

Effect of Prostatic Enlargement on Genitourinary System of Adult Male in Kassala State - Sudan 2023

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1. Abstract

1.1. Background

Prostate gland is a small, soft organ located deep in the pelvis, between the penis and the bladder. On average, it is roughly the size of a ping-pong ball. It weighs around 1 ounce and is usually soft and smooth to the touch, it has clinical significance and various functions most notably producing 20-30% seminal fluid plus and transporting sperms safely by neutralizing vaginal acidity. The prostate also produces enzymes that convert testosterone to biologically active di-hydrotestosterone which important for the development of secondary male characteristic. Changes in the size of the Prostate gland are usually accompanied by lower urinary tract symptoms. Several mechanisms seem to be involved in the development and progression of other prostate problem.

1.2. Method

Study conducted as cross sectional prospective analysis, based on sample of 100 individuals who had prostate size more than normal (35 gram) measure and asses effect on other organs (genitourinary) measured and assessed by ultrasound in different governmental and private ultrasound clinics. Samples information taken and documented by questionnaire between (January 2023 - January 2025).

1.3. Results

The majority of patients fall within the age group of 60-70 years, accounting for 53% of the total. The most common condition observed was benign prostatic hyperplasia (BPH) affecting 97% of patient and 2% prostatic cancer 1% prostate gland calcification. Twenty percentage (20 patients) were diagnosed with diabetes mellitus, 14% hypertension and 1% HIV. While 61 patients showed no prostate-related effects on other organs, 14 patients were diagnosed with cystitis. A total of 55 patients from the sample were undergoing treatment for prostate enlargement. Among the sample, 30 patients experienced some form of sexual dysfunction, with 29 of these patients specifically reporting erectile dysfunction and 1 patient with retrograde ejaculation.

1.4. Conclusions

Common causes changes in prostate size its BPH in 97% of samples, largest size was 191 grams, while the smallest was 9 grams. All sample were from individuals above 50th years of old. A common change in prostate gland affects other organ is type of urinary tract infection (cystitis) which occur in 14% of cases, while lesser effect bladder stone it found in 2% from samples. The effect of prostate enlargement in genital system show that 30% of patients experienced some form of sexual effects. Their no relation between size and severity of symptoms; some samples with larger prostate size than normal had no effects. The relation between prostate enlargement and chronic diseases (hypertension and diabetes mellitus) not clear, need future further research's investigation.

2. Introduction

Prostate gland is a small, soft organ located deep in the pelvis, between the penis and the bladder. On average, it is roughly the size of a ping-pong ball. It weighs around 1 ounce (30 grams) and is usually soft and smooth to the touch, it had clinical significance and various functions, most most notably producing 20-30% seminal fluid plus and transporting sperms safely by neutralizing vaginal acidity. The prostate also produces enzymes that convert testosterone to biologically active di-hydrotestosterone which important for the development of secondary male characteristic.

Additionally, the prostate gland close urethra during ejaculation and prostatic fluid is slightly acidic, but other components of semen make it alkaline overall. This alkalinity helps to counteract the acidity of the vagina and protect the sperm from damage. Symptoms of prostate problem include poor bladder control, urinary urgency, weak or painful urine stream & urinary retention [1].

I chose this name of research, because we didn't have enough documents information for effect of prostate changes in size and type of common causes for changes, and effects of that change

in other organ such as renal system and reproductive system on Kassala state. And also to fill agape about updating information of prostate gland change in size in Kassala state, and our country Sudan.

3. Study Aims

- 1) To Measure prostate change in size by ultrasound, largest and smallest one.
- 2) To define Common cause of change prostate size, among Kassala state citizen's
- 3) To characterize common age of prostate enlargement above 50th.
- 4) To determine effect of change in prostate size on other organ (genital-urinary system) to each patient.
- 5) To deny or confirm relation between prostate change in size and severity of effect in other organs (genital-urinary system).
- 6) To correlate between prostate enlargement and chronic diseases (Hypertension and Diabetes mellitus).
- 7) To know common effect of prostate enlargement in other organs (genital-urinary system).
- 8) To inform less common effect of prostate enlargement in other organs (genital-urinary system).

4. Materials and Method

4.1. Study Design

This study was designed as a prospective cross sectional, hospital-based investigation conducted across various ultrasound clinics and hospitals. The prospective nature of the study allows for the collection of real-time data, ensuring accuracy and relevance in assessing the changes in prostate size and their impact on the genitourinary system.

4.2. Study Area

The study will be conducted in Kassala state, state information:

- Distance: It 550 km away from Khartoum and 670 km from Red Sea state temporally capital of Sudan because of war.
- State locality's: Eleven in number (Kassala - Rural Wad El-heliw – Rural Khashm Elgirba – Rural Kassala – Rural West Kassala - New Halfa – Nahr Atbara – Wd sharifi – Telkok-Hameshkoreeib – Aroma)
- Capital: Kassala City.
- Population: Last governmental enumeration in 2011, close to 2 million citizens in all state locality.
- Location: Between length line 37 degree & 35 degree and horizontal 15.14 degree & 15.17 degree south. From east Eritrea country border length 235 kilometers. North Red sea state. From west Khartoum, River Nile states. South west Al-Gadarif state.
- Space: 42.282 Kilometers squared.
- Climate: North east wind in winter and south wind in autumn. Also have different ecologies area desert, semi-desert, vales & savanna.

- Temperatures: 33 to 47 degree, medium rains 350 to 400 millimeters by year.

- Road: Tarmac internal state and external connect with national roads and road connect with Eritrea country.

- Governmental Hospitals:

1-Kassala teaching hospital (departments: General surgery, pediatric, General medicine, oncology, ENT, ophthalmology, ICU, urology, orthopedic, Forensic, psychiatric, Cardiology).

2- Al-Kuwati pediatric hospital. 3- Al-Saudi Obstetric & Gynecologic hospital.

4- Police General hospital. 5- Military General hospital.

Also there is Renal dialysis center & General Hospital in most of other locality in state.

- Airports: One airport, Kassala international airport, its International Airport Transport Association (I.A.T.A) code KSL.

- Telecommunication: In all the state there is communication networks for different companies

- Water: Sources (surface, ground shallow and deep water).

-Electricity: State connect with Sudan National Electricity Grid.

4.3. Study Population

Kassala State According to the last census conducted in 2011, the state's population was approximately 2 million citizens.

4.3.1. Inclusion Criteria

The study included adult men, who exhibited changes in prostate size, as measured by ultrasound, exceeding 35 grams (average gland with BPH weighs around 35g) [1].

4.3.2. Exclusion Criteria

Adult men with a normal prostate size less than 35 grams or those who had undergone prostatectomy were excluded from the study.

4.4. Study Period

Two-year period, from (January 2023 to January 2025).

4.5. Sample Design

The sample size was derived from total number of cases of prostate gland size changes in Kassala state, based on data from Kassala Ministry of Health. A total of 787 cases recorded in 2022, we focused on the year before, because in 2023, and the federal statistic system was suspended and linkages between ministers of health across all Sudanese states we disrupted due to the war. By applying Taro Yamane's equation to select sample size for this study, was determined to equal 89 cases. However, we complete 100 sample during study due to emergence of diversity cases from patients who displaced and relocated to live in Kassala state because war.

4.6. Data Collection

Data were collected using a structured questionnaire and an ultrasound device (MINDRY DC-N) to measure changes in prostate size and assess their impact on other organs.

Figure of Equation

Simplified formula for proportions*
(Taro Yamane)

$$n = \frac{N}{1 + N * (e)^2}$$

n - the sample size
N - the population size
e - the acceptable sampling error

* 95% confidence level and p = 0.5 are assumed

Measurements Technicality

Transabdominal ultrasonography of the prostate gland in adults is performed using linear, sector or convex transducers with frequencies ranging from 2 to 5 MHz or wideband transducers with the frequency range from 2 to 5 MHz. The sector and convex transducers are more convenient, especially during performing longitudinal sections, because they may be inserted behind the pubic symphysis thus allowing to obtain the image of the entire urinary bladder.

First the measurements of the prostate are performed. The width (W) is measured on the transverse section, after finding the largest section and next the height (H) and the length (L) are measured on the largest longitudinal section. It is necessary to precisely define the lower measurement boundary, i.e. the apex of the prostate or the beginning of the urethra within the bulb. Some researchers measure the height (H) on the transverse section. The majority of modern ultrasound machines perform calculations of the volume of the gland automatically.

The next step is the evaluation of the shape, the symmetry of the gland, the integrity of the capsule, the echogenicity of each of the zones of the gland (described by McNeal), basing on the detailed transverse, longitudinal and intermediate sections which were developed. Attention is paid to areas of reduced and increased echogenicity – focal or diffuse. Evaluation is also performed in reference to the peri-prostatic structures (the adipose tissue, vascular plexi), the seminal vesicles – their dimensions (length and width), structure, symmetry and the angle between

the vesicle and the prostate – as well as the ampullae of the ducti deferens. Every abnormal change should be accurately measured and described with paying special attention to the echogenicity, the location, the shape and the demarcation from the adjacent structures examination of the prostate gland should include: the dimensions of the gland, the volume (in millimeters) and assessment of its shape. Moreover, the description should include the assessment of the seminal vesicles, their size, echogenicity and the symmetry of the angles between the vesicles and the prostate, as well as the assessment of the ampullae of the ducti deferens [2].

4.7. Ethical Permission

Ethical permission for the study was obtained from Kassala university and the Urology Department at Kassala Teaching Hospital for assistance in data collection. The department collaborated extensively, providing access to radiologist clinics and the ultrasound department at Kassala Health Insurance Foundation, this collaboration was instrumental in ensuring the successful collection of accurate and reliable data for the study.

Regarding ethical commitment, I obtained verbal and documented consent from patients, ensuring that their information would be kept confidential and they could retrieve their medical information any time. Additionally, I have all phone numbers and addresses of all cases of study in Kassala state.

5. Analysis

In analysis study results we use SPSS and Microsoft Excel, version 2021 by using descriptive analysis.



Figure: Illustration pro state enlargement and its pressure on the ure-thra, dated December 27, 2023.



Figure: show Ultrasound device MIN DRY DC-N3 use during study foe data collection.

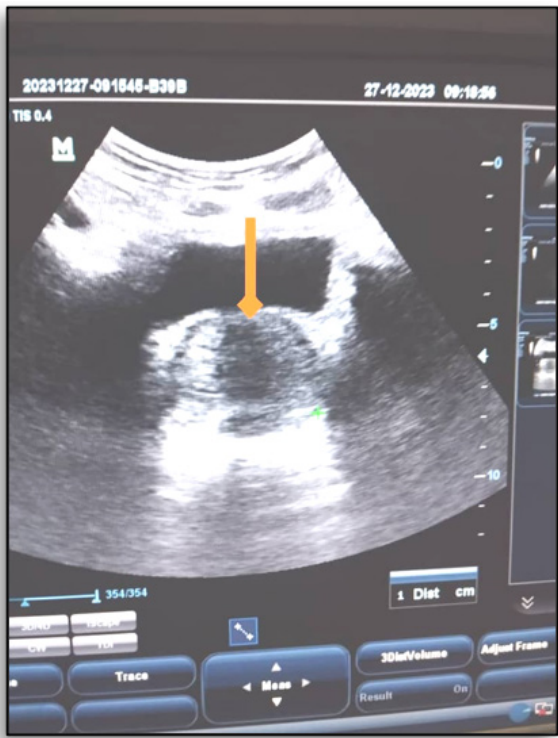


Figure: One of the cases showing enlargement of the prostate gland, dated March 11, 2024.

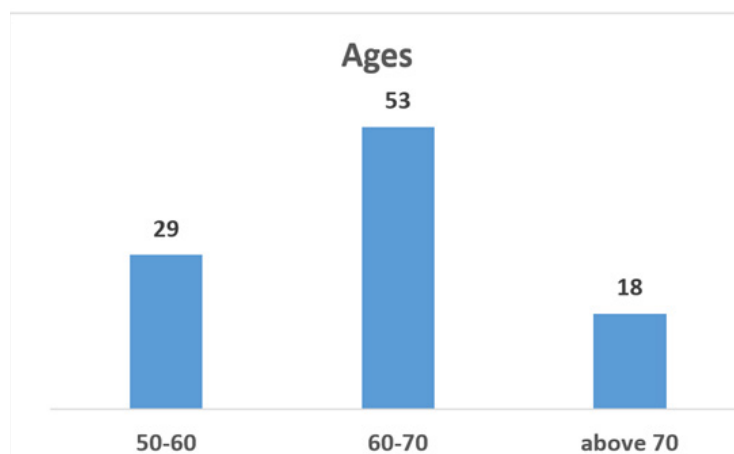
6. Results

Out of the 100 samples size, following tables and charts of study results:

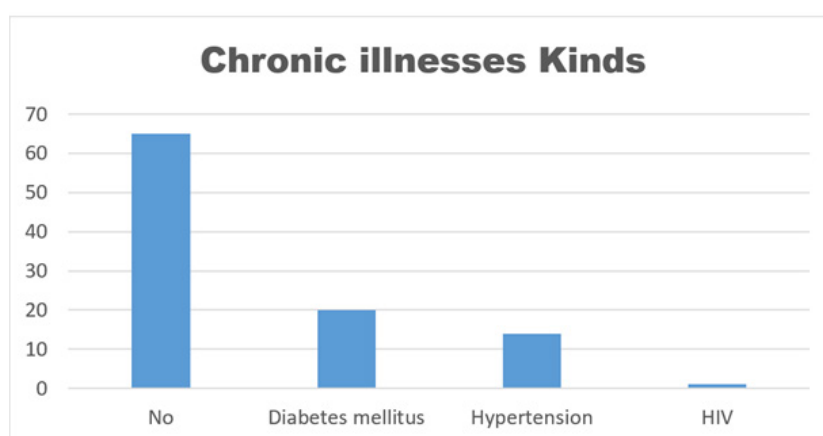
Results summary:

1. Demographic data: Table & chart below.

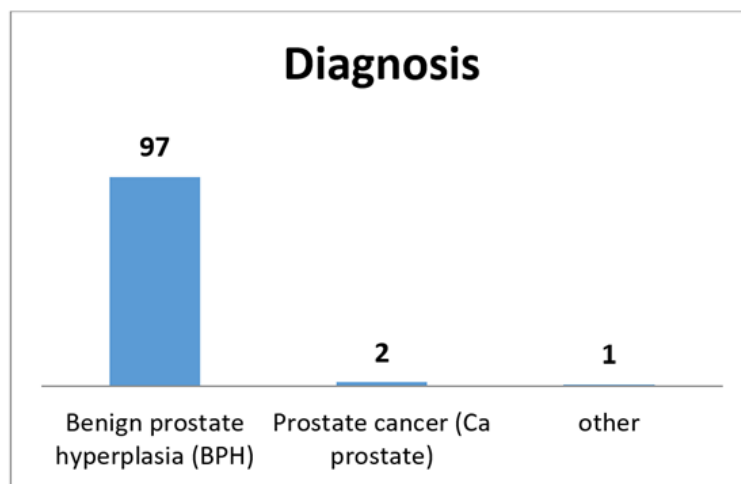
Age	Frequency	Percent
50-60	29	29.0
60-70	53	53.0
above 70	18	18.0
Total	100	100.0

**2. Chronic illnesses among samples: Table & chart below.**

Chronic illnesses Kind	Frequency	Percent
No	65	65.0
Diabetes mellitus	20	20.0
Hypertension	14	14.0
HIV	1	1.0
Total	100	100.0

**3. Prostate gland change in size Diagnosis: Table & chart below.**

Diagnosis	Frequency	Percent
Benign prostate hyperplasia (BPH)	97	97.0
Prostate cancer (Ca prostate)	2	2.0
Other (prostate calcification)	1	1.0
Total	100	100.0



4. Measuring Prostate Enlargement Effects in Other Organs: Table & chart below.

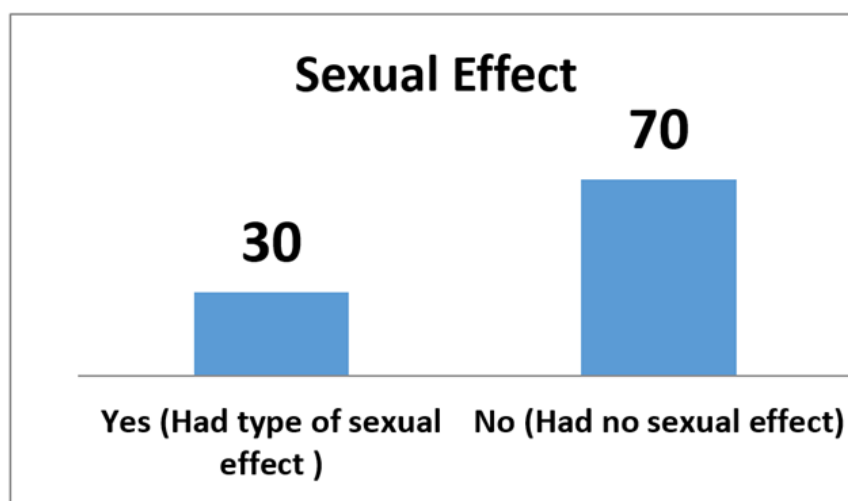
	Frequency	Percent
No	61	61.0
UTI	11	11.0
Acute renal failure	1	1.0
Chronic renal failure	2	2.0
Hydronephrosis	2	2.0
Renal stone	7	7.0
Cystitis	14	14.0
Other (Bladder stone)	2	2.0
Total	100	100.0

5. Prostate enlargement Treatment: Table & chart below.

	Frequency	Percent
Yes	55	55.0
No	45	45.0
Total	100	100

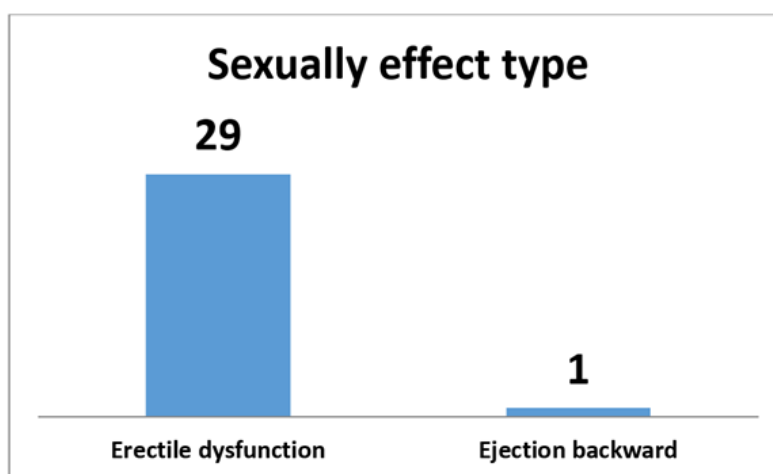
6. Sexual Effect: Table & chart below.

	Frequency	Percent
Yes had sexual effect	30	30.0
No had sexual effect	70	70.0
Total	100	100



7. Sexually effect type: Table & chart below.

	Frequency	Percent
Erectile dysfunction	29	29.0
Ejection backward	1	1.0
Total	30	30.0



- The largest prostate size recorded during the study was 191 grams, and the smallest prostate gland size in the study was 9 grams due to prostate calcification.
- The abundance of patients in within the age group of 60-70 years was 53% of the cases.
- Among the chronic disease samples 65 patients (65%) had no chronic illnesses. Additionally, 20 patients (20%) had Diabetes mellitus, 14 patients (14%) had Hypertension, and 1 patient (1%) had HIV.
- In the final diagnosed samples 97 patients (97%) were diagnosed with benign prostatic hyperplasia (BPH), 2 patients (2%) had Prostate Cancer (CA prostate), and 1 patient (1%) had calcification of prostate gland.
- Research result indicates that 61 patients did not show any observed effects of prostate enlargement on other organs, while 14 patients (14%) mostly diagnosed as Cystitis.
- Thirty patients experienced some form of sexual effect, while 70 patients reported no sexual effects.
- Twenty-nine case had erectile dysfunction, and 1 patient experienced retrograde ejaculation.
- Results shows that there are 55 patients from the sample size who are on prostate enlargement treat, and for ty-five patients from the sample size were first discovered prostate enlargement, but not on prostate enlargement treatment.

6. Discussion

According to the Prostate Cancer Foundation, about 20% of men will develop BPH by the time they are in their age of 50th, increasing to 70% by the time they reach 70 years of age [3]. Additionally BPH is one of the leading diagnoses affecting men of increasing age. By age 50 years, about 50% of men are diagnosed with BPH [4]. This agree with study demographic result

all sample above 50th. The study demographic findings, with the majority of samples aged 60–70, are consistent with research showing that microscopic BPH develops in aging men, affecting 70% of individuals aged 61–70, 80% of those aged 71–80, and 90% of those aged 81–90 [5]. This underscores the strong association between aging and BPH.

Article states that men with BPH can experience great discomfort with urination and may develop complications, including recurrent urinary tract infections (UTIs) [4], which closely aligns with research results regarding the effect of BPH on urinary system, particularly type of urinary tract infection (cystitis).

The complications of BPH, among others include bladder stones. The prevalence higher in men with BPH (3.4%). [6] It like study results of the less common effect of prostate enlargement in other organ it bladder stone (vesical calculus) 2% of study samples. Study explored the potential link between chronic diseases like diabetes and BPH severity. Diabetes has been associated with more severe BPH symptoms, possibly due to overlapping urologic symptoms such as reduced bladder flow rates and increased post-void residual volume. Vascular damage from type 2 diabetes may also contribute to BPH development. Additionally, hypertension has been implicated in BPH pathophysiology, with about 25% of BPH patients experiencing arterial hypertension [7]. These findings highlight the importance of considering co-morbid conditions in the management of BPH.

The study also observed that changes in prostate size due to BPH did not consistently correlate with symptomatic effects in other organs some large prostate size sample did not have any kind of complication. This is symmetry with scientific literature, which distinguishes between the static component of obstruction (caused by anatomical enlargement of the adenoma) and the dynamic component (related to prostate smooth muscle tone). No-

tably, research has shown that prostate size does not necessarily correlate with the severity of BPH symptoms [8].

Results were reported, with 29 cases of erectile dysfunction and one case of retrograde ejaculation. It is likely that erectile dysfunction (ED) and BPH share similar pathogenetic mechanism. Metabolic syndrome has been found to play an important role in BPH and ED etiology, additionally patients with BPH may display low testosterone levels and benefit from testosterone replacement therapy, as well as patients with ED, Chronic inflammation, vascular dysfunction, dyslipidemia and hormonal impairment occur in benign prostatic hyperplasia furthermore [9].

Study results indicated 29 patients out of 55 patients taking anti-prostate drug experienced some kind of sexual effect. These effects are likely linked to medications used for BPH, as studies have shown that drugs for lower urinary tract symptoms can significantly impact sexual function. A meta-analysis of 6,131 patients found a higher prevalence of erectile dysfunction and libido changes in patients receiving combination therapy compared to those on alpha-blockers alone [9], other research also highlights that anti-BPH medications often cause sexual side effects, though their incidence tends to decrease over time [5]. This means that drug side effect the genital system but not caused in base of BPH.

While complications such as bladder diverticula, bladder stones, vesicoureteral reflux, hydronephrosis, renal insufficiency, and urinary retention were observed in men with clinical BPH, the study did not find conclusive evidence that BPH directly causes these conditions [5]. This suggests that while BPH may contribute to these complications, other factors may also be involved.

7. Conclusions

- This study aimed to identify the most common changes in prostate size among citizens of Kassala State and to compare these findings with existing research. The results confirmed that benign prostatic hyperplasia (BPH) is the most frequent changes observed.
- The study also validated that treatments for prostate enlargement can have sexual side effects, also prostate enlargement itself without anti-prostate enlarge can cause sexual effect.
- Relationship between chronic diseases and prostate size changes remains unclear and requires further investigation and research for further exploration.
- The most common age group experiencing prostate size changes more than 50th, most if cases age category (60–70) years.
- A significant finding was that prostate enlargement often impacts other organs, particularly causing thickening of the bladder wall (cystitis) and less affect it bladder stone.
- Study show that no relation between prostate gland enlargement size and severity of symptoms in genitourinary systems.
- study provides valuable insights into the prevalence, and associated effects of BPH, while also emphasizing the need for further research to better understand its relationship with other conditions and treatment-related side effects.

8. Conflict of Interest

The authors declare that they have no conflict of interest.

9. Acknowledgments

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