

Sexual Dimorphism in Relation to Structural Changes in Renal Cortex in Different Age Groups: Possible Role of Endogenous SCs

Original
Article

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ABSTRACT

Background: Chronic kidney disease (CKD) is an inevitable process which might be the major cause of death in senile age. In certain diseases male gender is a risk factor. The mitotic division of resident SCs might be stimulated by cellular injury and contribute to the restoration of damaged cells.

Aim of study: The current study is designed to study the sexual dimorphism in relation to structural changes in the renal cortex in prepubertal, pubertal and postpubertal age groups of rat. In addition, possible role of endogenous stem cells (SCs).

Materials and methods: Thirty albino rats were divided into three groups, Pre-pubertal, pubertal and post-pubertal each was subdivided into two subgroups male and female respectively. The body weight (BW), kidney weight (KW), cross sectional area (CA) and serum creatinine (sC) were determined. Kidney sections were subjected to histological, histochemical, immunohistochemical, morphometric and statistical studies.

Results: BW and glomerular area values recorded age related changes. While KW, CA, sC, count of dark nuclei, area of collagen, thickness of tubular basement membrane, count of proliferation marker proved age and sex related changes.

Conclusion: Progressive age related increase in BW, KW, CA, sC and glomerular area (GA) was found, that became reciprocal for the GA in postpubertal rats due to atrophy. Elevated sC, enhanced apoptosis, fibrosis and thickened tubular basement membrane (tBM) and reduced cellular proliferation were detected. Enhanced SCs migration in response to injury were more noticeable in male postpubertal rats.

Received: 04 September 2018, **Accepted:** 28 November 2018

Key Words: Kidney, PCNA, postpubertal, prepubertal, pubertal.

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ISSN: 1110-0559, Vol. 42, No. 1

INTRODUCTION

Chronic kidney disease (CKD) is an inevitable process which might be the major cause of death in senile age and poor countries. Most of cases of CKD further progressed to end stage case, in which renal transplant is not an affordable option^[1].

Age changes in many organs and systems in human body are also related to sex which might explain the predominance of certain diseases in male or female. As in old male cardiovascular disease, while in old female autoimmune disease are overwhelming^[2].

Rodents are the ideal model for aging as well as for age-related diseases for many reasons, their short life span compared to human make it easier for studying different modalities^[3]. National Institute of aging assume that the aging curve for rats aged 6, 30 months rats correspond roughly to humans in their third, sixth decades of life respectively^[4].

Sexual dimorphism which means gender difference between male and female, was found in rat, mice and human

species^[5]. It sometimes explains why in certain diseases male gender is a risk factor, where female hormones give an additional protection against^[6]. Postmenopausal reduction of female hormones can be related to the female becoming vulnerable to such diseases same like male^[7].

Recently, studies have proved that some types of glomerulonephritis are affected also by gender^[8]. There have been many studies regarding decrease in renal function and glomerular filtration rate, nephrons segmentation, structural features of the proximal tubular epithelium affected by gender^[9]. Preclinical trials on the kidney in experimental animal models revealed the importance of sex in these trials even for non aged animals^[10].

It was suggested that the mitotic division of resident stem cells (SCs) might be stimulated by cellular injury^[11]. Intra renal resident cells have stem- or progenitor-like characteristics and contribute to the restoration of damaged tubular epithelial cells^[12].

In the current study our aim was to prove the hypothesis

of sexual dimorphism in relation to structural changes in the renal cortex in prepubertal, pubertal and postpubertal age groups of rat. In addition, possible role of endogenous SCs was studied.

MATERIALS AND METHODS

Animals

The current study was carried out on 30 albino rats. The rats were obtained from Animal House of Kasr -Alainy, Faculty of Medicine, Cairo University. Rats were housed for one week for environmental adaptation under standard laboratory conditions at 22-24 °C with 12 hours light \ dark cycle. They were fed on a constant adequate nutrition diet and allowed free access to drinking water ad libitum. The experimental work was conducted in accordance with the guidelines of the Committee of Laboratory Animals at Kasr-Alainy.

Rats were divided into three groups, each was subdivided into two subgroups, each subgroup (5 rats) was kept in a separate cage as follows:

1. Pre-pubertal (Pre) group: 10 rats 4-6 weeks old^[13], weighing 80-100 gram (g), subdivided into two subgroups 5 males and 5 females.
2. Pubertal (Pub) group: 10 rats 4-6 months old^[14] weighing 150-180 g, subdivided into two subgroups 5 males and 5 females.
3. Post -pubertal (Post) group: 10 rats 20-24 months old^[13] weighing 250-280 g 5 males and 5 females.

All rats were sacrificed by cervical dislocation^[15], after IP injection of phenobarbitone sodium (60 mg/kg)^[16] after 1 week of housing for environmental adaptation.

Methods

1. Determination of the body weight (BW) of rats in the different subgroups.
2. Before sacrifice, blood was collected from the tail veins of animals belonging to each subgroup using capillary tubes for assessment of serum creatinine (sC).
3. Median abdominal incision was performed, both kidneys were excised and fixed in 10% formal saline for 24 hours.
4. Determination of the kidney weight (KW) and kidney cross sectional area (CA) (cm²) of rats in the different subgroups.
5. Paraffin blocks were prepared and 5µm thick sections were subjected to the following studies:

Histological study:

Hematoxylin and eosin (H&E) stain^[17].

Masson's trichrome stain^[18].

Histochemical study:

Periodic acid Schiff (PAS) reagent^[18].

Immunohistochemical study:

0.1 ml of the primary antibody (Ab) proliferating cell nuclear antigen (PCNA)^[19] mouse monoclonal (PC 10) proliferation marker was applied at a concentration 200 microgram (µg)/ml for 60 minutes. Tonsil sections are used as positive control which give a brown coloration. On the other hand, one of the kidney sections was used as a negative control by passing the step of applying the primary Ab.

Cluster of differentiation (CD)105 immunostaining the marker for mesenchymal stem cells (MSCs)^[20] 0.1 ml prediluted primary antibody (CD105) rabbit polyclonal Ab (ab27422) and incubate at room temperature in moist chamber for 60 minutes. Tonsil used as positive control specimens. Cellular localization is the cell membrane. On the other hand, one of the kidney sections was used as a negative control by passing the step of applying the primary antibody.

Morphometric study:

Using Leica Qwin 500 LTD (Cambridge, UK) computer assisted image analysis system, glomerular area (GA) (µ²) and count of dark nuclei (DN) were performed in H&E stained sections. In addition, the area of collagen fibers and the thickness of the tubular basement membrane (tBM) were measured in Masson's trichrome and PAS stained sections. The count of PCNA +ve nuclei (N) and area of CD105 +ve cells were done in immunostained sections. The measurements were done in 10 fields using interactive measurements menu.

Statistical study:

Quantitative data were summarized as means and standard deviations and compared using one-way analysis-of-variance (ANOVA). Any significant ANOVA was followed by post hoc Tukey test to detect which pairs of groups caused the significant difference. P-values <0.05 were considered statistically significant (sig)^[21]. Calculations were made on Statistical Package of Social Science (SPSS) software version 16.

RESULTS

Mean BW, KW, CA and sC induced changes

The mean BW estimated revealed a sig increase in the Post group compared to the other 2 groups and in Pub group versus Pre group. Also, the mean KW, the mean CA and the mean sC measured denoted a sig increase in the Post group compared to the other 2 groups and in the Pub group compared to the Pre group only. In addition, a sig increase was proved in the Pub and Post male subgroups compared to the corresponding female subgroups as regards mean KW, mean sC and mean CA, the latter showed sig increase in Pre male versus the corresponding female (Table 1, Histograms 1a, 1b, 1c, 1d).

Histological changes

Changes in the GA and count of DN

Sections in the renal cortex of rats representing Pre group showed apparently small sized glomeruli, some dark nuclei among the lining of glomerular capillaries and the lining cells of the renal tubules (Fig 1a, 1b). Pub group revealed apparently average sized glomeruli and few dark nuclei among the lining of glomerular capillaries and the lining cells of the renal tubules (Fig 1c, 1d). Post male subgroup demonstrated some distended glomeruli, others atrophic and multiple dark nuclei among the glomerular capillaries among (Fig 1e). Post female subgroup recruited distended and atrophic glomeruli, but some dark nuclei among the lining of glomerular capillaries and the lining cells of the renal tubules (Fig 1f). Widening of the Bowman's space was noticed in the last group.

The mean GA estimated revealed a sig increase in the Pub group compared to the Pre and Post groups. While, the mean count of DN a sig increase was found in the Post male subgroup compared to all other subgroups and in Post female compared to Pub female (Table 2, Histograms 2a, 2b).

Changes in the collagen content

Sections in the renal cortex of rats representing Pre group showed dense collagen deposition among the tubules (Fig 2a, 2b). Pub group revealed fine collagen fibres between the tubules (Fig 2c, 2d). Post group demonstrated fibrosed shrunken glomeruli (Fig 2e, 2f).

The mean area of collagen detected recorded a sig increase in the Post group compared to the Pre and Pub groups and in the Pre group compared to Pub group. In addition, a sig increase was proved in the Post male subgroup compared to the corresponding female subgroup (Table 2, Histogram 2c).

Age and sex induced histochemical changes

Changes in the tBM thickness

Sections in the renal cortex of rats representing: Pre and Pub groups showed obvious reaction in the tubular BM and apparently normal brush border (Fig 3a, 3b, 3c, 3d). Post group revealed thickened parts of the tubular BM and apparently normal brush border (Fig 3e, 3f).

The mean tBM detected indicated a sig increase in the Post group compared to Pre and Pub groups and in Post male compared to the corresponding female. While, a sig increase was found in the Pub group compared to Pre female subgroup (Table 2, Histogram 2d).

Age and sex induced immunohistochemical changes

Changes in the count of PCNA +ve N

Sections in the renal cortex of rats representing Pre group showed some PCNA +ve nuclei (Fig 4a, 4b). Pub group revealed few +ve nuclei (Fig 4c, 4d). Post male subgroup demonstrated accidental +ve nuclei (Fig 4e) and Post female subgroup recruited few +ve nuclei (Fig 4f).

The mean count of +ve N estimated revealed a sig decrease in the Post male subgroup compared to all other subgroups and in the Post female subgroup to Pre group. While, in the Pub male subgroup a sig decrease was found compared to the Pre group and in Pub female compared to Pre female.

Changes in the count of CD105 +ve cells

Sections in the renal cortex of rats representing Pre group showed some +ve spindle cells (Fig 5a, 5b). Pub group revealed few +ve spindle cells (Fig 5c, 5d). Post male subgroup demonstrated some +ve spindle cells (Fig 5e). Post female subgroup recruited few +ve spindle cells (Fig 5f). The spindle cells were found around blood vessels and glomerular capillaries in all groups.

The mean count of +ve cells denoted a sig increase in Pre group and Post male subgroup versus Pub group and in Pre female subgroup versus Post female subgroup in addition. (Table 3, Histograms 3a, 3b).

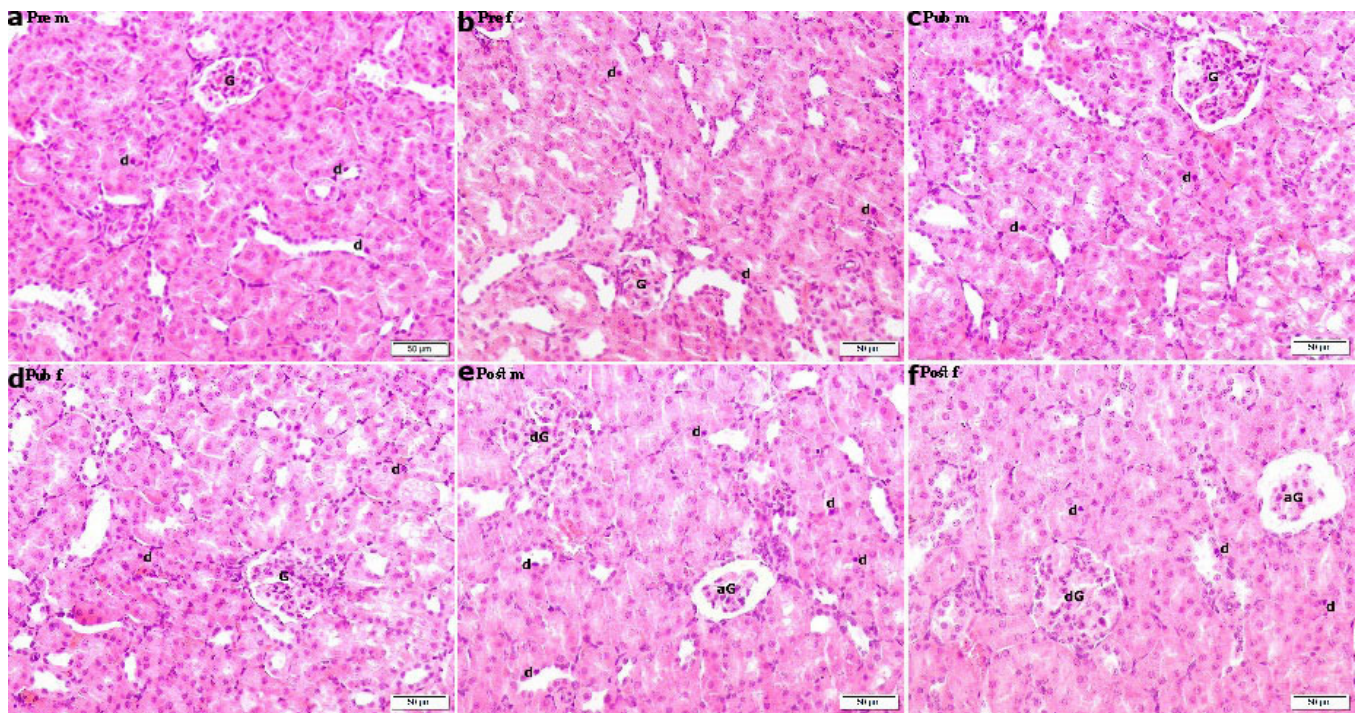


Fig 1: H&E (X200): staining of the rat renal cortex showing: a) and b) apparently small sized glomerulus (G), some dark nuclei (d) in Pre male and female. c) and d) apparently average sized glomerulus (G), few dark nuclei (d) in Pub male and female. e) a distended glomerulus (dG), an atrophic one (aG) and multiple dark nuclei (d) in Pošt male. f) a distended glomerulus (dG), an atrophic one (aG) and some dark nuclei (d) in Pošt female.

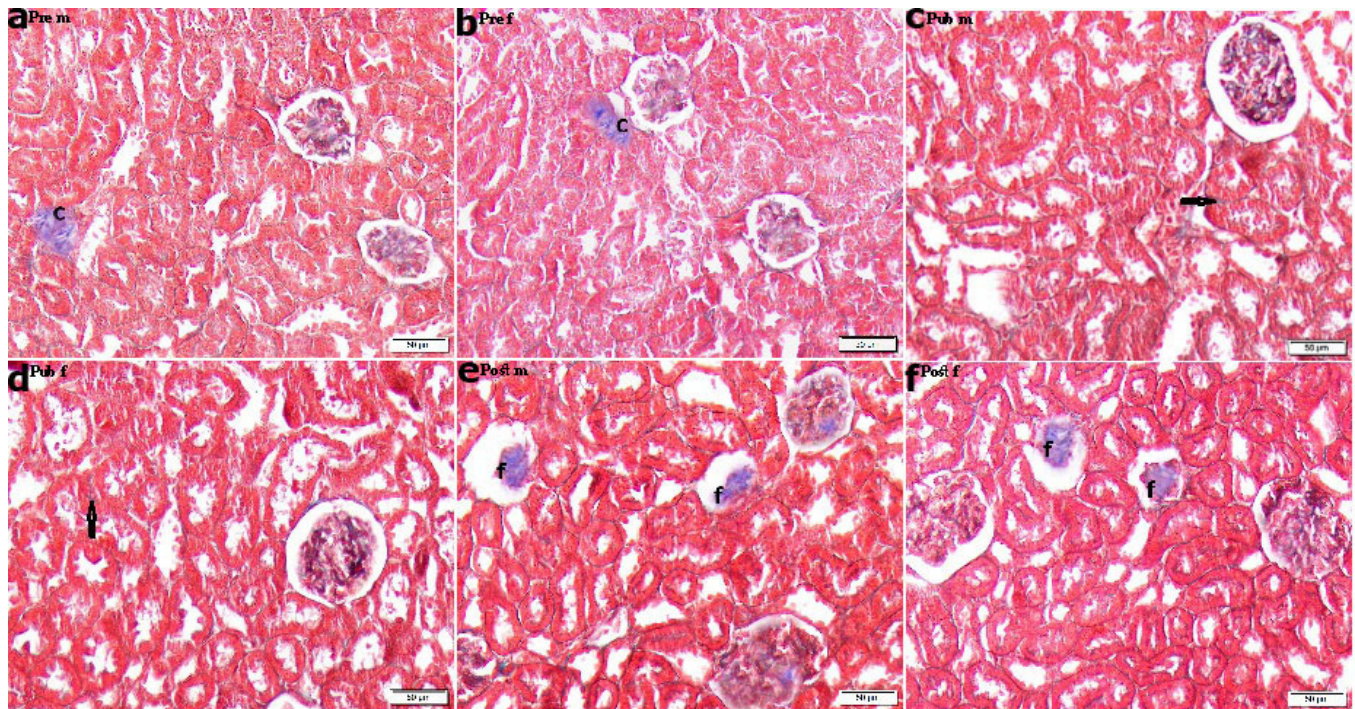


Fig 2: Masson's trichrome (X200): staining of the rat renal cortex showing a) and b) dense collagen (C) deposition among the tubules in Pre male and female. c) and d) fine collagen fibres (arrow) between the tubules in Pub male and female. e) and f) fibrosed shrunken glomeruli (f) in Pošt male and female.

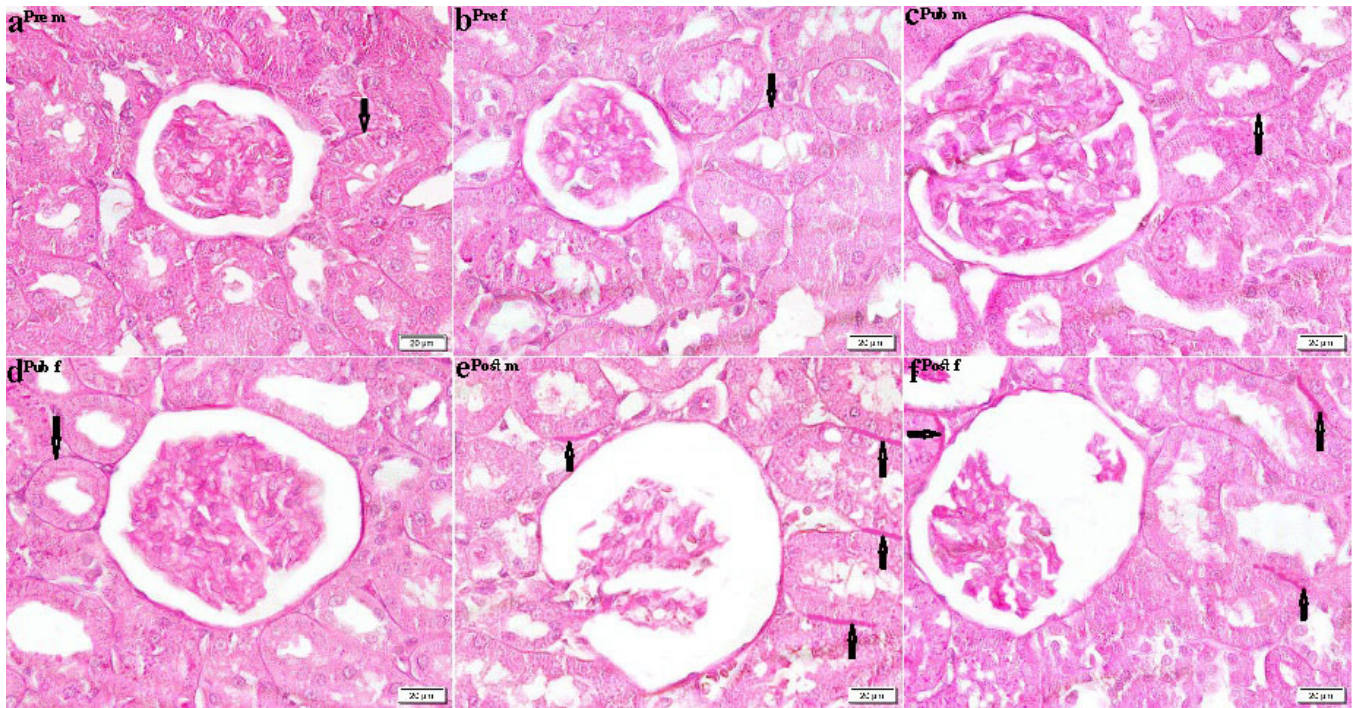


Fig 3: PAS staining(X400): of the rat renal cortex showing: a), b), c) and d) obvious reaction in the tBM (arrows) in Pre, Pub male and female. e) and f) thickened parts of the tBM (arrows) in Post male and female.

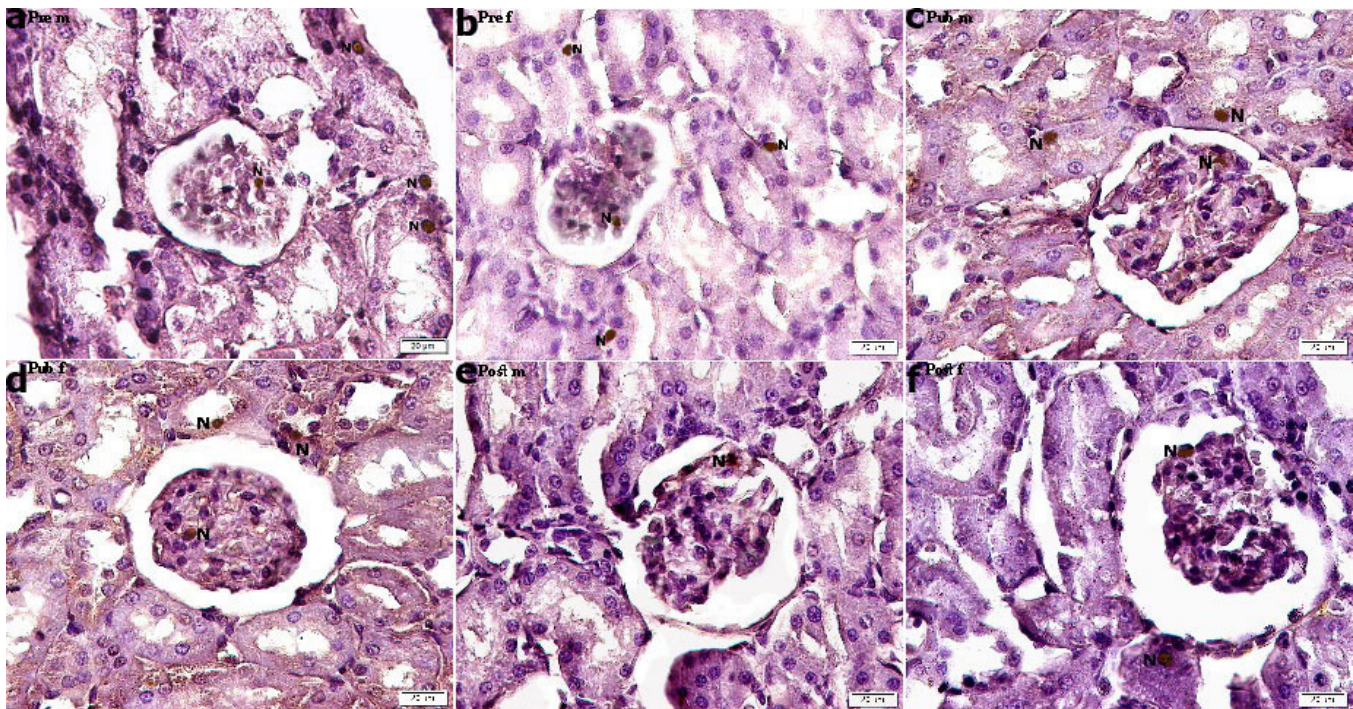


Fig 4: PCNA immunostaining (X400) of the rat renal cortex showing: a) and b) some +ve nuclei (N) in Pre male and female. c) and d) few +ve nuclei (N) in Pub male and female. e) a +ve nucleus (N) in Post male. f) two +ve nuclei (N) in Post female.

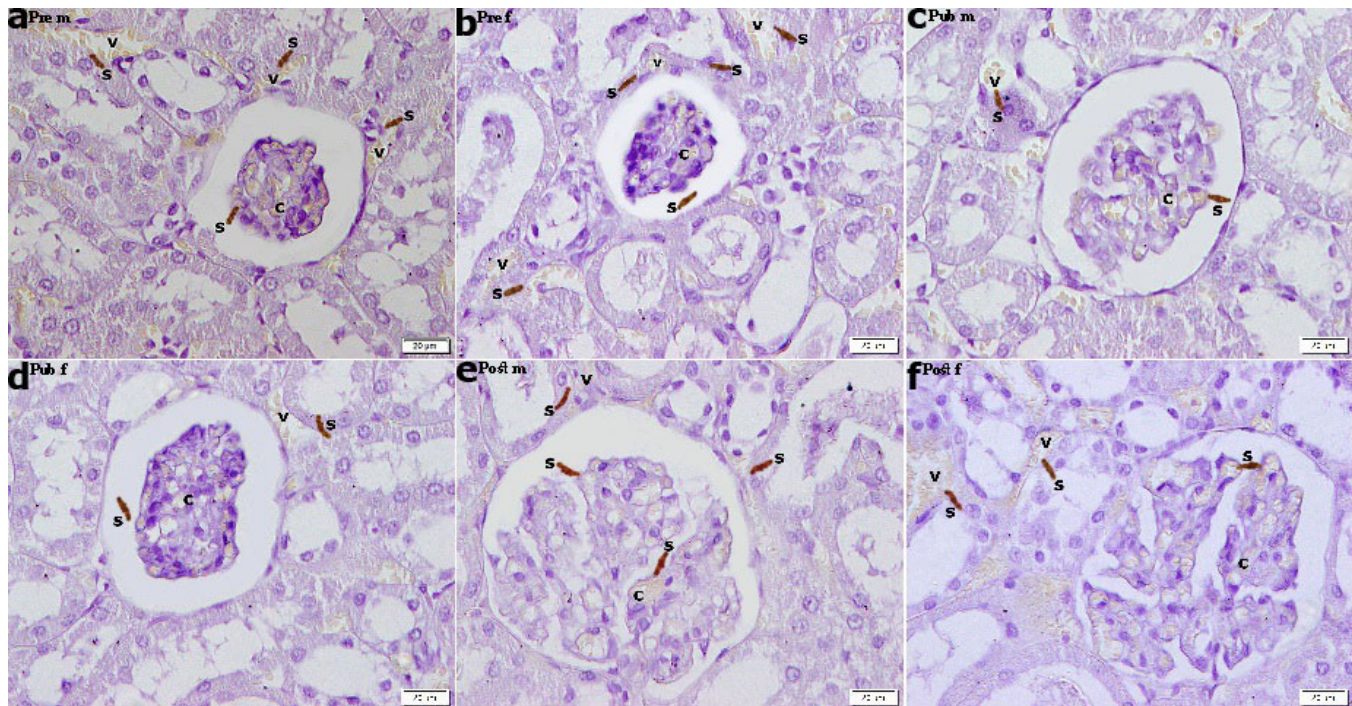


Fig 5: CD105 immunostaining (X400) of the rat renal cortex showing: a) and b) some +ve spindle cells in Pre male and female (s). c) and d) few +ve spindle cells in Pub male and female (s). e) some +ve spindle cells in Pošt male (s). f) few +ve spindle cells in Pošt female (s). The spindle cells (s) were found around blood vessels (v) and glomerular capillaries (c).

Table 1: Mean BW, KW, CA and sC in different subgroups

Subgroup	BW	KW	CA	sC
Pre-pubertal male	89.00±5.72	0.67±0.04	0.63±0.02 ^{^^}	0.24±3.59
Pre-pubertal female	90.00±3.59	0.64±0.05	0.54±0.01	0.22±3.59
Pubertal male	160.00±13.48**	1.76±0.21 ^{**^}	1.00±0.16 ^{**^}	0.41±3.59 ^{**^}
Pubertal female	171.0±20.30**	1.41±0.16 ^{**}	0.93±0.22 ^{**}	0.35±3.59 ^{**}
Post-pubertal male	260.00±29.71*	2.54±0.61 [^]	1.65±0.30 [^]	0.75±3.59 [^]
Post-pubertal female	269.00±28.96*	2.14±0.50 [*]	1.34±0.21 [*]	0.54±3.59 [*]

* significant (sig) $P < 0.001$ (Pošt versus Pre and Pub)

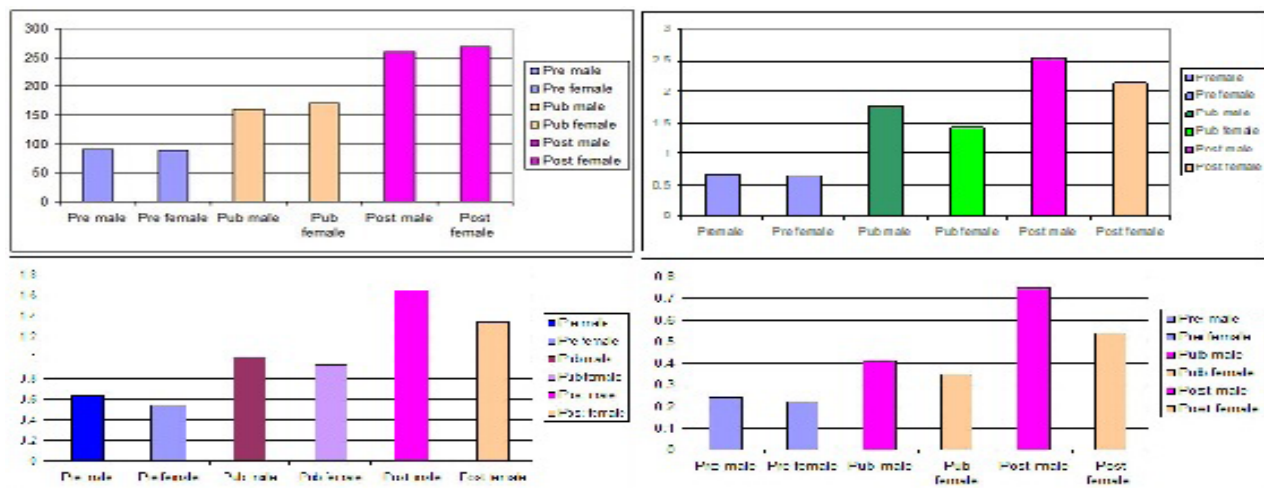
** sig $P < 0.001$ (Pub versus Pre)

• sig $P < 0.001$ (Pošt versus Pre and Pub)

•• sig $P < 0.001$ (Pub versus Pre)

[^] sig $P < 0.001$ (Pošt male versus Pošt female) $P < 0.05$ (Pub male versus Pub female)

^{^^} sig $P < 0.01$ (Pre male versus Pre female)



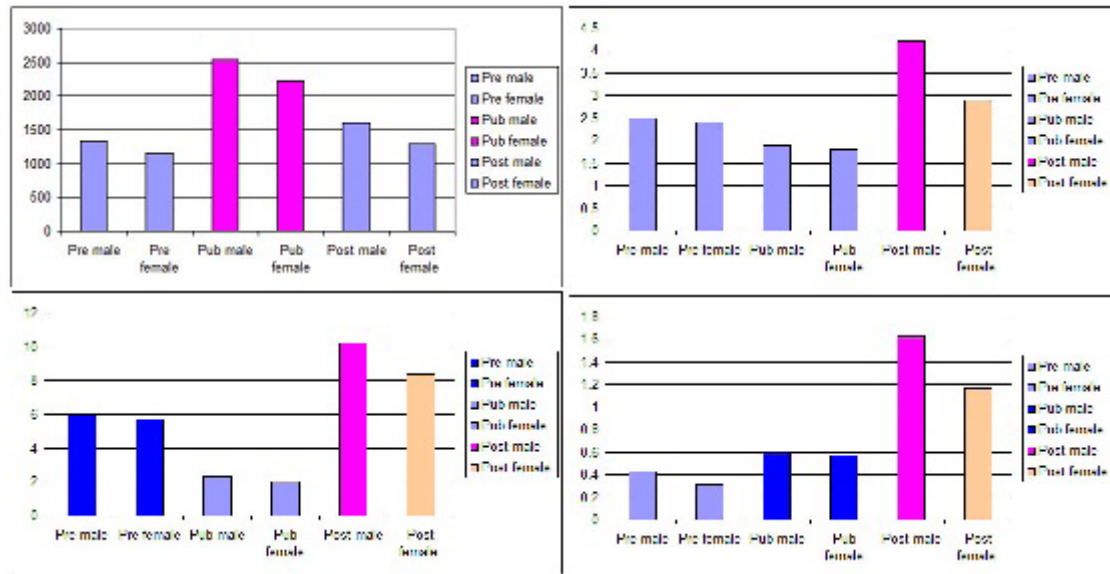
Histogram 1: a) Mean BW. b) Mean KW. c) Mean CA. d) Mean sC.

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Table 2: Mean GA, count of DN, area of collagen fibers and tBM thickness in different subgroups

Subgroup	GA	Count of DN	Area of collagen fibers	tBM thickness
Pre-pubertal male	1332.30±34.59	2.50±0.13	5.94±1.01**	0.43±0.02
Pre-pubertal female	1159.38±59.72	2.40±0.09	5.71±0.95**	0.31±0.03
Pubertal male	2533.36±77.48*	1.90±0.05	2.29±0.08	0.59±0.07**
Pubertal female	2229.06±65.30*	1.80±0.04	2.02±0.22	0.57±0.05**
Post-pubertal male	1607.89±29.71	4.20±0.31^	10.21±1.63*#	1.63±0.14*#
Post-pubertal female	1285.04±26.96	2.90±0.08^^	8.39±2.05•	1.17±0.09•

* sig $P < 0.001$ (Pub versus Pre and Post)
 ^ sig $P < 0.001$ (Pošt male versus Pre and Pub) $P < 0.01$ (versus Pošt female)
 ^^ sig $P < 0.05$ (Pošt female versus Pub female)
 • sig $P < 0.001$ (Pošt versus Pre and Pub) # $P < 0.05$ (Pošt male versus Pošt female)
 •• sig $P < 0.001$ (Pre versus Pub)
 • sig $P < 0.001$ (Pošt versus Pub and Pre) # $P < 0.01$ (Pošt male versus Pošt female)
 •• $P < 0.01$ (Pub versus Pre female).

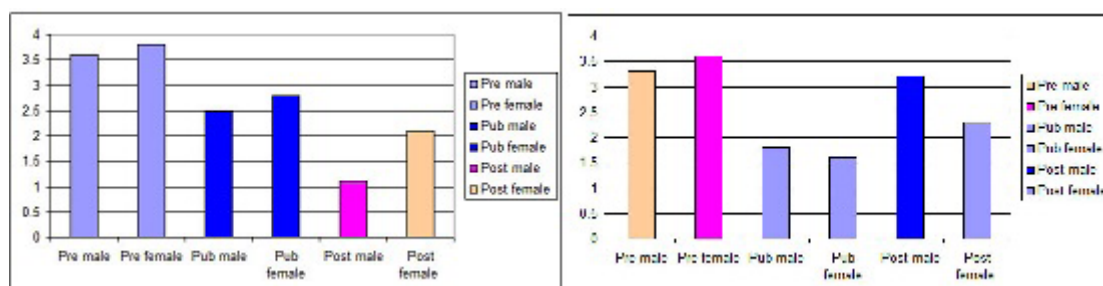


Histogram 2: a) Mean GA. b) Mean count of DN. c) Mean area of collagen fibers. d) Mean tBM.

Table 3: Mean count of PCNA +ve nuclei and CD105 +ve cells in different subgroups

Subgroup	Count of PCNA +ve N	Count of CD105 +ve cells
Pre-pubertal male	3.60±0.59	3.30±0.19•
Pre-pubertal female	3.80±0.70	3.60±0.219**
Pubertal male	2.50±0.08^	1.80±0.04
Pubertal female	2.80±0.30^^	1.60±0.02
Post-pubertal male	1.10±0.21*	3.20±0.71•
Post-pubertal female	2.10±0.46**	2.30±0.10

* sig $P < 0.001$ (Pošt male versus Pre and Pub) $P < 0.05$ (versus Pošt female)
 ** sig $P < 0.001$ (Pošt female versus Pre)
 ^ sig $P < 0.01$ (Pub male versus Pre female) $P < 0.05$ (versus Pre male)
 ^^ sig $P < 0.05$ (Pub female versus Pre female)
 • sig $P < 0.01$ (Pre male versus Pub)
 •• sig $P < 0.001$ (Pre female versus Pub female) $P < 0.01$ (versus Pub male) $P < 0.05$ (versus Pošt female)
 • sig $P < 0.01$ (Pošt male versus Pub female) $P < 0.05$ (versus Pub male)



Histogram 3: a) Mean count of PCNA +ve N. b) Mean count of CD105 +ve cells.

DISCUSSION

The present study investigated the dimensional, histological, histochemical, immunohistochemical and morphometric changes that may develop in the kidney in relation to age and sex.

The mean BW estimated in the current work revealed a sig increase in the Post group compared to the Pre and Pub groups. In agreement, It was stated that the BW increased with age until 18 months then started to decrease after^[22]. In human, BW was related to changes in age and sex hormones as ovarian failure during the late perimenopause is associated with a sharp rise in serum FSH, which coincides with the onset of visceral adiposity^[23].

The mean KW and mean CA in the present study denoted a sig increase in the Post group and, in the Pub group compared to the Pre group. In addition, a sig increase was proved in the Pub and Post male subgroups compared to the corresponding female. In support, It was confirmed with previous findings^[24]. Moreover in the present study mean CA showed a sig increase in Pre male versus the corresponding female, in opposite the presence of any sex difference was denied in the pre group^[24]. In human, kidney volume changes with gender only and not by age were correlated in healthy donors^[25]. On the other hand, a larger cohort of 1344 kidney donors were studied and it was pointed out that kidney volume is nearly stable till age of 50 then decline after^[26].

The mean sC measured in the current study denoted a sig increase in the Post group compared to the other two groups and in the Pub group compared to the Pre group. In agreement, it was recorded that elevated sC in Pub group than Pre one, and assumed that this elevation is related to greater muscle mass^[27]. In addition, a sig increase was proved in the current study in Pub and Post male subgroups compared to the corresponding female subgroups. In accordance, many studies proved that males have a more accelerated age-related functional decline in kidney function than females which might be due to lower estrogen level^[28].

Glomerular changes, in Pre group the glomeruli appeared small, in the Pub group average sized and in the Post group some were distended or atrophic. The previous results were confirmed by a sig increase in the mean GA in the Pub group compared to the Pre and Post

groups. Going with, glomerular atrophy and collapse were reported in aged rats^[29]. It was stated that the rat renal corpuscle diameter continuously increased from age 3 to 30 months^[30] and the incidence of glomerulosclerosis was confirmed in 20 months aged rats^[31]. In human, it was stated that glomerulosclerosis may develop in the kidney with age progression^[32].

The mean count of DN a sig increase was found in the present work in the Post male subgroup compared to all other subgroups and in Post female compared to Pub female, indicating enhanced apoptosis in Post male subgroup. In support, increased apoptotic cell death that was proved in senile male rodents can count for injury in aged kidney^[33]. It was confirmed that the aging is associated with oxidative stress^[34].

Collagen content, increased deposition was detected in the Pre group, while in the Post group fibrosed glomeruli were seen, these changes were evidenced by a sig increase in the mean area of collagen in the Post group compared to the Pre and Pub groups and in the Pre group compared to Pub group. Moreover, a sig increase was proved in the Post male subgroup compared to the corresponding female. Similarly, slight interstitial fibrosis was noticed after 24 months^[30]. It was pointed out that extracellular matrix synthesis and degradation must be in balance to maintain tissue homeostasis and any deviation of this balance lead to interstitial fibrosis^[35].

It was added that extracellular matrix accumulation especially collagen is an important factor in pathogenesis of chronic renal disease, leading to renal fibrosis^[36]. In addition, it was proved that fibrosis resulting from repeated injury is a cumulative process by age. It was added that testosterone has more potent effect in collagen expression than estrogen that may lead to sexual dimorphism.

In human, it was documented that aging is accompanied with extracellular protein accumulation and replacement of functioning kidney parenchyma by fibrosis^[32].

On the other hand, interstitial fibrosis was noticed from age 3 to 12 months^[30]. It was declared that collagen expression is stimulated by estrogen^[38] which was confirmed by a sig increase in the collagen content found in female adult rats than corresponding male rats, with no sex difference in young and old rats^[24].

Thickened tBM was observed in Post group, confirmed by a sig increase in the mean tBM thickness in the Post group, in addition to a sig increase found in Post male compared to the corresponding female and in Pub group compared to Pre female subgroup. Thickening and undulation of the tBM was postulated in old rats^[39]. In human, obvious thickening of tBM was reported in aged cases, which was symptomless in more than 30%^[40].

The mean count of PCNA +ve N estimated revealed a sig decrease in the Post male subgroup compared to all subgroups and in the Post female subgroup to Pre group. Going with, it was found that genes associated with cell proliferation become altered in 24 months old mice and associated with reduced tissue proliferation^[41]. It was added that cellular proliferation was decreased in aged ovariectomized rats^[42].

While, in the Pub male subgroup a sig decrease was found compared to the Pre group and in Pub female compared to Pre female. In accordance, it was commented on inability of tubular epithelial cells of adult kidneys for de novo nephrogenesis^[43]. Enhanced cellular proliferation was confirmed in young rats^[44].

On the contrary, no sig difference was found in +ve staining of nuclear PCNA between young and aged mice although the number of +vely stained nuclear PCNA were more in young mice than in aged mice^[45].

The mean count of CD105 +ve cells denoted a sig increase in Pre group and Post male subgroups versus Pub group and in Pre female subgroup versus Post female subgroup in addition. Concomitantly, it was proved that the postnatal SCs were described as fibroblastic cells that exhibit a surface marker profile positive for CD73, CD44, CD90 and CD105. They were defined by the International Society for Cellular Therapy as MSCs^[46]. Resident SCs function was reported to maintain and repair tissues and if depleted this can cause premature tissue aging^[47]. Additionally, in case of tissue injury that occurs usually with aging, expansion of progenitor population can occur resulting in an increase in the number^[48]. Recently, it was proved that young rat MSCs experienced robust tissue genesis^[49]. It was confirmed that reduced regenerative capacity of aged stem cells hampers organ regeneration, but not migration due to injury^[50].

CONCLUSION

Progressive age related increase in BW, KW, CA, sC and GA was found, that became reciprocal for the GA in Post group due to atrophy. Disturbed histophysiology was established in the form of elevated sC, enhanced apoptosis, fibrosis and thickened tBM as well as reduced cellular proliferation. Enhanced MSC migration in response to injury were more noticeable in male Post group. So, it is recommended that close attention should be focused on sex and gender differences regarding kidney disease progression, risk factors and prescription patterns.

COMPLIANCE WITH ETHICAL STANDARDS

CONFLICT OF INTEREST

None of the authors have a conflict of interest to report.

LIST OF ABBREVIATION

- +ve: Positive.
- Ab: Antibody.
- ANOVA: Analysis of variance.
- BW: Body weight.
- C: Centigrade.
- CA: Cross sectional area.
- CD: Cluster of differentiation.
- CKD: Chronic kidney disease.
- CM2: Centimeter.
- DN: Dark nuclei.
- GA: Glomerular area.
- Gm: gram.
- H&E: Haematoxylin and eosin.
- KW: Kidney weight.
- PAS: Periodic acid Schiff.
- PCNA: Proliferating cell nuclear antigen
- Post: Post-pubertal.
- Pre: Pre-pubertal.
- Pub: Pubertal.
- sC: Serum creatinin.
- SCs: Stem cells.
- Sig: Significant.
- SPSS: Statistical Package of Social Science.
- tBM: Tubular basement membra

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الملخص العربى

علاقة التغيرات الهيكلية بلقشرة الكلوية باختلاف الجنس فى مختلف الفئات العمرية والدور الوقائى المحتمل للخلايا الجذعية

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خلفية: مرض الكلى المزمن قد يسبب الوفاة فى مرحلة الشيخوخة. وفى بعض الاحيان يكون نسبة اصابة الذكور أعلى منها فى الإناث. انقسام الخلايا الجذعية والذى ينشط عند حدوث الإصابة مما يؤدي إلى إعادة بناء الخلية. **الهدف من الدراسة:** تم تصميم الدراسة الحالية لدراسة اختلاف الجنس فيما يتعلق بالتغيرات الهيكلية فى القشرة الكلوية فى مختلف الفئات العمرية قبل سن البلوغ والبلوغ وما بعد البلوغ فى الفئران. بالإضافة إلى ذلك الدور المحتمل للخلايا الجذعية فى علاج مثل هذه التغيرات.

المواد والطرق: تم تقسيم ثلاثين فأرا من فئران الألبينو إلى ثلاث مجموعات: قبل البلوغ، البلوغ وما بعد البلوغ. وحيث تنقسم كل مجموعة إلى مجموعتين فرعيتين من الذكور والإناث على التوالي. وتم حساب وزن الجسم ووزن الكلى ونسبة الكرياتينين فى الدم وقد تم فحص عينات الكل بالنسجية والمناعية، وتم عمل الدراسات المورفومترية والإحصائية. **النتائج:** سجلت بعض النتائج تغييرات لها علاقة بالعمر والجنس مثل وزن الجسم الذى بين تغير مرتبط بالعمر فقط، بينما وزن الجسم ونسبة الكرياتينين وسمك الغشاء القاعدى وعدد الخلايا التالفة اوضحت تغيير مرتبط بالجنس والسن. **الخلاصة:** تم الوصول على ان زيادة وزن الجسم ووزن الكلى ونسبة الكرياتينين مرتبط بالتقدم فى العمر، بينما زيادة نسبة تليف الخلايا وسمك الغشاء القاعدى بينما وزن الجسم ونسبة الكرياتينين وعدد الخلايا التالفة اوضحت تغيير مرتبط بالجنس والسن. اما زيادة نسبة الخلايا الجذعية فكان اكثر وضوحا فى الذكور عنة فى الإناث فى المراحل العمرية المتقدمة.