SUMMARY & CONCLUSION
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The kidney is a vital organ plays essential role in health and diseases. The main function of the kidney is to maintain total body fluid volume, its composition and pH within physiologic range by virtue of its reabsorptive properties. The kidney is a heterogenous structure consisting of several tissue zones e.g., cortex, the outer medulla and the inner medulla. Each tissue zone has individual "organ" characteristics with respect to distinct structures of its components, their metabolic activities, and eventually their contributions in the overall kidney functioning. The kidney is comprising at least of a million of nephrons - the fundamental unit, which itself is subdivided into distinct structural and functional subsegments running through the various tissue zones. The inter- and intra nephronal heterogeneity of the nephron further contribute to heterogenous structure and function of the kidney. Although various nephronal subsegments play important role in the functioning of the kidney the proximal tubule is considered to be the major functional site where most of the solutes including various ions, minerals, sugars, fatty acids and amino acids in addition to water are
reabsorbed. The brush border membrane in the proximal tubule is the chief site at which the reabsorption takes place (26,30,42). The reabsorption of Na\(^+\) ions by active transport is the major work function of the kidney in general and the proximal tubule in particular upon which the reabsorption of other ions and solutes including glucose and Pi is dependent. The reabsorption of Pi and glucose is essential in providing energy by various metabolic pathways required for the transport functions by active transport processes. The proximal tubule is consisting of two distinct structural and functional units, i.e., pars convoluta (proximal convoluted tubule) and pars recta (proximal straight tubule).

The metabolic activity, the oxygen tension and the transport functions vary in different tissue zones of the kidney and/or in various nephronal subsegments including the proximal tubule under physiologic and in various environmental and dietary conditions and in response to several drugs and hormones (5,31-39). In many of the situations the transport of Pi in the proximal tubular subsegment is regulated at the BBM site, usually exhibited by alterations in the capacity, affinity or both of the transport system.
It is known that kidney does not function to its full capacity under normal physiological conditions. It has the ability to adapt itself to maintain a positive balance of many of the nutrients and other needy elements to keep going according to the environmental and other conditions in which it lives. The most adaptive changes were observed in the phosphorus homeostasis in response to dietary phosphorus intake, starvation-refeeding and several hormones and drugs (1,2,6,51,79-81,152-167,5,31-39). Certain structural and functional components or the metabolic activity of proximal tubules are known to be affected by starvation (1,2,51,152-156) and by feeding of various diets such as high or low phosphorus diet (119), high protein (158,159) high carbohydrate (157) and high fat diets (160,161).

Thus, it can be envisaged that certain structural, functional and/or metabolic components of the kidney might be altered by hunger, malnutrition certain dietary imbalances, religious compulsions and environmental variations. It is believed that the kidney has the ability to adapt and adjust its functioning to work at its best capacity to maintain the body fluid volume and its composition, and to maintain the positive balance of many
nutritional elements by selective reabsorption and to reject excess harmful elements by excretion. In view of the above the present research was carried out to gain comprehensive knowledge regarding the adjustment of the kidney in general and the proximal tubule in particular with respect to alterations in the structure, metabolic activity and the reabsorption of certain solutes and in particular the inorganic Pi required for providing energy for many cellular and biochemical processes under various dietary conditions. In specific, the central aim of the present work was to determine the effects of fasting (or starvation), fasting-refeeding, Islamic fasting (12 hr fasting - 12 hr refeeding for 30 d), and of various diets enriched in carbohydrates fats and/or proteins on certain structural, metabolic and functional components of the kidney in general, and on the proximal tubule in particular. The effects of the above variations were determined a) on serum and urinary biochemical parameters, b) on the activities of certain enzymes of carbohydrate metabolism, c) on the activities of marker-BBM enzymes and, d) on the transport of $^{32}\text{Pi}$ and/or L-$^{3}\text{H}$-Proline in whole cortex and in superficial and juxtamedullary cortex. The results of the present study are summarized as follows:
In general, 1, 3, and 5 d fasting resulted in marked reduction of body weights (upto -37%). The kidney and cortex weight were also declined. Refeeding to fasted rats slightly improved the body and tissue weights but not completely. Islamic fasting and HFD caused only a small decline in the body (-20%, -12%) and kidney (-18%, -28%) weights. However, the feeding of HCD, and HPD resulted in the significant increase of body, kidney and cortex weights.

a) Serum and urinary biochemical parameters

(1) Serum or urinary creatinine levels were not affected by any of the experimental condition used in the study. (2) Both serum and urinary Pi declined by the fasting and returned towards the control values by re-feeding. Islamic fasting, HCD and HPD caused a significant increase in the serum Pi accompanied by a significant decrease in urinary Pi values. In contrast, serum Pi declined while urinary Pi increased by HPD. (3) Serum PL and Ch levels were lowered by 1 d fasting but increased by 3 and 5 d fasting. Opposite was the effect of refeeding. Serum PLs were significantly lowered by IF while PL as well as Ch both were increased by HFD. However, serum PL and Ch were not altered by HCD or HPD and Ch by IF.
b) Enzymes of carbohydrate metabolism

(1) LDH activity was lowered both in the kidney and liver by up to 5 d fasting more so in the kidney than liver. Refeeding resulted in the improvement of the activity. Similar to the effect of fasting the enzyme was lowered both in the kidney (WC) and liver by HPD, HFD and IF but less effectively by IF. However, profound increase in the activity of LDH was observed by HCD. When further analyzed, the effect was more pronounced in the juxtamedullary cortex by IF, HCD, HFD or HPD while the enzyme was similarly declined both in SC-H and JMC-H by the fasting.

(2) Similar to LDH, the activity of MDH was lowered in the kidney and liver by fasting, IF, HPD and HFD and it was increased by HCD. Unlike, LDH, MDH was greatly affected in the superficial cortex as compared to JMC-H. However, the decrease in the activity both in SC-H and JMC-H was similar by the fasting.

(3) Differential effects of various dietary manipulations were observed on the enzymes (FBPase, G6Pase) of the gluconeogenesis. The activity of FBPase and G6Pase were increased in the kidney tissues by fasting, IF, HPD and
HFD while decreased by HCD. On the other hand, the activity of FBPase in the liver was significantly lowered by fasting, HCD and HFD, increased by HPD while not affected by IF. The activity of G6Pase, however, significantly increased by fasting and HPD, decreased by HCD and HFD and not changed by IF. The effect on FBPase was appeared to be much greater as compared to the effect on G6Pase activity. Greater affects of fasting, IF, HCD, HPD and HFD on the activity of both the enzymes were observed in SC-H while relatively a small effect were observed only by fasting in JMC-H. Moreover, the enzymes were significantly not altered in the JMC-H by HCD, HFD, HPD and to some extent by IF.

(4) The activities of G6PDH and ME in control rats were apparently much higher in the kidney tissues (more so in JMC-H) than the liver. The activity of G6PDH was profoundly increased both in the liver and the kidney by fasting. The activity in the liver and kidney was also increased by IF and HPD while declined by HFD. However, by HCD, the activity of G6PDH was increased in the liver but decreased in the kidney. The activity of ME, on the other hand was increased in the kidney by only fasting and HPD but lowered by IF, HCD and HFD. In the liver, however, the activity of ME was
increased by fasting, IF, HCD and HPD but declined by HFD. The effects of all the experimental conditions on the activity of G6PDH was more pronounced in the SC-H while the activity of ME was profoundly affected in the JMC-H.

c) **Marker BBM enzymes**

(1) Differential effects on the activity of AlkPase and GGTase (marker BBM-enzymes) were observed by fasting, IF and other diets. The activity of AlkPase was significantly lowered by fasting, IF, HPD and HFD while increased by HCD in BBMV-WC. Further analyses showed that AlkPase was affected to greater extent in BBMV-SC than BBMV-JMC by IF, HCD, HPD and HFD. However, it profoundly decreased both in BBMV-SC and BBMV-JMC to much similar extent by the fasting. The activity of GGTase was also lowered by fasting (1 and 3 d), IF, HCD and HFD but profoundly increased by HPD and by 5 d fasting. The effect on the GGTase in BBMV-WC was relatively prominent than AlkPase at least by fasting, HCD and HFD if not by IF and HPD. Further analyses indicate that the activity of GGTase was affected to a greater extent in BBMV-JMC as compared to the effect in BBMV-SC.

(2) Kinetics of the effects in BBMV-WC revealed that both Vmax and Km values were altered but Vmax values were
changed to greater extent than Km. The activity of AlkPase in BBMV-SC by 1, 3 and 5 d fasting was lowered due to profound decrease of Vmax and Km was not altered significantly. In BBMV-JMC Vmax was also decreased by 1, 3 and 5 d fasting but Km was increased by 5 d fasting. The activity of GGTase was affected by 1, 3 and 5 d fasting due to the alteration of both Vmax and Km values to similar extent both BBMV-SC and BBMV-JMC. While the activity was lowered by 1 and 3 d fasting in both the BBMV-SC and BBMV-JMC it was increased in BBMV-SC due to increase in Vmax and Km values but decrease (which was reduced than 3 d fasting) in the BBMV-JMC by IF, the activity of both AlkPase and GGTase were lowered due to decrease of Vmax and Km values but Km values were lowered to lesser extent than Vmax in BBMV-WC, BBMV-SC but in BBMV-JMC where both Vmax and Km declined for the GGTase and not for AlkPase. Similar Vmax effects were observed for AlkPase and GGTase in the case of HCD, HPD and HFD.

(d) Transport of $^{32}$Pi in BBMV-WC, BBMV-SC and BBMV-JMC

(1) The result of the present study indicate that Na-dependent $^{32}$Pi uptake in BBMV-WC in the initial time phase (5-30s) was markedly lowered by 1 d fasting without the
change in serum and urinary Pi. It further decreased by 3 and 5 d fasting but with the declining of both serum and urinary Pi. Refeeding to fasted rats caused the reversal of fasting effect kinetic studies revealed that the uptake of $^{32}\text{Pi}$ was lowered due to greater decrease of both Vmax and Km values.

(2) In the same preparations L-proline uptake was also lowered by 1 and 3 d fasting but unlike $^{32}\text{Pi}$ uptake increased by 5 d fasting.

(3) The effect of fasting was much greater in BBMV-SC than BBMV-JMC.

(4) In contrast to fasting Islamic fasting resulted in marked increase of $^{32}\text{Pi}$ uptake in the initial uphill phase in BBMV-WC. Both Vmax and Km were increased to much greater but similar extent.

(5) The effect of IF on the uptake of $^{32}\text{Pi}$ was much more pronounced in BBMV-SC (25-37%) than BBMV-JMC (10-14%). Similar to fasting, both Vmax (+72%) and Km (+61%) were affected in BBMV-SC by IF.
(6) Na-gradient dependent $^{32}$Pi uptake in the initial uphill phase (5-30s) was markedly increased (38-50%) by HCD and moderately enhanced (25%) by HFD while declined (21-35%) by HPD in BBMV-WC. The changes observed in $^{32}$Pi uptake by HCD, HFD or HPD were due to marked alterations of both Vmax and Km values in the BBMV-WC.

(7) Further analyses indicate that the effects of HCD, HFD and HPD on $^{32}$Pi were most profound in BBMV-SC and only minor alterations were observed in BBMV-JMC by these diets. Although both Vmax and Km were changed but the effect of Vmax was greater than Km.

(8) The transport of $^{32}$Pi in the presence of Na-gradient ($Na_o > Na_i$) at 120 min (equilibrium phase) and in the absence of Na-gradient ($K_o > K_i$) was not altered under any nutritional conditions.

The results of the present study suggest that by fasting or starvation and to some extent by high protein dietary intake the metabolic activity and $^{32}$Pi reabsorption capacity in the kidney are lowered. In contrast, Islamic fasting, high carbohydrate and to some extent high fat dietary intake greatly enhance metabolic activity and $^{32}$Pi
conservation in the kidney. It appears that God is kind to the poor who end up in eating HCD (like in India: rice with potatoes) and sometimes oily food but definitely not happy with the affluent societies who prefer to eat high protein diet.