INTRODUCTION AND REVIEW OF LITERATURE

It has been generally accepted that the kidney is a compound tubular gland which secretes urine. **Leeson and Leeson (1981)** described the kidney as being consisting of a large number of uriniferous tubules, each of which consists of two parts; the nephron and the collecting tubule. The nephron is responsible for urine secretion and consists of the renal corpuscle of Malpighi, and the proximal and distal convoluted tubules. The renal corpuscle consists of a dilated part called the Bowman's capsule, and a tuft of capillaries called the glomerulus. The average diameter of the renal corpuscle varies from 150 to 250 um. Those in the deeper areas of the cortex are larger, and are thought to differentiate first during development.

Many investigators tried to estimate a volumetric range for the renal corpuscle. **Peter (1907)** estimated the diameter of the renal corpuscle in the rabbit kidney by 116-191 um. On the other hand, **Boycott (1911)** reported that the diameter of the renal corpuscle of the same animals was in the range of 34-40 um. **Mueller (1955)** described the structures found in the renal corpuscle to be: the basement membrane of Bowman's capsule, the epithelium of Bowman's capsule, the basement membrane of the glomerulus, the endothelium of the glomerulus, and the glomerulus stalk and capillary lumen. **Bowman (1940) and Mueller (1955)** described the basement membrane of Bowman's capsule as being homogenous and transparent membrane and continous with the basement membrane of the proximal convoluted tubule.

Drasch (1877) described the epithelium of Bowman's capsule, lying on the inside of its basement membrane, to consist of a sheet of flattened cells with bulging nuclei. Again, the author reported that these cells were continuous with those of the tubule and also with those of the glomerulus. However, the electron microscope study conducted by **Mueller (1955)** demonstrated that the glomerular epithelial cells had large spherical nuclei and fairly large cell bodies. They were astrocyte-like in shape, and possessed many long protoplasmic arms extending all directions and terminating in small dendriform processes. These processes lay on the basement membrane of the glomerulus but was not continuous with it. The mesangial cells, which are star-shaped cells in the glomerulus and are considered as connective tissue cells between the glomerular loops, were firstly described by **Key (1865).**

The filtration barrier consists of three layers, the fenestrated glomerular endothelium, the basal lamina of the glomerulus and the pedicles of the visceral epithelium of Bowman's capsule (podocytes)which are connected by slit membranes **Leeson & Leeson (1981). Friis (1980)** described the postnatal development of the filtration barrier in pig's kidney he mentioned that the process. Comprises three step; namely, the formation of the visceral epithelial foot processes, the flattening and fenestration of the endothelium, and the formation of a common epithelial and endothelial basal lamina. During the formation of foot processes, the distribution pattern of the aggregated filaments in the visceral epithelial cells was changed. Therefore, the author suggested that the filaments might participate in the elongation of the foot processes. In the immature glomerulus, the endothelial fenestrae were closed by thin diaphragms which disappeared during the differentiation of the endothelium.

As regards the postnatal changes of the renal structures, **Nash and Edelmann (1973) and Loggie, Kleinman, and Van Maanen (1975)** stated that, in most mammals, nephrogenesis was not completed at birth resulting in relative lower efficiency of the kidney functions in the new-born animals. Moreover, **Friis (1980)** stated that the formation of nephrons continued up to about 3 weeks of postnatal age; after which only morphological differentiation of the already-existing nephrons took place. In the same context, **Fetterman, Shuplock, Philipp and Gregg (1965)** divided the kidney cortex of human into three zones; viz., subcapsular, midcortical, and juxtamedullary. The latter authors found that a great size difference of the renal corpuscles did exist between the three zones at time of birth. However, this difference rapidly decreased with age till 16 months whence all the corpuscles were of the same size. In addition **Kulz, (1899), Moberg, (1929), MacDonald and Emery (1959) and Potter (1972)**, stated that the peripheral zone of the cortex of the neonatal pigmy Hippopotamus (Choerop- sis Liberiensis Morton) is however, younger than the central zone. This was indicated by the size and maturity of the glomeruli and by the number of glomeruli per unit area of cortex. The same authors applied these results to the human infant. Also, **Souster and Emery (1980)** stated that, in human, the size of the juxtamedullary glomeruli were larger than those of the mid cortical and subcapsular zones, and this difference in size disappeared at the age of 3 years. The same authors suggested that the disappearance of this difference in size at 3 years age was due to the rapid growth of the corpuscles of the outer zones more than those of the juxtamedullary zones, thus allowing the corpuscles of the outer zones to attain the same, size of the deeper ones. However, it has been suggested by **Kampmeier (1926), Friedman, Grayzel and Lederer (1948) and Emery and MacDonald (1960)** that glomeruli in the deeper layers of the cortex in young children may scar and involute naturally, not as a part of a pathological process. Thus, the larger juxtamedullary glomeruli may disappear in the older children, helping to equilibrate the sizes throughout the cortex.

In the same connection, **Horster, Kemler and Valtin (1971)** stated that neogenesis of dog nephrons did not occur after 3 weeks of age. This conclusion was based on the findings that the number of glomeruli at 23 days fell within the range reported for mature dogs, on the constancy of this number during the subsequent postnatal period, and on the absence of nephrogenic tissue. In addition, they stated that the total glomerular volume increased by 33% from 23 to 74 days whereas the tubular volume increased by about 235%. The change in structural balance between the glomerulus and the tubule in the dog did not result in functional imbalance between them.

The proximal tubule commencing at the urinary pole of a renal corpuscle is formed of a convoluted part and a straight part that forms the descending limb of the loop of Henle. The outside diameter of the tubule ranges from 50 to 60 um, the cells are pyramidal in shape, the cytoplasm is abundant and intensely eosinophilic, the basal cytoplasm is striated by mitochondria and the brush border is obvious on the luminal surface **(Leeson and Leeson, 1981)**.

In postnatal development of the structures of the proximal tubules, **Friis (1980)** stated that, in pig kidney, microvilli were observed in the proximal tubule cells in an early developmental stage before the onset of glomerular filtration, few cellular organelles were seen in the tubule, but the number of mitochondria, apical vacuoles and lysosome like bodies increased markedly during maturation, peroxisomes however, first appeared in a late developmental stage. **Darmady, Offer and Woodhouse (1973)** stated that in human the growth rate of the proximal tubule in the infant is faster than that of the glomerulus and this increased growth was observed to continue until the age of 18-20 years whence maturity was reached.

Yadava and Calhoun (1958) Tisher, Bulger and Trump (1968) and Maluf (1978) devided the distal segment of the nephron into an ascending portion, short macula densa portion and a distal convoluted portion. However **Faarup (1965)** in different animal **Species and Arey (1974)** in man considered the distal tubule as a continuation of the ascending thick limb of the nephron loop, again the former author added that the macula densa was the part of the distal tubule which came in contact with the afferent vessels at the vascular pole. **Trautmann and Fiebiger (1957)** stated that the distal tubules had wider lumina, and their cell lining were less acidophilic with especially large nuclei. **Baert (1979)** explained that the distal tubules of human kidney had a slightly wide portions following a narrow ones in an irregular sequence. **Again,** Darmady et al. (1973) observed the occurrence of diverticula in the distal convoluted tubules of man, the lumen of which communicate directly with the lumen of the tubules and lined by the same epithelium of the tubules. However, **Oliver (1945), Darmady and Stranack, (1957) and Paatela (1963)** reported that these diverticula were uncommon under the age of 4 years and the numbers gradually increased with age. The cause of occurrence of these diverticula may be due to an arrest of the involution process of a developing nephron. It is also possible that, as the distal tubule is fixed to the glomerulus at the site of macula densa, constant pulsations might cause mechanical strain on the basement membrane with herniation of the epithelium between the fragmented fibres and subsequent formation of the diverticula **(Darmady et al., 1973).**