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The Physiological Influence of Prostate size and Prostatic Specific Antigen (PSA) on The Concentrations of some Hormones and Biochemical Compounds for Males in Salah Alden Governorate

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ABSTRACT

This study was conducted to investigate the effect of difference in prostate big size benign and prostate specific antigen (PSA) concentrations on some biochemical (Glucose , Cholesterol , Acid Phosphatase) and hormones(ACTH , Estrogen , Testosterone) in the men patients having prostatic hyperplasia and compared with healthy men. The study was carried for 60 patients males infected by the prostatic hyperplasia and 40 healthy males, there ages were ranged between (47 – 90 years). The results show that high significant increased (P ≤0.05) in all patients categories (20 – 40 mm^3), (41 – 60) ,(61 – and more) mm^3 of prostatic with BPH in the (Glucose, Cholesterol, Acid Phosphatase ACTH and estrogen) compared with a healthy men. There is significant (P ≤0.05) increased in the patients prostate size category of (61 – more mm^3) compared with the other patients categories (20 – 40 mm^3), (41 – 60 mm^3) in the (Glucose , Acid Phosphatase , ACTH and estrogen) parameters , while the healthy men was increased significant (P ≤0.05) in the testosterone compared with all patients prostate size categories. On the other hand the all categories for the PSA concentrations (0-3.5) , (3.6-7.0), (7.1 and more) ng/ml are increase significant (P ≤0.05) in prostatic patients compared with healthy men in the components (Glucose , Cholesterol , Acid Phosphatase ACTH) and significant increase (P ≤0.05) in healthy testosterone compared with all PSA categories of prostatic patients. The high PSA category (7.1 and more) ng/ml gives the high concentrations in (Glucose, Cholesterol, Acid Phosphatase ACTH) and a significant effect (P ≤0.05) between the the patients categories.

Introduction

Prostate gland consist of two types of tissues, the first one is the glandular tissue, and the second is the strom muscular smooth tissue (smooth muscles). The glandular part responds to the effect of male hormones which is an important part of the seminal fluid that can stimulate the production of its secretions. Also, the infection of the prostate by cancer for instance, can occurs by the infection of only the glandular tissue without the muscular tissue. While, the Benign Prostate Hyperplasia (PBH) is a hyperplasia in the fibro smooth muscular tissue which is accompanied by an increase in the ratio of estrogen to the testosterone.

The reason of it is the decrease of the secretion of the male hormone that was synthesised and secreted in the Leydig cells with the advancing age, or when increasing the Estrogen by the Testicles cells, or from Adrenal cortex [1,2] Prostate weight increases slowly from the birth, and continued until the age of sexual maturity where it reach about 20 gm. Afterwards, its weight increases when it infected by the prostate benign hyperplasia to reach between 50-100 gm, and in some rarely cases like the malignant tumours its weight reaches about 200 gm. While its length is 3.5 cm and its width is 4.5 cm and its thickness is 2.5 cm. Prostate secretions is a sparkling aqueous liquid contain Prostatic acid phosphatase in addition to magnesium, calcium, citric acid, spearmen, and fibrolysin. Its secretions were subtracted into the Urethra by the muscular contraction process (by the assistance of the fibro smooth muscular tissue which represent the muscular part of prostatic tissues). During the flow of the ejaculated sperm, the sexual hormones take control on the prostate size and activity,

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therefore it can be developed quickly at maturity. The prostate hyperplasia is a common reason of the appearance of the Urinary retention symptoms as a result of the Urethra blockage and increasing the urination times in males [1,3].

The Prostatic Specific Antigen (PSA) is a Glycoprotein with a molecular weight of 33000 Dalton, its chemical structure consist of 237 amino acid [4]. It was discovered by [5 , 6] . It can be synthesized and secreted by the epithelial cells of the prostate, and its concentrations in the seminal plasma are between 0.2 – 5.0 mg/ml [7] . These concentrations are one million time more than its concentration in the blood serum which is between 0.1 – 4.0 ng/ml [8,9]. The PSA function is to assist in the liquefying the ejaculated sperm by decomposing the protein that was produced from the prostate cells which called semenogelin. The function of this protein is to make a gelatinous cover surrounding the ejaculated sperm to protect it from the effects of the free radicals and the oxidation, and also to protect it from the bacterial effect on the seminal fluid. But, this covering that was done by semenogelin prevents the capacitation process of the sperms in the female uterus, which make it loses its ability for fertilization. While, the PSA can decomposes the semenogelin and therefore assists the sperms to reinforcement the occurrence of the capacitation process and give it the ability for eggs fertilization [10,11] discovered that the PSA concentrations in the blood serum increases when the benign prostatic hyperplasia occurs, and these concentrations are more increases with the prostatic cancer infection. Therefore, it was adopted in the 1980s as an important examination to indicate the presence of the prostatic hyperplasia and the prostatic cancer [12]. Increasing the PSA concentrations in the blood serum gives an evidence for increasing the cells number which responsible for its manufacturing and secretion in the prostate, and also simulate the prostatic tumour growth [13].

This study aimed to know the effect of the hyperplasia size of the prostate, and the Prostatic Specific Antigen (PSA) concentrations on the concentrations changes of some hormones and biochemical compounds, this study was suggested to know the physiological changes that can be happen by these two factors.

Materials and procedures:

This study was done to know the influence of the variations on the prostate sizes, and the variations of the Prostatic Specific Antigen (PSA) concentrations on the concentrations of some biochemical compounds (Glucose, Cholesterol, Acid phosphatase) and some hormones (ACTH, Estrogen, Testosterone). The study was carried for 60 patients males infected by the prostatic hyperplasia and 40 healthy males, there ages were ranged between (47 – 90 years). The prostatic hyperplasia was diagnosed depending on the medical staff and specialized sonar devices. After that, the patients were distributed into three categories according to the prostatic hyperplasia sizes which is (20 – 40 mm^3), (41 – 60 mm^3), and (61 – more mm^3), and according to the PSA concentrations which is (0 – 3.5 ng/ml), (3.6 – 7.0 ng/ml), and (7.1 – more ng/ml). 100 blood samples were withdrawn from the brachial vein from 60 patients and 40 healthy and placed in test tubes free of EDTA. The blood was left at room temperature for 20 minute, then the blood serum was separated using centrifuge with a speed of 3500rpm cycle/min. for 15 min. After that, the blood serum was withdrawn using micropipette, and placed in the refrigerator under -20 °C until the examinations that included in this study were occurs using ELIZA and Minividas techniques for the determination of Estrogen, Testosterone, and PSA concentrations .

While, the spectrophotometer was used to determine the concentrations of glucose, cholesterol, and Acid phosphatase.

The statistical analysis:

The statistical analysis procedure was occurred using SPSS program, and the means were compared using t-test for the comparison between two means, and Duncan test SPSS for the comparison between more than two means.

Results and discussion:

From Table (1) it can shows a moral superiority of ($P \leq 0.05$)for all size categories of the prostate patients in comparison with the healthy group in the Glucose concentrations. The reason was due to the psychological and physiological stress which causes the rise of the concentrations of adrenocortico trophic hormone (ACTH), cortisone, adrenaline, and Noradrenaline which were responsible for the increase of Glucose concentration by its influence in the activation of glucose synthesis process from the non-carbohydrates by Gluconeogenesis process, therefore the glucose concentration increases [14]. The prostate size category of (61 – more mm^3) showed a moral superiority of ($P \leq 0.05$) in the glucose concentrations in comparison with the other categories for the prostate patients, the reason could be attributed to the increase in PSA concentrations. This increase in the PSA concentrations that resulted from the increase of prostate size, led to lack of response of the Insulin receptor which causes the rise of the glucose concentrations [15,16] stated that prostate benign hyperplasia patients suffer from the same symptoms that resulted from the Diabetes type-2.

Table (1) The effect of prostate size on the concentration of some biochemical and hormones.

Variables	Mean± Stander div.			
	Healthy mm^3	Prostate size of patients (mm^3)		
		(40-20) 28	(41-60) 20	(61-and more) 12
Glucose mg/dl	^{c}86.66 ± 9.6	^{b}108.38 ± 33.4	^{b}118.50 ± 41.6	^{a}134.05 ± 29.8
Cholesterol mg/dl	^{b}204.8 ± 38.2	^{a}292.06 ± 56.9	^{a}289.93± 84.4	^{a}278.8 ± 84.4
Acid phosphatase ng/ml	^{c}1.66 ± 0.66	^{b}4.81 ± 3.5	^{b}5.3 ± 2.1	^{a}7.14 ± 3.5
ACTH pg/ml	^{c}13.11 ± 4.8	^{b}23.77 ± 15.3	^{a}27.75 ± 22.3	^{a}30.42 ± 18.4
Estrogen pg/ml	^{c}12.40 ± 3.9	^{b}26.63 ± 29.8	^{a}38.41 ± 24.6	^{a}34.12 ± 17.3
Testosterone ng/ml	^{a}6.04 ± 2.6	^{b}2.53 ± 1.4	^{b}3.09 ± 1.1	^{b}2.38 ± 0.8

The horizontally different letters means the presence of moral differences of (P≤0.05).

Moreover, it can be seen a moral superiority in the cholesterol concentrations for all size categories of the prostate patients with a level of probability of (P ≤0.05) in comparison with healthy males. The reason behind that can be due to the increase in PSA concentrations with the increase in prostate size. [17] found a positive relation between PSA concentrations and total cholesterol concentrations for PBH patients. He attributed the reason to the role of the cancer cells in manufacturing the fat compounds including cholesterol. As the cells number increases, the cholesterol concentrations increases in the blood serum. Increasing the cholesterol contributes to stimulating the pathways of increasing the tumour size or the prostatic hyperplasia BPH [18].

From the same table (1), it can shows a moral superiority of (P ≤0.05) in acid phosphatase (PAP) concentrations for all size categories of the prostate patients in comparison with healthy males. Also, a moral superiority of the size category (61 – more mm^3) can be shown in comparison with size categories (20 – 40 mm^3) and (41 – 60 mm^3) in PAP concentrations. These results were in agreement with what referred to by [19] , who attributed the cause of the superiority of BPH patients in PAP concentrations to the increase of PSA concentrations which stimulates the prostate cells for patients to make more PAP enzyme. Also, [20] found a high correlation coefficient between PAP and PSA concentrations, they attributed the reason of increasing PAP to the increase in PSA concentrations.

In addition, it shows a moral superiority of (P ≤0.05) for all size categories of the prostate patients in adrenocorticotrophic hormone (ACTH) concentrations in comparison with healthy males. Although, there are no references can explain our results, we believe that the reason behind increasing ACTH concentrations is due to the psychological stress intensity that caused by the BPH infection. This hyperplasia causes the activation of α1-adrenegic receptors and increasing norepinephrine concentrations who act to hyperplasia of the smooth muscular fibres which exist within the prostatic tissues, and resulted from that pressing on the urinary bladder neck and causing the urinary retention, and thus the stress that resulted from this retention causes a stress that affected the glandular pituitary lobe of the pituitary gland, and stimulates the production and secretion of ACTH as was noted by [21]. Also, increasing ACTH concentrations confirm the intensity of the psychological stress that was experienced by the patients [22].

Moreover, all size categories of the prostate patients shows a moral significant increase (P ≤0.05) in estrogen concentrations in comparison with healthy males, and a moral decrease (P ≤0.05) in testosterone concentrations. [23] noted that the rise of estrogen concentrations for males can led to occurrence of the hyperplasia in the prostate, and they attributed the reason to the negative effect of estrogen on the pituitary gland, by decreasing the LH and FSH production and resulting in decreasing the production of androgenic hormones represented by testosterone from leydig cells. Increasing testosterone and decreasing estrogen acts to reduce the prostate size [24]. Also, it was found that testosterone concentrations decreases with age [25], and this decrease was occurs as a result of increasing

testosterone transformation to dihydrotestosterone (DHT) by the assistance of 5α-reductase, and this enzyme increases with age [26,27].

Table (3) shows a moral superiority of (P ≤0.05) for all PSA categories of the prostate patients in comparison with healthy males in blood glucose concentrations. These results were in agreement with what referred to by [28], who attributed the reason to the presence of a positive correlation coefficient between glucose and PSA concentrations. Also, [29] found a relation between diabetes infection and prostate cancer infection, and increasing the Glucose lead to stimulate the prostate cells to produce more of PSA, where increasing its concentrations in the blood gives an indication to the presence of prostate cancer especially in the ages between 40 – 50 years.

Our results in table (2) showed a moral superiority (P ≤0.05) for all PSA categories of the prostate patients in Cholesterol concentrations in comparison with healthy males. These results were in agreement with what found by [29,30] where they found a positive relation between BPH and the increase in Cholesterol concentrations. They attributes the reason to the decrease in insulin concentrations for BPH patients which can led to increase cholesterol concentrations to provide an energy sources can alternates the non-use of high glucose in blood serum that resulted from the decrease in Insulin concentrations. All these events were due to the increase in PSA concentrations that concurrent with the prostate hyperplasia [31,32].

Moreover, it shows a moral superiority (P ≤0.05) in acid phosphatase concentrations for all PSA categories for the patients in comparison with healthy males. Also, the PSA category of (7.1 – more ng/ml) shows a superiority in comparison with the categories (0 – 3.5 ng/ml) and (3.6 – 7.0 ng/ml). These results are similar to what found by [33] , where the acid phosphatase increases when the PSA concentrations increases. These high concentrations occurs for prostate cancer patients, while the low concentrations are for BPH patients. In all cases, the moral superiority for prostate cancer patients and BPH patients can be seen in comparison with healthy males, and this explain the variation in the acid phosphatase values for patients [34].

Table (2) shows the effect of PSA on the concentrations of some Hormones and biochemical compounds for males.

Variables	Mean± Stander div.			
	Healthy ng/ml	PSA Concentration(ng/ml)		
		(0-3.5) 32	(3.6-7.0) 19	(7.1 and more) 9
Testosterone ng/ml	^{a}6.04 ± 2.6	^{b}2.53 ± 1.2	^{b}2.96 1.4	^{b}2.46 ± 1.02
Estrogen pg/ml	^{c}12.40 ± 3.9	^{b}28.88 ± 20.7	^{a}34.12 ± 22.7	^{a}33.1 ± 24.6
ACTH pg/ml	^{c}13.11 ± 4.8	^{b}25.26 ± 15.4	^{b}24.37 ± 24.0	^{a}30.43 ± 16.4
Acid phosphatase ng/ml	^{d}1.66 ± 0.66	^{b}5.43 ± 4.8	^{c}3.9 ± 2.5	^{a}7.25 ± 6.2
Cholesterol mg/dl	^{b}204.8 ± 38.2	^{a}292.95 ± 52.3	^{a}273.95 ± 80.8	^{a}310.89 ± 100.9
Glucose mg/dl	^{c}86.66 ±9.6	^{b}97.39 ± 25.8	^{a}125.56 ± 39.3	^{a}127.89 ± 42.8

The horizontally different letters means the presence of moral differences of (P≤0.05).

It can also be seen from table (2) a moral superiority (P ≤0.05) for all PSA categories for the patients in comparison with healthy males in ACTH concentrations which was produced and secreted from the frontal glandular lobe of the pituitary gland. Also, it can be seen a moral superiority for the PSA category (7.1 – more ng/ml) in comparison with the categories (0 – 3.5 ng/ml) and (3.6 – 7.0 ng/ml). We believe that the reason behind that is due to patients whose PSA concentrations were increased by prostate cancer, where [35,36,37] pointed that the ACTH increases occurs as a result of this disease which act to rise the blood glucose.

In addition, all PSA categories for the patients in comparison with healthy males shows a moral superiority (P ≤0.05) in estrogen concentrations. Also, it can be noted a moral superiority for PSA categories (3.6 – 7.0 ng/ml) and (7.1 – more ng/ml) in comparison with the category (0 – 3.5 ng/ml), and this indicates the existence of a positive relation between estrogen and PSA [38.39] found that increasing estrogen concentrations can led to increase the prostate size. Another study was done by [40] pointed that this increase in estrogen concentrations was caused by the

increase in PSA concentrations. Estrogen role on prostate cells is to increase the cyclic adenosine monophosphate (CAMP) who mediates the G- protein couple receptor-30 (GPR30), and makes the optical phosphorylation which produces proteins inside prostate cells, and thus increases its cells number [41] . Estrogen effect on prostate is similar to its effect on graafian follicle in the Ovary, and by the same mechanism estrogen increases the number of cumulus cells inside the follicle, in addition to its effect on the theca interna cells, which is an epithelial cells in the follicles. While, its effect on epithelial prostatic cells is to increase its number, and at the end causes the infection by prostate benign hyperplasia (PBH) which can developed to prostate cancer.

It can also be seen from table (2) a moral superiority (P ≤0.05) for all healthy males in comparison to all PSA categories for patients in testosterone concentrations. While, any moral differences doesn't noticed between PSA categories for patients, and this indicates that there is no relation or correlation coefficient between the variation of testosterone concentrations and the variation of PSA concentrations. These results were in agreement with all previous studies which doesn't noticed any relation between testosterone and PSA [42,43]. The reason of decreasing testosterone concentrations for patients in comparison to healthy males. This means that increasing PSA concentrations doesn't have any relation with decreasing testosterone concentrations. Some researcher believes that the main problem of the prostate hyperplasia is caused by the normal decrease in the hormone concentrations with age [44], resulting an increase in estrogen concentrations which can participate in making prostate hyperplasia.

Conclusion

This study concluded that the increase in the prostate size and PSA concentrations leads to increase in (Glucose , Cholesterol , Acid Phosphatase , ACTH and estrogen) and decreased in testosterone , we can used this high parameter as a signs of increase prostatic hyperplasia disease and PSA concentration. The increased in concentration of ACTH hormone proved that the patient have a stress caused the rising in glucose concentrations.

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التاثير الفسلجي لحجم البروستات والمستضد البروستاتي في تركيز بعض الهورمونات والمركبات الكيموحيوية في الذكور في محافظة صلاح الدين

وهبي عبد الرزاق سلمان

الخلاصة

هدفت هذه الدراسة لمعرفة تأثير الزيادة في حجم غدة البروستات وفي تراكيز المستضد (البروستاتي النوعيPSA) في بعض المعايير الكيموحيوية (سكر الدم, الكولستيرول, انزيم الفوسفاتيز الحامضي) وبعض الهرمونات (هرمون محرض الغدة الكضرية ACTH, هرمون الاستروجين Estrogen, الهرمون الذكري Testosterone) في60 من الرجال المرضى بالتظخم البروستاتي و40 من الاصحاء, تراوحة اعمارهم (47−90) سنه. أظهرت النتائج زيادة معنوية ($P \leq 0.05$) في جميع الفئات الحجمية لغدة الروستات لدى المرضى (20−40), (41−60), (61− فأكثر) ملم3 بالمقارنة مع الاصحاء في تراكيز (سكر الدم, الكولستيرول, انزيم الفوسفاتيز الحامضي, هرمون ACTH, هرمون الاستروجين), وكذلك تفوقت الفئة الحجمية لغدة البروستات (61− فأكثر) mm3 للمرضى ($P \leq 0.05$)بالمقارنة مع الفئتين الحجميتين لغدة البروستات (20−40), (41− 60) ملم3 في تراكيز (سكر الدم, انزيم الفوسفاتيز الحامضي, هرمون ACTH , هرمون الاستروجين), بينما تفوق الاصحاء بالمقارنة مع جميع الفئات الحجمية لغدة البروستات المرضى. وفي الجانب الاخر تفوقت جميع فئات المستضد البروستاتي النوعي (7.1 , (3.6 – 7.0) , (0 −3.5) PSA – فأكثر) نانو غرام/مل للمرضى معنويا ($P \leq 0.05$) بالمقارنة مع الاصحاء في تراكيز (سكر الدم , الكولستيرول, انزيم الفوسفاتيز الحامضي, هرمون الاستروجين), وكذلك فقد تفوقت فئة المستضد البروستاتي (7.1 PSA –فأكثر) بالمقارنة مع الفئتين (0 −3.5), (3.6− 7.0) نانو غرام/مل. بينما تفوق الاصحاء معنويا ($P \leq 0.05$) في تركيز الهرمون الذكري Testosterone بالمقارنة مع جميع فئات المستضد البروستاتي للمرضى PSA.