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Evaluation of some physiological parameters for Benign Prostatic hyperplasia patients in Diyala province

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Abstract

Benign prostatic hyperplasia (BPH) is a non-malignant tumor of the prostate that enlarges prostate tissue and reduces the flow of urine from the bladder. The study aimed to investigate the relationship between certain physiological parameters (body mass, diabetes, smoking, first- and second-degree consanguinity, prostate-specific antigen (PSA) and testosterone (TES)) with the risk of benign prostatic hyperplasia. The study included 100 samples, divided into two groups: the first group consisted of 50 patients, and the second group consisted of 50 healthy controls. The results revealed that the majority of patients were underweight (36.0%), while a small percentage were obese (12.0%). Similarly, the majority of the control group were underweighted (60.0%), with only a small percentage being overweight (10.0%). The differences in BMI between the two study groups were statistically significant ($p<0.05$). There were also significant differences in hemoglobin A1c (HbA1c) levels between the two groups. The cumulative glucose test showed that 44.0% of patients with prostate enlargement had elevated cumulative glucose levels, compared to 0.0% in the healthy control group. The results further indicated that most of the patients had relatives with the disease (46.0%), with 34.0% having second-degree relatives and 20.0% having first-degree relatives affected by the disease. The differences in the percentages of kinship degrees were statistically significant ($p<0.05$). Additionally, the study found significantly higher PSA levels in patients (11.18±4.06) compared to healthy controls (3.27±1.35). Conversely, testosterone levels were lower in patients (1.74±0.45) compared to healthy controls (6.33±1.80). The differences in hormone levels between the two groups were also statistically significant ($p<0.05$). The study concluded showed that PSA levels are higher in patients compared to controls, and there is a relationship between high levels of diabetes and hormone metabolism and low levels of TES compared to control.

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1. INTRODUCTION

Benign prostatic hyperplasia (BPH) is a non-malignant tumor of the prostate that enlarges prostate tissue and reduces the flow of urine from the bladder. It can be caused by one of two conditions: Benign prostatic hyperplasia or Benign prostatic hypertrophy (both abbreviated BPH) and although the conditions are slightly different, the prostate enlarges in both cases [1]. The development of BPH increases with age, reaching 50% to 60% for males and more than 80% for those over 70 years of age. BPH can be a progressive disease, especially if left untreated, as incomplete voiding results in stagnation of bacteria in the residual urine in the bladder and increases the risk of urinary tract infections. In addition, urinary bladder stones may form due to crystallization of salts in the residual urine [2].

Androgens play an important role in normal prostate growth and development, and changes in the balance between testosterone (TES) and estrogen levels in prostate tissue with age can contribute to BPH. However, there is also an association between metabolic disorders and prostate enlargement [3]. Growth factors such as insulin like growth factor are potent inducers of prostate growth in vitro [1]. Roehrborn et al. in 1999 showed that prostate-specific antigen (PSA) and prostate volume have a linear relationship with age and that PSA has a good predictive value for assessing prostate volume[4]. Vesely et al in 2003 also found that prostate volume and serum PSA are highly correlated and increase with age[5]. Therefore, prostate volume can be predicted by knowing total and free PSA as both forms of PSA have been found to be able to predict prostate volume in more than 90% of cases [6]. TES stimulates the proliferation of prostate cells and prostate size increases with age in normal men. Men with low TES levels have smaller prostate size than normal, but when TES deficiency is treated, prostate size increases, but only to the size expected for men with normal TES levels in the same age group [7]. It has been shown that higher than normal TES can lead to an increased incidence of prostate cancer [8]. The study aims to investigate the relationship between certain physiological parameters (body mass, diabetes, smoking, first- and second-degree consanguinity, PSA and TES) with the risk of benign prostatic hyperplasia.

2. METHOD

The current study was conducted on a group of patients and healthy people attending Baquba Teaching Hospital / Consultant Clinics, where blood samples were taken from healthy people and patients with BPH from October 2022 to February 2023, and the number of study samples amounted to 80 samples divided into 50 samples for BPH patients and 30 samples for the control group aged between 50 to 80 years. (6) ml of venous blood was drawn from patients and control samples and divided into two sections. In the first section, 3 ml of blood was placed in gel tubes and left for 20-15 minutes at room temperature, then placed in a centrifuge at 3000 rpm for 10 minutes to obtain serum, and the serum was withdrawn with a micropipette and transferred to new white plastic tubes on which the information for each sample was recorded, and the tubes were kept under freezing at -20 °C until serological tests, and the second section, 3 ml of blood was placed in EDTA. TES and PSA concentrations were estimated for all study samples following the steps included in the kit and according to the manufacturer's instructions using an enzyme-linked immunosorbent assay (ELISA) using an ELISA reader It was measured at a wavelength of 450 nm. In addition, body height and weight were measured to calculate the body mass index (BMI) of patients and healthy people. BMI = weight (kg)/height (m), as the normal range of body mass for men is between 21- 25 kg/m2 and 19-24 kg/m2 for women. The estimation of hemoglobin A1c (HbA1c) is calculated in the following steps: Prepare the Ichroma cassette from Bio basic INC of Canada and place it inside the incubator at 30Co. Take 5µL of blood and add it to 100µL of the device's proprietary pharmaceutical solution and mix them together with a bouncing motion 15 times. Take 75µL of the mixed solution and place it in the cassette and the customized hole in the device for 12 minutes. The degree of kinship and family history of the disease was estimated by recording the patient's information.

3. RESULTS AND DISCUSSION

The results of the current study show that there are statistically significant differences ($p<0.05$) between the age groups and the two study groups, as the 51-60, 61-70 and >70 age groups recorded the highest percentages in patients (26.0%, 32.0% and 34.0%) compared to the 41-50 age group, which recorded the lowest percentage (8.0%). As for healthy people, the 41-50 and 51-60 age groups recorded the highest percentages (30.0% and 34.0%) compared to the 61-70 and >70 age group, which recorded the lowest percentage (26.0%,10.0%).

The results of the current study showed that the majority of BPH had Underweight (36.0%) and a small percentage of them had Obesity (12.0%). Similarly, the majority of controls had Underweight (60.0%) and a small percentage of them had Over weight (10.0%). The differences between BMI and the two study groups were significant as shown in Table 1. Obesity is associated with a large number of adverse health outcomes including cardiovascular disease, sleep apnea, osteoporosis, increased risk of certain cancers, and a study of 28 million people showed that 270000 deaths were attributed to obesity [9].

Obesity has a role in altering the metabolism of sex steroid hormones. Obesity is one of the causes of primary inflammation and may have a role in prostate growth. It is also associated with oxidative stress, which can affect prostate enlargement due to the effect of oxidative stress [10]. A study supporting the positive association between obesity and prostate enlargement by Dyandra et al. (2016) showed that obesity causes increased intra-abdominal pressure, altered endocrine status, increased sympathetic nervous activity, increased inflammation, oxidative stress and decreased TES, all of which play an important role in benign prostatic hyperplasia [11]. Zucchetto et al (2005) found no relationship between obesity and BPH [12].

Table 1 Comparison of age groups and BMI between the two study groups.

			Groups		Total	P value
			Patients (n=50)	Controls (n=50)		
Age groups	41-50	N	4	15	19	p<0.001***
		%	8.0%	30.0%	19.0%	
	51-60	N	13	17	30	
		%	26.0%	34.0%	30.0%	
	61-70	N	16	13	29	
		%	32.0%	26.0%	29.0%	
	>70	N	17	5	22	
		%	34.0%	10.0%	22.0%	
P value			p<0.05*	p<0.05*	p<0.05*	
BMI	Under weight	N	18	30	48	p<0.001***
		%	36.0%	60.0%	48.0%	
	Normal weight	N	10	15	25	
		%	20.0%	30.0%	25.0%	
	Over weight	N	16	5	21	
		%	32.0%	10.0%	21.0%	
	Obesity	N	6	0	6	
		%	12.0%	0.0%	6.0%	
p value			p<0.01**	p<0.001***	p<0.01**	

The results of the study show that there are significant differences between HbA1C and the two study groups, as the cumulative sugar test recorded a positive (44.0%) in patients with prostate enlargement compared to healthy people who did not record any cumulative sugar positive (0.0%). as shown in Table 2. Diabetes alters the metabolism of sex steroid hormones, including testosterone and dihydrotestosterone, and is a condition of primary inflammation [13]. A study by Caihong Xin et al. in 2022 showed a positive correlation between clinical signs of BPH patients and diabetic patients where a decrease in free TES was found in men with diabetes [14]. Previous studies have shown that insulin resistance is an important factor in promoting prostate gland size and that low insulin levels are associated with a decrease in prostate size. Several mechanisms have been proposed to link the development of BPH in diabetes mellitus, including insulin resistance in ventromedial hypothalamic neurons. This concept has been studied in mouse models where they observed an association between sympathetic and parasympathetic nerve inputs to the prostate and prostate growth rates, while the absence of these inputs leads to a decrease in gland size [15].

Table 2 Comparison of HbA1C between the two study groups

			Groups		Total
			Patients	Controls	
HbA1C	Negative	N	28	50	78
		%	56.0%	100.0%	78.0%
	Positive	N	22	0	22
		%	44.0%	0.0%	22.0%
P value			p<0.001***		

high Significant different (P<0.001***)

The results of the present study show that most BPH patients had 46.0% with no relatives with BPH, 34.0% of them had second degree relatives with BPH and 20.0% of them had first degree relatives with BPH. The differences between the percentage of degrees of kinship were significant ($p<0.05$) as shown in Table 3. The family medical history has a high impact on the disease, as it indicated that the incidence rate rises to four times when there are second-degree relatives affected, as the British Medical Journal (BMJ) reported for the year 2008 that prostate enlargement is frequent in some families, and if the father or brother has BPH, the risk of infection increases significantly [16].

Table 3 Number and percentages of degrees of kinship between patients

		Count	Percent
Relativity	No	23	46.0%
	Fist	10	20.0%
	Second	17	34.0%
P value		P<0.05*	

Significant different (P<0.05*)

The results of current study show that PSA levels were higher in patients (11.18±4.06) than healthy controls (3.27±1.35), while Testosterone levels were lower in patients (1.74±0.45) than healthy controls (6.33±1.80). The differences between the levels of the above hormones and study groups were significant As in Table 4. A study has shown that the lumen of the prostate gland contains high concentrations of PSA. There are a number of barriers between the lumen and the capillaries, including the basement membrane, prostate stroma, and capillary endothelial cells. Total PSA levels in the blood are increased in patients with BPH (benign prostatic hyperplasia). As a result of damage to the barriers between the epithelial layer and the bloodstream, a small amount of PSA usually leaks into the bloodstream, but in the case of prostate enlargement, a large amount will leak, and this may be the reason for the increase in PSA in men with BPH In addition, there is evidence suggesting a relationship between androgen levels and PSA levels, with a study showing a decrease in PSA levels upon anti-androgen therapy in transgender men [17].

Therefore, elevated DHT levels in BPH patients may lead to increased PSA expression and consequently increased PSA levels as well as an increase in prostate size [18]. Previous studies have also shown a correlation between PSA levels and prostate size, with PSA levels correlating with the growth rate of prostate cells, and PSA expression levels and concentration correlating with prostate weight [17]. Understanding the relationship between TES levels and PSA is very important for TES replacement therapy in men with hypogonadism as well as the impact on prostate function [19].

Table 4 Comparison of PSA and Testosterone levels between the two study groups

Groups		N	Mean	SD	P value
PSA	Patients	50	11.18	4.06	p<0.01**
	controls	50	3.27	1.35	
Testosterone	patients	50	1.74	0.45	p<0.001***
	controls	50	6.33	1.80	

high Significant different (P<0.001***)

4. CONCLUSION

Benign prostatic hyperplasia is associated with hormonal and physiological changes. The results showed that PSA levels are higher in patients compared to controls, and there is a relationship between high levels of diabetes and hormone metabolism and low levels of TES compared to controls, and the results showed that family history has an important role in the disease.

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