Full Length Research Paper

The effect of quince leaf decoction on renal injury induced by hypercholesterolemia in rabbits: A pilot study

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There has been no investigation on the efficacy of quince extracts (Cydonia oblonga Miller) against hyperlipidemia-induced renal injury. In the present study, this hypothesis was evaluated by a histological comparison of kidney tissues from New Zealand white rabbits fed on a cholesterol-rich diet with and without a quince leaf extract supplement. Mild glomerular injury and moderate tubular damage were apparent in all rabbits in disease group. Meanwhile, milder tubular injury was detected in all animals in treatment group. The results were consistent with the hypothesis and suggest that a more extended study would be justified.

Key words: Quince, kidney, cholesterol, herb, diet.

INTRODUCTION

Dyslipidemia and hypercholesterolemia have been linked to the pathogenesis of progressive renal injury (Attia et al., 2002; Mune et al., 1999). Studies have revealed that cholesterol-fed rats develop proteinuria, interstitial injury, glomerulosclerosis, and podocyte and mesangial cell damage (Eddy, 1996; Joles et al., 2000). Renal injuries induced by hyperlipidemia are in part attributable to enhanced oxidative stress and defective renal vascular functions (Attia et al., 2002; Joles et al., 2000; Feldstein et al., 1999). Interestingly, Kasiške et al. (1988) reported an improvement in glomerular injury following lipid-lowering therapy in hyperlipidemic rats. Quince (Cydonia oblonga Miller), a tree belonging to the Rosaceae family, grows wild in the Caucasus and Northern Iran (Golgolab, 1961). Different parts of quince have been used as traditional remedies for cardiovascular, respiratory, gastrointestinal and urinary tract symptoms (Oliveira et al., 2007; Fattouch et al., 2007). Recent experimental animal studies have revealed that the fruit and leaves of quince have cell-protecting properties owing to the abundance of antioxidants they contain, for example, phenolic acids and flavonoids (Oliveira et al., 2007; Fattouch et al., 2007; Hamauzu et al., 2006). Quince leaf has also been attested to possess anti-hemolytic (Costa et al., 2009), anti-diabetic and anti-lipoperoxidative (Aslan et al., 2010), and lipid-lowering characteristics (Osman et al., 2010).

Despite these medicinal features, there is currently no evidence that quince leaf has renoprotective effects. The aim of this study was to assess the effect of quince (C. oblonga Miller) leaf decoction on renal injury induced
by hypercholesterolemia in rabbits.

MATERIALS AND METHODS

Eleven adult New Zealand white male rabbits were used in this study in accordance with the international and local institutional guidelines for use of animals in research. The animals were kept under constant laboratory conditions with respect to humidity, illumination and temperature for two weeks prior to the study. Their regular diet included drinking water and standard food in the form of compact granules containing all essential nutrients (Shakouri et al., 2010). The rabbits were randomly divided into three groups: Group 1 (hypercholesterolemia group) received a cholesterol-enriched diet. Group 2 (treatment group) received a cholesterol-enriched diet plus C. oblonga leaf decoction as drinking supplement. After almost six weeks of these dietary modifications, Groups 1 and 2 were switched to a normal diet for another six weeks. Group 3 (control group) was maintained throughout the whole period of study on a regular diet without cholesterol enhancement or quince leaf decoction.

To prepare the cholesterol-enriched diet, cholesterol (Merck, Germany) was dissolved in ethanol and the solution was sprayed on to the ground food in a 2% weight/weight ratio. The mixture was then prepared, dried and granulated and the dried granules were used for the study. The cholesterol enriched diet elevated the serum cholesterol levels in Groups 1 and 2 by at least 10 folds when compared to those in the normal diet fed rabbits. To prepare the quince leaf decoction, dried leaves (4.95 g) were added to 600 ml boiling water, and the mixture was kept in a 100°C water bath for two hours. The decoction was then cooled to room temperature and filtered through a membrane. The rabbits drank the decoction (100 ml/each rabbit in Group 2) and tolerated it well.

At the end of the study (12th week), the animals were sacrificed with an anesthetic overdose (ketamine plus acepromazine). Urine samples were drawn by direct catheterization of the bladder. The urine samples were stored at 5°C for three days until analyses were performed. Spot urine creatinine and protein concentrations were measured by standard techniques. The ratio of urine protein to creatinine was calculated and used to estimate 24 h urine protein with an anesthetic overdose (ketamine plus acepromazine). Urine samples were drawn by direct catheterization of the bladder. The urine samples were stored at 5°C for three days until analyses were performed. Spot urine creatinine and protein concentrations were measured by standard techniques. The ratio of urine protein to creatinine was calculated and used to estimate 24 h urine protein (Price et al., 2005). The immediately excised kidneys were washed with 0.9% NaCl, cut into 5 × 5 mm pieces and fixed in 10% neutral buffer (Price et al., 2005).

The results of this study showed that cholesterol-fed rabbits had both glomerular and tubular injuries, while the basement membrane was intact. Cholesterol-fed animals treated with the quince (C. oblonga Miller) leaf decoction supplement exhibited milder glomerular and tubular injuries. It is therefore plausible that quince leaf has a protective effect on the kidneys. To the best of our knowledge, this has not hitherto been reported.

RESULTS AND DISCUSSION

Light microscopy observations revealed mild glomerular injury in all rabbits in Group 1 (Figure 1A to C) and in two of the six rabbits in Group 2 (Figure 2B and D). The remaining animals had no glomerular changes in their HE- and PAS-stained sections (Figure 2A and C). While desquamated and vacuolated tubular epithelium (moderate tubular damage) was observed in kidney sections from Group 1 (Figure 1D), milder tubular injury was detected in all animals in Group 2. No glomerular or tubular alterations were seen in Group 3. Furthermore, no basement membrane thickening and fibrosis were discerned. The glomerular, tubular and basement membrane changes along with the urine analyses of the studied animals are listed in Table 1.

Owing to their antioxidant components including phenolic acids and flavonoids, different parts of quince have been used as traditional remedies for numerous medical complaints (Osman et al., 2010; Silva et al., 2004). For instance, quince leaf decoction is used as a diuretic and for kidney stones in some regions of Turkey (Kültür, 2007). It is noteworthy that higher total concentrations of phenolics have been found in quince leaves than in pulps, peels and seeds (Oliveira et al., 2008). Because of its antioxidant properties, quince leaf can have anti-hemolytic, anti-diabetic and anti-lipidperoxidative effects (Costa et al., 2009; Aslan et al., 2010). Furthermore, Carvalho et al. (2010) and Osman et al. (2010) reported that quince leaf has anti-cancer and lipid-lowering characteristics. The probable protective effects of quince leaf on the hypercholesterolemia-induced renal
Figure 1. Histopathological findings in the kidneys of rabbits in Group 1 (disease group) showed mesangial hyperplasia and dilatation of vascular lumen with no evidence of fat deposits (mild glomerular change). Moderate tubular damage, that is, desquamated and/or vacuolated tubular epithelial cells, was noted as well. Paraffin-embedded kidney sections from rabbit 1 (A) and rabbit 2 (B), revealing glomerular and tubular alterations, were stained with HE. (C) Glomerular and tubular changes in PAS-stained kidney section from rabbit 1. (D) Tubular changes in rabbit 2 (PAS). Arrows indicate the glomerulus.

Figure 2. Microscopic examination of glomeruli in renal specimens from rabbits in Group 2 (treatment group). HE- (B) and PAS- (D) stained kidney sections from rabbit 6 showed mild glomerular and tubular change. Cloudy swelling of tubular epithelium is seen in B and D. No glomerular and tubular changes are apparent in HE-stained kidney sections from rabbit 1 (A) or in a PAS-stained specimen from rabbit 5 (C). Arrows indicate the glomerulus.
injury observed in the present study might be attributed to both its antioxidants and its lipid-lowering characteristics.

In conclusion, our results indicate that quince leaf decoction (C. oblonga Miller) partially protects rabbit kidneys from glomerular and tubular injuries during hypercholesterolemia. To the best of our knowledge, this is the first report concerning this effect of quince leaf.

ACKNOWLEDGMENTS

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REFERENCES


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<th>Parameter</th>
<th>Glomerular injury</th>
<th>Tubular injury</th>
<th>Basement membrane changes</th>
<th>Fibrosis</th>
<th>Urine protein (mg/d)</th>
<th>Urine creatinine (mg/d)</th>
<th>Urine protein/creatinine ratio</th>
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