

## **Astragalus membranaceus (Huangqi) exerts differential angiogenic properties under physiological and pathological conditions**

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Physiological angiogenesis requires strict regulation of angiogenic and angiostatic elements inside the body. In some diseased states, for example, cancer, atherosclerosis and retinopathies, this homeostasis is disturbed resulting in the abnormal formation of new blood vessels and thus worsening the conditions of patients. Under both atherosclerotic and cancer conditions, newly formed blood vessels exacerbate the diseases by providing nutrients to assist growth of plaque and tumor, respectively. Therefore, careful usage of traditional Chinese medicine (TCM) is gaining popularity worldwide due to its differential therapeutic effects in different diseases. *Astragalus membranaceus* (Huangqi) is a commonly used TCM and one of its bioactive components, saponins (AST), is able to downregulate proangiogenic proteins in gastric cancer cells [1]. Astragaloside IV (AS IV), a component of AST, possesses pro-angiogenic effect on endothelial cells [2]. Therefore, the present study aimed to investigate the effects of different bioactive components of Huangqi, namely AST, AS IV and the flavonoid calycosin, on the proliferation and angiogenic properties of endothelial and cancer cells. The effects of Huangqi components on cell proliferation were investigated using 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay. AST (0.1 lg/ml to 25 lg/ml), AS IV (0.5 lM to 100 lM) and calycosin (10 lM to 200 lM) did not affect the viability of human umbilical vein endothelial cells (HUVECs) compared with the control group (with no treatments). AS IV, at the same concentrations used for treating HUVECs, had no significant effects on the viability of HCT 116 colon cancer cells, while calycosin concentration-dependently impaired HCT 116 cell viability. In addition, tube formation assay and wound healing assay indicated that AST (25 lg/ml) and AS IV (100 lM) promoted tube formation and migration of HUVECs, respectively. In contrast, AS IV and calycosin concentration-dependently reduced the expressions of angiogenesis-related proteins matrix metalloproteinases (MMP)-9, MMP-2 and vascular endothelial growth factor (VEGF) in HCT 116 cells. These data suggest that bioactive components of Huangqi possess proangiogenic effect on HUVECs while it suppressed the proteins expressions of MMP-9, MMP-2 and VEGF in HCT 116 cells. Further investigation is required for examining the mechanisms underlying these differential effects.