride levels in the blood, develops as a result. **(Klopet al., 2013).**

When an excessive amount of fatty acids starts to build up in the liver, it triggers a process called lipotoxicity, which leads to an increase in overall insulin resistance throughout the body. As a result of this insulin resistance, there is a condition called hyperinsulinemia, where there are more insulin molecules in the blood than usual.. This occurs because our body does not respond properly to the effects of insulin. Consequently, this improper response prompts the pancreas to produce more insulin to compensate for the reduced effectiveness of insulin **(Unger et al., 2003).**

Insulin communicates through the insulin receptor, while the IGF-I receptor also transmits signals to the androgen receptor, resulting in cellular growth in both stromal and epithelial cells. Thus, promoting the development of BPH **(Yaker et al., 2002).**

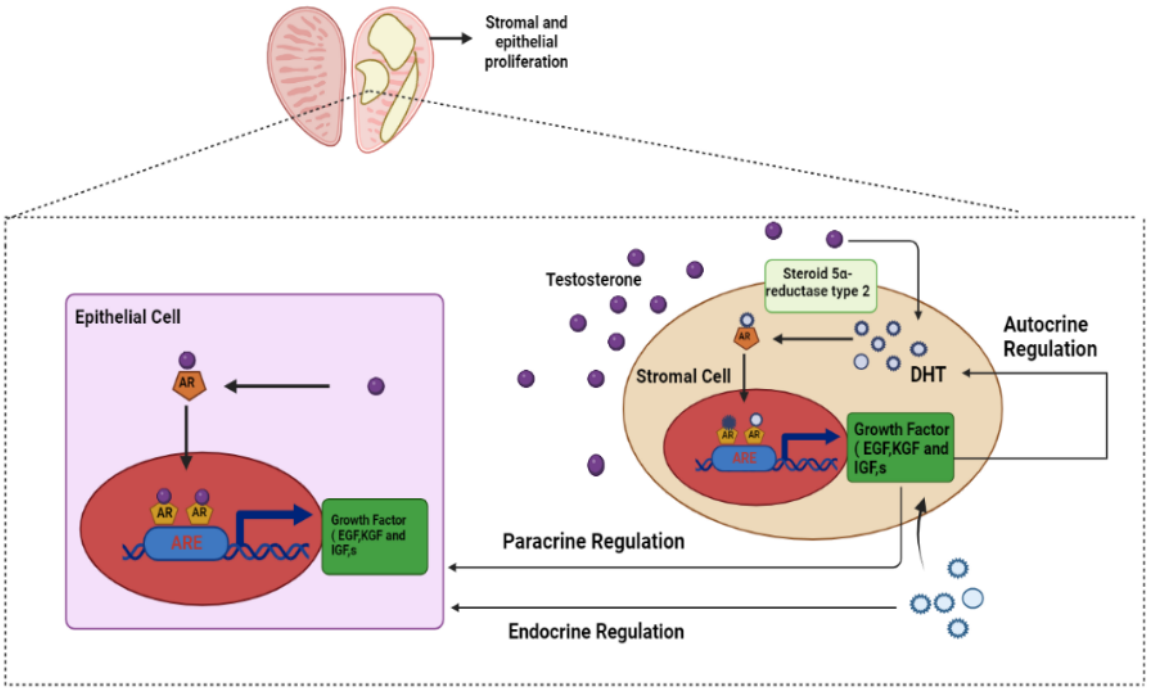

Fig.2. (a) Role of testosterone in BPH

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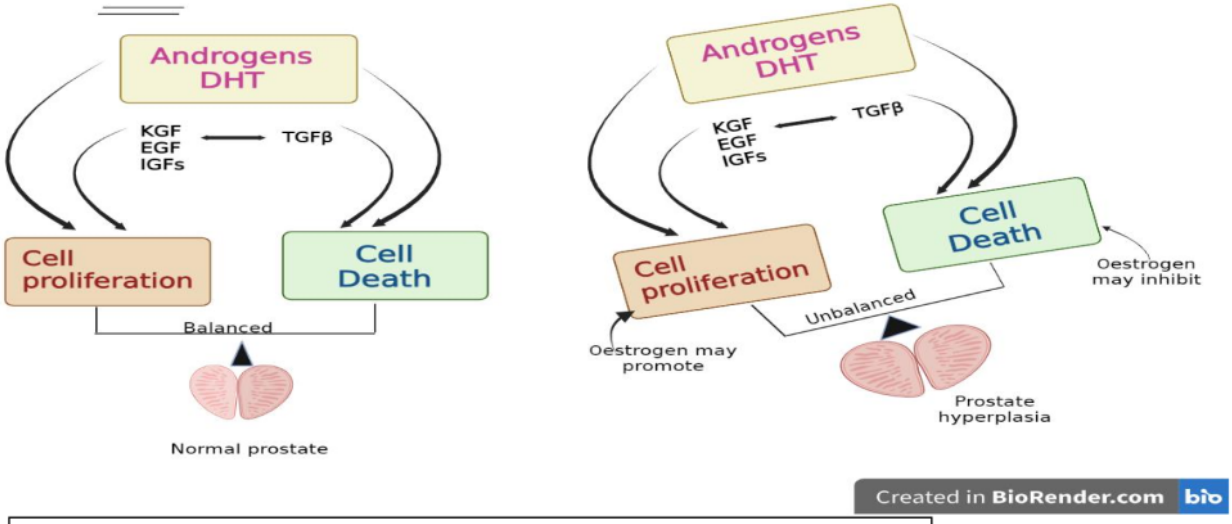

Fig.2. (b) Molecular control of prostate growth

BPH, a disorder that frequently affects elderly men, is a serious threat to the public's health. In the United States in the year 2000, which marks latest comprehensive data available, BPH resulted in more than 4.4 million visits to medical clinics, around 117,000 visits to emergency rooms, and approximately 105,000 cases requiring hospitalization **(Wei et al., 2005)**.

Among men in the United States aged 60-69 years, the estimated prevalence of benign prostatic hyperplasia (BPH) exceeds 70%. This condition affects approximately 6.5 million white men between the ages of 50 and 79 **(Parsons J.K., 2010).**

The occurrence of benign prostate hyperplasia (BPH) significantly increases with advancing age. BPH is observed in 70% of men in the United States aged between 60 and 69, while the figure rises to 80% for those aged 70 or above. Between 1994 and 2000, Both the incidence and the prevalence of BPH elevated slowly in the US. **(Parsons J.K., 2010).**

By the year 2030, In the United States, projections indicate that elderly people will make about 20% of the population, with over 20 million individuals being men aged 65 or above **(Wei et al., 2005).**

In India, approximately half of men aged 60 or above are affected by benign prostatic hyperplasia (BPH). Several studies conducted in India have shown that the prevalence of BPH ranges from 25% to 50% across different age groups. Specifically, prevalence percentages between the ages of 40 and 49, 50 to 59, 60 to 69, and 70 to 79 are approximately 25%, 37%, 37%, and 50% respectively. This means that by the time men reach the age of 60, more than 50% of them will have some signs of the condition. On a global scale, the prevalence of BPH in men over 50 years old generally ranges from 20% to 62% **(Bhat et al., 2021).**

In older men, having BPH is directly related to the development of lower urinary symptoms (LUTS) that have a variety of symptoms.

SYMPTOMS: -

1. Difficulty starting urinating
2. Weak or slow urine flow
3. Dribbling after urinating
4. Sudden, uncontrolled urge to urinate
5. Nocturia
6. Difficulty emptying the bladder,
7. Feel pain or a burning sensation during urination **(Parsons J.K., 2010).**

FACTORS AT RISK FOR BPH AND LUTS

From a population-based perspective, there are mainly two primary groups of health risks associated with BPH and LUTS: non-modifiable factors (such as ageing, geomorphology, and family history) along with modifiable factors (such as testosterone, the metabolic syndrome progression, fat, type 2 diabetes, regular exercise, nutrition, and irritation). Table.1

Table 1: FACTORS AT RISK FOR BPH AND LUTS

Non-modifiable	Modifiable
1. Ageing 2. family history 3. Geography	1. Testosterone 2. Dihydrotestosterone 3. Obesity 4. Type 2 diabetes Diet 5. Irritation 6. Nutrition

AGE: -The frequency of benign prostatic hyperplasia (BPH) significantly increases with advancing age. Postmortem examinations have revealed that the histological occurrence of In the 4th decade of daily life, BPH is 8%, in the 6th decade it is 50%, and in the 9th decade it is 80%. **(Barry et al., 1997).**

Numerous observational studies carried out in the United States, Europe, and Asian countries have consistently demonstrated that increasing age is linked to an increased chance of getting BPH, and experiencing its clinical progression, as indicated by various criteria.

Results from the Krimpen and Baltimore Longitudinal Study of Ageing (BLSA) cohorts show that men's prostate size similarly tends to increase with age. These studies suggest that In elderly males, the prostate expands at a rate of between 2.0 percent to 2.5 per cent each year (Bosch et al., 2007).

While the size of the prostate does not have a direct correlation with the severity of symptoms, Lower Urinary Tract Symptoms (LUTS) progression is at risk due to prostate enlargement. Additionally, greater chances of Benign Prostatic Hyperplasia (BPH) clinical development, urine retention, and the need of prostate surgery are associated with bigger volume prostates **(Bosch et al., 2008).**

GENETICS: -Research findings indicate a lot of evidence exists to suggest that both BPH (benign prostatic hyperplasia) and symptoms of the lower urinary tract (LUTS) are influenced by hereditary factors.
This investigator additionally calculated that benign prostatic hyperplasia (BPH) surgical treatment is performed on 50% of male patients. before the age of 60 possess a hereditary variant of the condition **(Sanda et al., 1994).**

BPH and LUTS have been found that exhibit concordance rates of 63% and 26% among monozygotic twins, respectively. Certain rates imply that inherited factors might be quite important in the onset of certain illnesses. In fact, according a single study, hereditary variables may account for up to 72% of the chance for high-moderate or serious LUTS in elderly males. **(Parsons et al., 2013).**

OBESITY: -Research consistently indicates a positive correlation between higher levels of body fat and an enlarged prostate. In various study populations, studies have repeatedly demonstrated that more adiposity, comprising elements like obesity, a body mass index (BMI), and circumference of the waist, is linked to a higher prostatic volume. **(Kristal et al., 2008).**

Baltimore in his Longitudinal Study of Aging, It was found that there was a 0.41 mL raised the volume of the prostate for every 1 kg/m2 rise in BMI. Additionally, When compared to persons who were not obese (BMI 25 kg/m2), obese people (BMI > 35 kg/m2) were shown to have a 3.5-fold greater risk of enlarged prostates. **(Maserejian et al., 2011).**

Epidemiological data also indicates that being overweight or obese raises the chances of undergoing BPH surgery, experiencing the advancement of urinary symptoms, and beginning BPH medical treatment **(Parsons et al., 2011).**

DIET: - The risk of BPH and LUTS may be influenced via both micronutrients as well as macronutrients, according to some studies, though the outcomes are not always in accordance. In terms of macronutrients, consuming more total calories, energy-adjusted protein intake, red meat, fats, milk and other dairy products, grains, bread, chicken, and starches may raise the risks of developing symptoms of BPH and having BPH surgery. On the other hand, consumption of fruits, vegetables (especially those high in carotenoids), polyunsaturated fatty acids, linoleic acid, the antioxidant vitamin A, and vitamin D may lower the risk of developing LUTS and symptomatic BPH. **(Kristal et al., 2008).**

Regarding micronutrients, studies have indicated an inverse association between BPH and LUTS and blood levels of the antioxidant vitamin E, lycopene, the element selenium and carotene. As for zinc and vitamin C, their association with the risk is inconsistent, as they have been linked to both increased and decreased risks **(Maserejian et al., 2011).**

Lastly, an extensive review of 19 research papers indicated conflicting relationships with alcohol use. It discovered that drinking alcohol was associated with both reduced and elevated chances of BPH & LUTS, respectively. **(Parsons et al., 2009).**

OTHER RISK FACTOR

Additional risk factors that can be changed include cigarette smoking, elevated blood pressure, serum lipids, and lipoproteins have not yet shown clear and consistent patterns of risk in relation to BPH and LUTS **(Parsons J.K., 2011).**

DIAGNOSIS OF BPH

Blood Tests: -In people with chronic high-pressure retention or acute retention, blood tests, such as renal function tests, are critical in assessing the initial level of kidney function and can help confirm the diagnosis of renal failure or acute kidney injury, as examples.

Urine examination: - examination of urine samples is valuable in identifying various conditions, including infection, non-visible blood in urine (haematuria), and metabolic disorders such as glycosuria. By examining urine samples, healthcare professionals can detect these abnormalities and gather important diagnostic information.

Prostate specific Antigen (PSA): - Research has demonstrated that prostate-specific antigen (PSA) testing can serve as a predictive indicator of prostate volume. Increased PSA levels can be seen in a

variety of situations, such as prostate carcinoma, infection, and an enlarged prostate. **(Bohnen et al., 2007).**

Ultrasound: - Urinary tract stones and cases of haematuria (blood in the urination) are both investigated using ultrasound imaging.

LIPID PROFILE AND BPH

Significant amounts of cholesterol are produced and stored by the prostate gland, and prostatic tissues may be especially vulnerable to changes in the metabolism of cholesterol. BPH risk is further elevated by hypercholesterolemia, a major factor in risk for cardiovascular disease (CVD).

In this review, we're look at the evidence pointing to a possible link between cholesterol metabolism and the development of benign prostate illness. **(Freeman et al., 2011).**

Triglycerides, also known as triacylglycerols, serve as the primary storage form of fatty acids. Elevated triglyceride levels lead to a condition called hypertriglyceridemia. The frequency of hypertriglyceridemia, which is indicated by triglyceride levels that are higher than 200 mg/dl, is approximately 10% among males aged over 30 years and females aged over 55 years **(Karanchi et al., 2017).**

Recent research suggests that hypertriglyceridemia and an increased risk of cardiovascular disease may be related, especially when combined with low levels of HDL-C (high-density lipoprotein cholesterol) & higher levels of LDL-C. These abnormalities in the levels of lipids are linked to BPH additionally. **(Yuan et al., 2007).**

The production of high-density lipoprotein, or HDL, takes place in the liver and intestines. Transmitting extra cholesterol back to the liver for processing and excretion, HDL-C levels aids in

removing it through the circulation. Reverse cholesterol transfer is this procedure. Myocardial infarction and cardiovascular disease, two disorders associated with BPH, are more likely in people with HDL-C levels below 35 mg/dl.**(Bailey A. & Mohiuddin., 2022).**

LDL, or low-density lipoprotein, levels of cholesterol are known to be correlated with an increased risk for coronary artery disease. LDL cholesterol, which is sometimes referred to as "bad" cholesterol because it may lead to atherosclerosis, a condition in which plaque accumulates in the blood vessels. The risk of coronary artery disease, heart attacks, as well as other cardiovascular issues might increase as a result of this plaque formation because it can reduce blood flow to the heart and other organs. Several studies have found a link between cardiovascular disease and BPH (benign prostatic hyperplasia) **(Bailey A. & Mohiuddin., 2022).**

Different authors in their studies found an association of serum total cholesterol, TG, HDL, & LDL in patients of benign prostate hyperplasia (BPH) in different populations. However, very few studies have been conducted on the association between lipid profile & BPH in the Indian population. Prostate cancer, a major cause of deaths in elderly men, can develop from BPH over time. Therefore, research linking BPH with serum lipid profile will be very interesting in the future since we can considerably lower mortality and morbidity by altering lipid levels.

Therefore the purpose of this study is to find out association of lipid profile in BPH patient & control subjects in the Indian population.

Aim

To find an association between lipid profiles (total cholesterol, triglycerides, HDL & LDL) in diagnosed cases of benign prostatic hyperplasia (BPH) & Control subjects.

Objectives

1. To determine serum concentration of total cholesterol level in patients of benign prostatic hyperplasia & Control subjects.
2. To determine serum concentration of triglyceride level in patients of benign prostatic hyperplasia & Control subjects.
3. To determine serum concentration of HDL-C level in patients of benign prostatic hyperplasia & Control subjects.
4. To determine serum concentration of LDL-C level in patients of benign prostatic hyperplasia & Control subjects.
5. To find the correlation between lipid profile in patients of benign prostatic hyperplasia & Control subjects, if any.

OBSERVATION:-

Table 3.
Means and standard deviations of evaluated parameters in BPH patients & control subjects.

Parameters	BPH (n=30)	Control (n=30)	p-value	Significance
Age	50.66± 6.69	50.4± 3.78	0.853	Not statistically significant
BMI	27.53 ± 3.72	27.43 ± 3.54	0.915	Not statistically significant
Total cholesterol	205.99 ± 16.44	188.37 ± 19.07	**0.0003**	statistically significant
Triglyceride	161.65 ± 38.35	119.99 ± 34.79	**0.0001**	statistically significant
HDL-cholesterol	35.39 ± 3.13	37.20 ± 3.03	**0.0268**	statistically significant
LDL-cholesterol	137.42 ± 17.77	126.38 ±18.94	**0.0234**	statistically significant

n= Cases or controls in number, p-value <0.05 is regarded as statistically significant.

AGE

In this study, 30 control Subjects aged 40 years and above along with 30 benign prostatic hyperplasia (BPH) patients were included. The mean age of control subjects (50.4 ±3.78) and BPH patients (50.66 ±6.69) have been found.

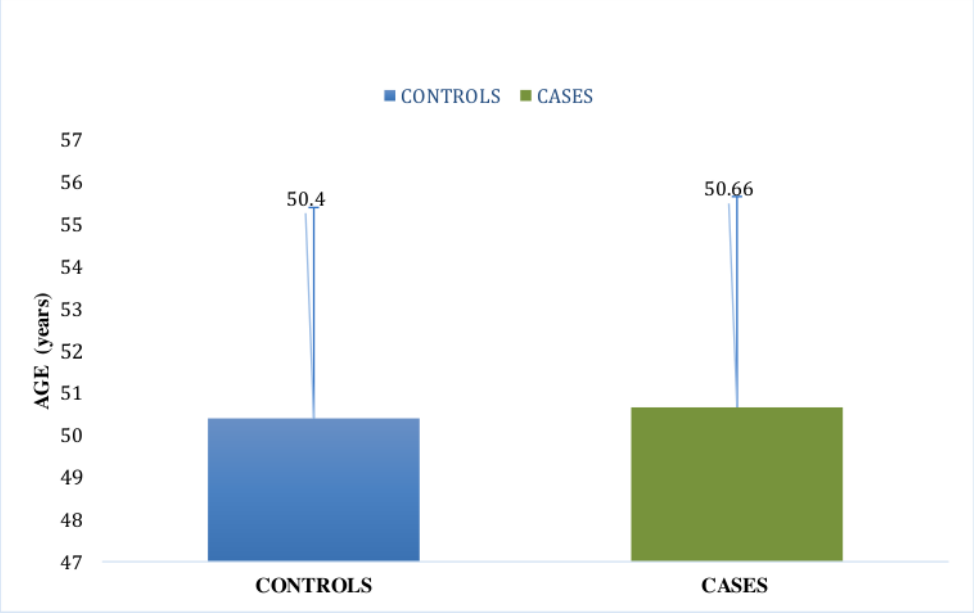

Figure.3. Comparison of ages (years) in cases & controls

BODY MASS INDEX (BMI)

Anthrpometric parameter body mass index (BMI) were not significant in BPH, comparing patients to control subjects, p=0.915 shown in table 3.

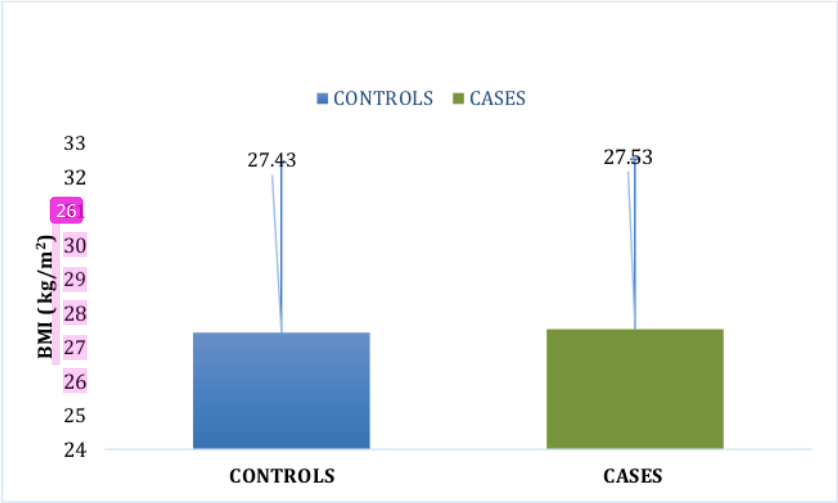

Fig. 4 Comparison of BMI in cases and controls

Total Cholesterol

Serum total cholesterol is significantly increased in BPH, comparing patients to control subjects, p= 0.0003 shown in table. 3.

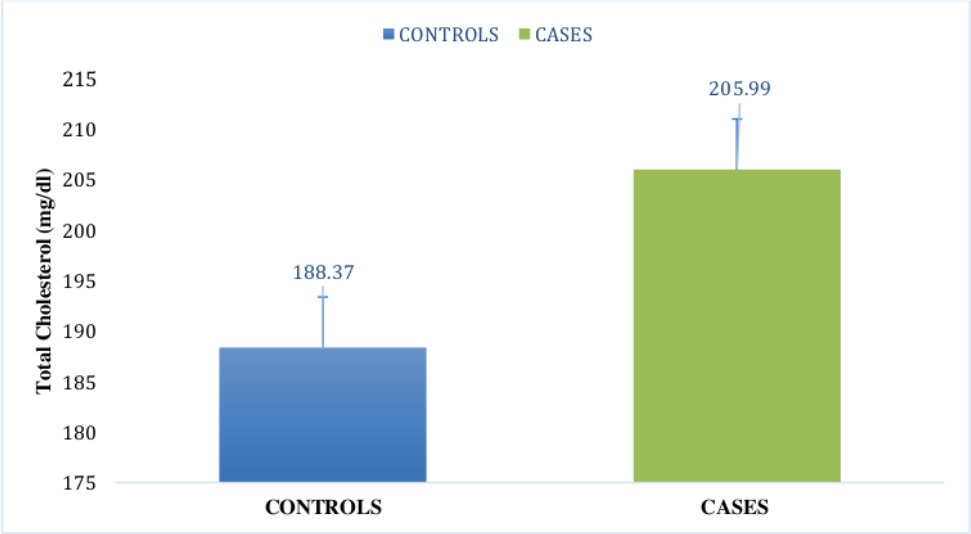

Fig. 5. Comparison of total cholesterol in cases and controls

Serum triglycerides

In BPH patients compared to control subjects, serum triglycerides are considerably higher (p= 0.0001) shown in table.3.

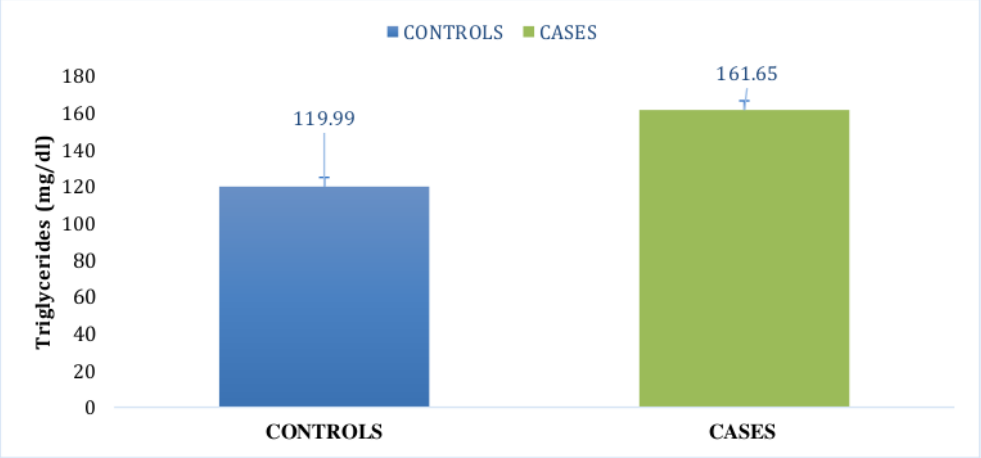

Fig.6 Comparison of triglycerides in cases and controls

Serum HDL

Compared to control persons, BPH patients' serum HDL-C is considerably lower (p=0.0268) shown in table.3.

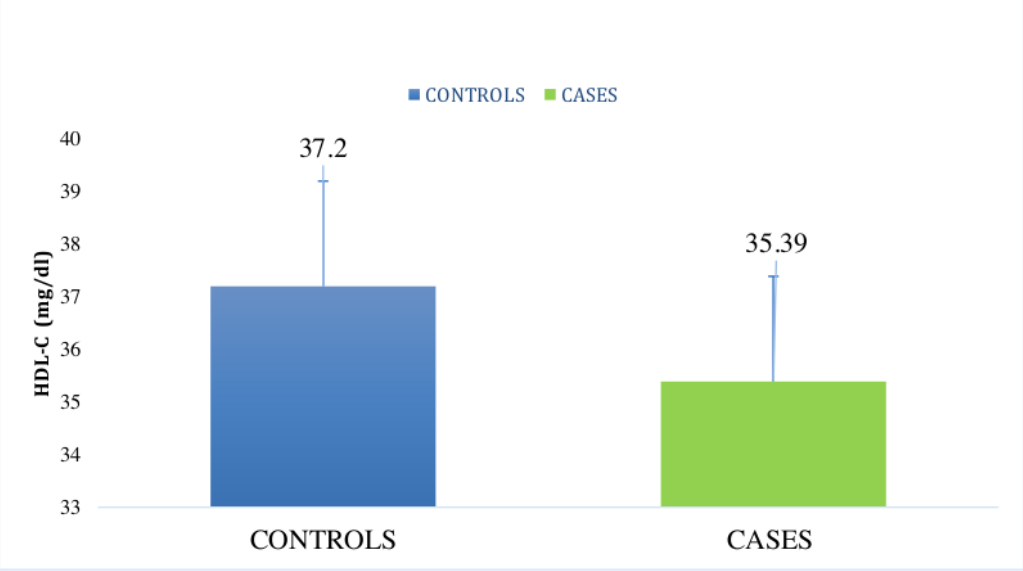

Fig.7. Comparisonof HDL-C in cases and controls

Serum LDL

When compared to control persons, BPH patients' serum LDL-C is considerably higher (p=0.0234) shown in table.4.

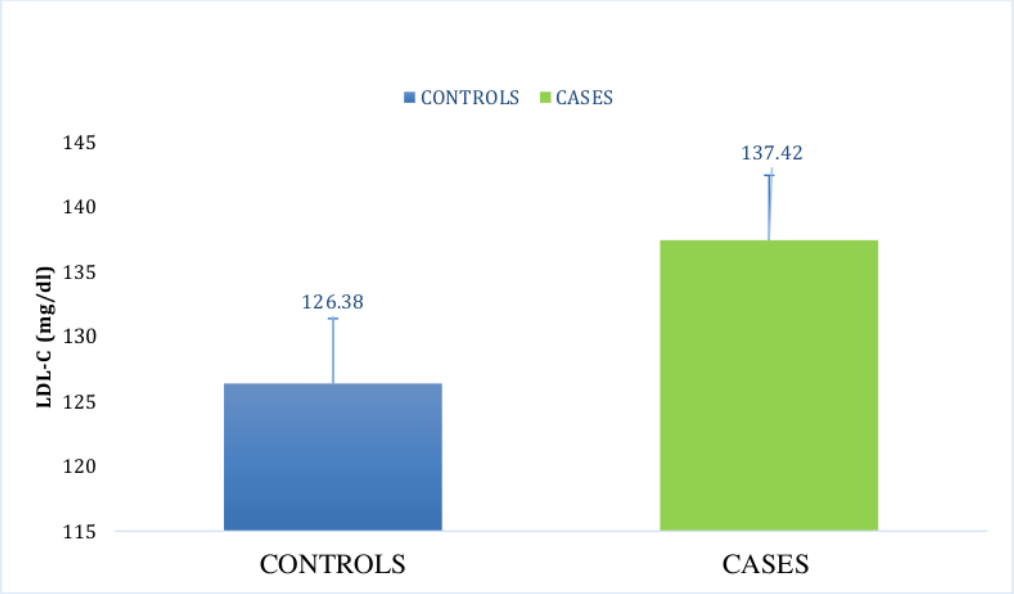

Fig.8. Comparison of LDL-C in cases and controls

KARL PEARSON'S CORRELATION

Significant correlations between serum total cholesterol, triglycerides, HDL, and LDL-C have been found.

Table:4 – Pearson's correlation coefficient between total cholesterol & LDL.

Correlations

		T.CHOL (mg/dl)	TG (mg/dl)	HDL (mg/dl)	LDL (mg/dl)
T.CHOL (mg/dl)	Pearson Correlation	1	0.083	0.102	.888**
	Sig. (2-tailed)		0.661	0.590	0.000
	N	30	30	30	30
TG (mg/dl)	Pearson Correlation	0.083	1	-0.010	-0.337
	Sig. (2-tailed)	0.661		0.960	0.068
	N	30	30	30	30
HDL (mg/dl)	Pearson Correlation	0.102	-0.010	1	-0.072
	Sig. (2-tailed)	0.590	0.960		0.707
	N	30	30	30	30
LDL (mg/dl)	Pearson Correlation	.888**	-0.337	-0.072	1
	Sig. (2-tailed)	0.000	0.068	0.707	
	N	30	30	30	30

** Significant correlation at the 0.01 level (2-tailed).

* Significant correlation at the 0.05 level (2-tailed).

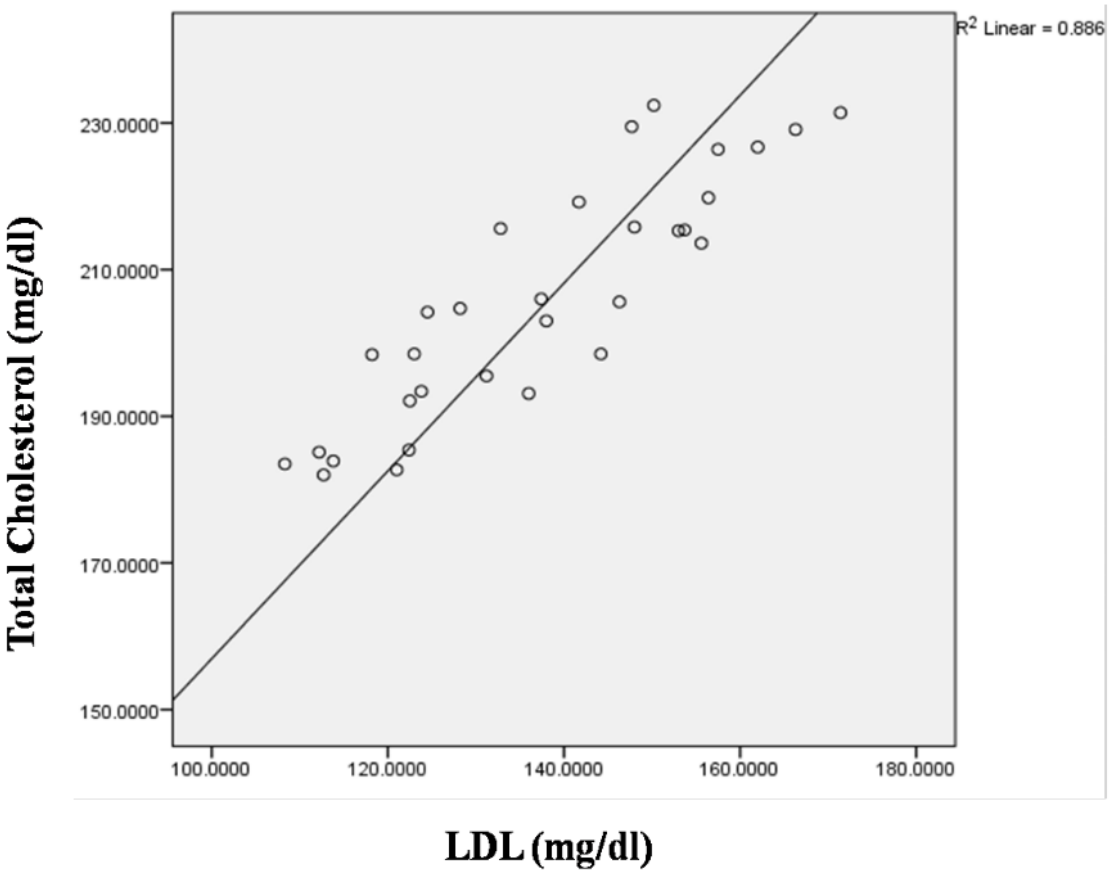

Fig.9. LDL-C levels and total cholesterol levels are shown in a scatter plot.

RESULT

The purpose of this study was to evaluate the lipid profile of patients with benign prostatic hyperplasia & apparently healthy controls.

The parameters estimated were:

1) Total cholesterol
2) Triglycerides
3) HDL, or high density lipoprotein,
4) LDL, or low density lipoprotein

The parameter levels were compared with control levels, who are apparently healthy individuals.

The study observations were as follows-:

1) When compared to control subjects, the level of total cholesterol was considerably higher in cases (p=0.0003) (Table.3 & Fig.5).
2) When compared to control subjects, the level of triglycerides was considerably higher in cases (p=0.0001) (Table.3 & Fig.6).
3) When compared to control subjects, the level of HDL-C was considerably lower in cases (p=0.0265) (Table.3 & Fig.7)
4) When compared to control subjects, the level of LDL-C was considerably higher in cases (p=0.0234) (Table.3 & Fig.8).

A frequent age-related illness in males known as BPH, which stands for benign prostatic hyperplasia, causes the prostate gland to expand non-malignantly, causing symptoms of incontinence and the possibility of urethral blockage. **(Michael et al., 2020).**

We included BPH patients and controls that appeared to be in good health in our case-control study to reduce the impact of variables that caused confusion. Lipid profiles and BPH patients have been shown to be strongly correlated. Several studies have shown that age, BMI & abnormalities of various risk factors are associated with BPH.

The mean age of BPH is (50.66 ± 6.69) and apparently healthy controls are (50.4 ± 3.78) have been found.

Clinical factors that affect lipid profiles such as total cholesterol, triglycerides, LDL & HDL were found to be considerably higher in our current study's participants compared to control people.

These findings were highly consistent with earlier research that suggests that BPH may be accompanied with elevated levels of total cholesterol, triglycerides, LDL-C & HDL-C.

Dahle et al., (2002) also noted that males with higher waist-to-hip ratios and age were more likely to undergo BPH surgery. **Nandeesha et al. (2006)** reported that BPH patients have significantly elevated levels of total cholesterol levels, TG & LDL and lower levels of HDL-C.

According to **Nandeesha et al., (2006)** dyslipidemia in BPH can arise as a result of insulin resistance. It is thought that insulin, which is well known for its capacity to stimulate growth, aids in the growth of the prostate. It indicates that insulin may contribute to the enlargement of the prostate gland in BPH.

Published evidence suggests an increasingly strong correlation between BPH progression and obesity. Obesity, characterized by increasing Triglyceride and reduced HDL concentration in serum, has been observed in our results. This suggests that the patients sampled for this study were

at a risk of obesity, probably due to BPH. According to **Parsons, J. K., et al., (2013)** It has been suggested that obesity raises arterial pressure because to obstruction, and this has had a negative effect on the prostate. It was observed that the arterial pressure contributed to marked prostatic growth as observed in ultrasounds taken from BPH patients. If this be, then our data agrees to this, that there is an association between BPH progression and obesity.

Previous research has provided evidence that an abnormal lipid profile can contribute to the development of prostatism **(Lee et.al., 1997).** Furthermore, there is a theory that suggests dyslipidemia is an indicator of risk for the development of BPH. The present study's findings align with previous research, further supporting this notion **(Hostedt et al., 1999).**

An increased total cholesterol concentration as observed in our case sample pool can be a signal of hormonal dysregulation. As discussed earlier, cholesterol is directly involved in the biosynthesis of steroid hormone testosterone. This hormone has a causal relationship with BPH disease. In view of this, there could be an increase in the synthesis of testosterone hormone from the androgens, and its subsequent conversion to DHT, the active form that has been found to cause prostatic hyperplasia.

SUMMARY

A common disorder known as a benign form of prostate (BPH) causes the prostate gland to expand in a non-cancerous manner in males. The incidence of BPH increases with age, with a substantial number of men experiencing symptoms by their 60s and 70sBPH is thought to impact up to 90% of men in their 70s and 80s, and more than half of those in their 60s. Although the specific origins of BPH are not entirely understood, it is thought that hormonal changes and age-related variables play a role in its onset. Urinary symptoms brought on by BPH include frequent urination, poor urine flow, and trouble clearing the bladder.

In this study, 30 patients of BPH aged 40 years & above along with 30 control subjects were included. The average age of BPH patients is (50.66 ± 6.69) and control subjects of (50.4 ± 3.78) have been found.

Total cholesterol has significantly elevated in patients with BPH versus control subjects (p=0.0003). Triglycerides have significantly elevated BPH patients in comparison to control subjects (p=0.0001). As compared to control subjects, the HDL levels of BPH patients were lower (p=0.0265).

The level of low-density lipoprotein or LDL values is higher in BPH patients compared to control people. Evaluation of lipid profile and follow-up of BPH patients are important to understanding the causes of BPH and other abnormalities that might help in better understanding in management of BPH, or benign prostatic hyperplasia.

CONCLUSION

In the current study, it was found that BPH patients had considerably higher levels of total cholesterol, triglycerides, LDL-C, & HDL-C, compared to the apparently sound control. Numerous researches looked at the relationship between BPH patients and their age, obesity, and cardiovascular disease. Therefore, increased levels of total cholesterol, triglycerides, , and lower HDL indicate the presence of BPH, making it crucial to look at the lipid profile in BPH patients, including total cholesterol, triglycerides, HDL, and LDL.

The findings of this study may be useful in understanding how lipid profiles contribute to the pathophysiology of BPH (Benign Prostate Hyperplasia).

Ramashish Kushwaha

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