

## Flavonoids from the Roots of *Astragalus membranaceus* (Fisch.) Bge. Prevent Development of Diabetic Nephropathy *In Vitro*

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**SUMMARY.** Phytochemical investigation on the roots of *Astragalus membranaceus* (Fisch.) Bge. gave eight flavonoids including formononetin (**1**), formononetin-7-O- $\beta$ -D-glucoside (**2**), calycosin (**3**), calycosin-7-O- $\beta$ -D-glucoside (**4**), 3'-hydroxy-7,4'-dimethoxyisoflavone (**5**), 10'-hydroxy-3,9'-dimethoxypeterocarpan (**6**), 8,3'-dihydroxy-3,9'-dimethoxyisoflavone (**7**), and 2'-hydroxy-3',4'-dimethoxyisoflavan-7-O- $\beta$ -D-glucoside (**8**). Their structures were identified on the basis of spectroscopic analysis. Protective effect of eight compounds on rat glomerular mesangial cells was evaluated *in vitro*. The results showed that the compounds obtained especially formononetin (**1**) and calycosin (**3**) could ameliorate diabetic nephropathy *in vitro* via anti-proliferation of glomerular mesangial cells and down regulation of TGF- $\beta_1$ , CTGF, type IV collagen and fibronectin.

**RESUMEN.** La investigación fitoquímica de las raíces de *Astragalus membranaceus* (Fisch.) Bge. Reveló la presencia de ocho flavonoides, incluyendo formononetina (**1**), formononetina-7-O- $\beta$ -D-glucósido (**2**), calycosina (**3**), calycosina-7-O- $\beta$ -D-glucósido (**4**), 3'-hidroxi-7,4'-dimethoxyisoflavona (**5**), 10'-hidroxi-3,9'-dimethoxypeterocarpano (**6**), 8,3'-dihidroxi-3,9'-dimethoxyisoflavona (**7**) y 2'-hidroxi-3',4'-dimethoxyisoflavan-7-O- $\beta$ -D-glucósido (**8**). Sus estructuras fueron identificadas mediante análisis espectroscópico. Se evaluó *in vitro* el efecto protector de los ocho compuestos sobre las células mesangiales glomerulares de rata. Los resultados mostraron que los compuestos obtenidos, especialmente formononetina (**1**) y calycosina (**3**), podrían mejorar la nefropatía diabética *in vitro* a través de anti-proliferación de las células mesangiales glomerulares y en la regulación de TGF- $\beta_1$ , CTGF, colágeno de tipo IV y fibronectina.

**KEY WORDS:** *Astragalus membranaceus* (Fisch.) Bge., diabetic nephropathy prevention, flavonoids,

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