Chemopreventive activities of spent hops (*Humulus lupulus* L.) extract against colorectal cancer

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Introduction and aim of the study

Colorectal cancer is one of the most frequent cancers occurring in the modern world with high annual mortality rates. The anti-cancer drugs used in the cancer treatment are expensive and their use is known to cause a range of side effects and complications. Therefore, chemopreventive agents inhibiting the development of colorectal cancer are subjects of many studies. The spent hops, prepared by the hops (*Humulus lupulus* L.) extraction by supercritical CO_2, are the source of polyphenols with high biological activity, including anti-cancer. The aim of the present study was to evaluate the effect of spent hops extract (SHE) on the invasion and migration of colorectal adenocarcinoma cells, as well as on the expression and activity of type IV collagenases, matrix mettaloproteinase-2 (MMP-2) and -9 (MMP-9).

Materials and methods

In experiments, we used two colorectal adenocarcinoma cell lines (SW-480 and HT-29). Epigallocatechin gallate (EGCG), one of polyphenol with proved anti-cancer activity, was used as a positive control. The Matrigel BM matrix assays were used to determine the impact of SHE on the cell invasion and migration. In turn, quantitative real time polymerase chain reaction (Q-PCR), enzyme-linked immunosorbent assay (ELISA), and zymography were performed to evaluate mRNA expression, protein expression and MMPs activity, respectively.

Results

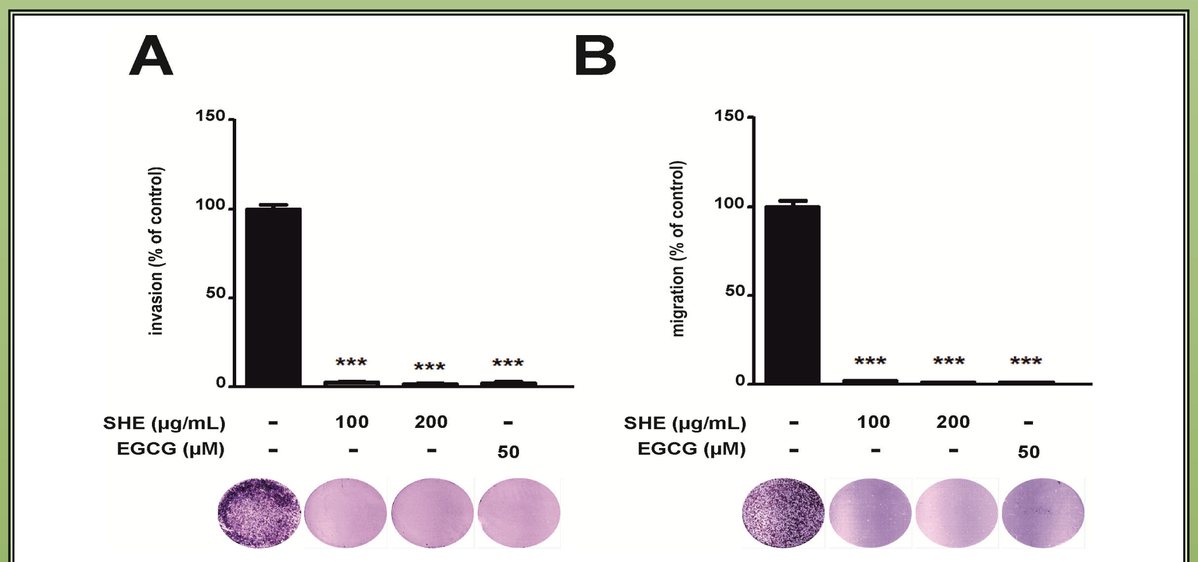

Figure 1. Effect of SHE on the SW-480 cell invasion and migration. The cell invasion (A) and migration (B) were determined after incubation in the insert of Matrigel BM with SHE for 48 hours. Each value represents the mean value ± SEM, n = 3 independent experiments (each experiment was carried out in triplicate).

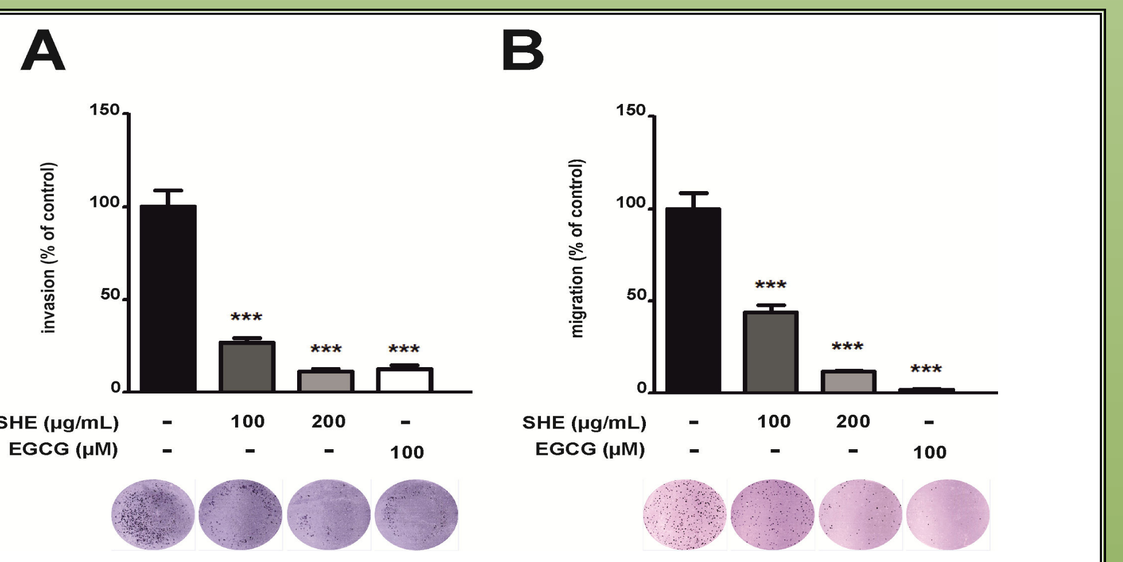

Figure 2. Effect of SHE on the HT-29 cell invasion and migration. The cell invasion (A) and migration (B) were determined after incubation in the insert of Matrigel BM with SHE for 96 hours. Each value represents the mean value ± SEM, n = 3 independent experiments (each experiment was carried out in triplicate).

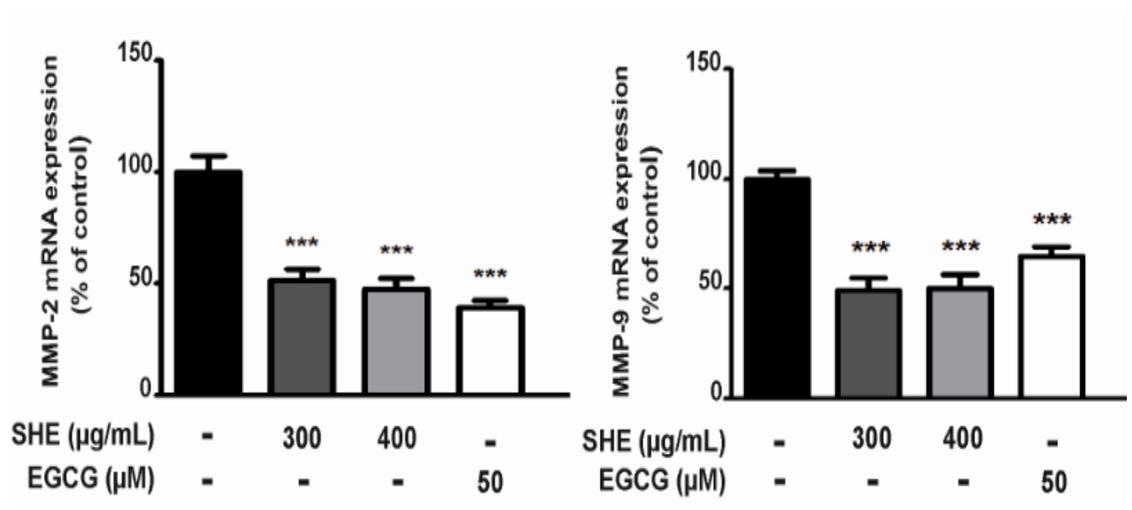

Figure 3. Effect of SHE on the mRNA expression of MMP-2 and MMP-9 in SW-480 cells determined by Q-PCR. Data represent the mean ± SEM of three independent experiments.

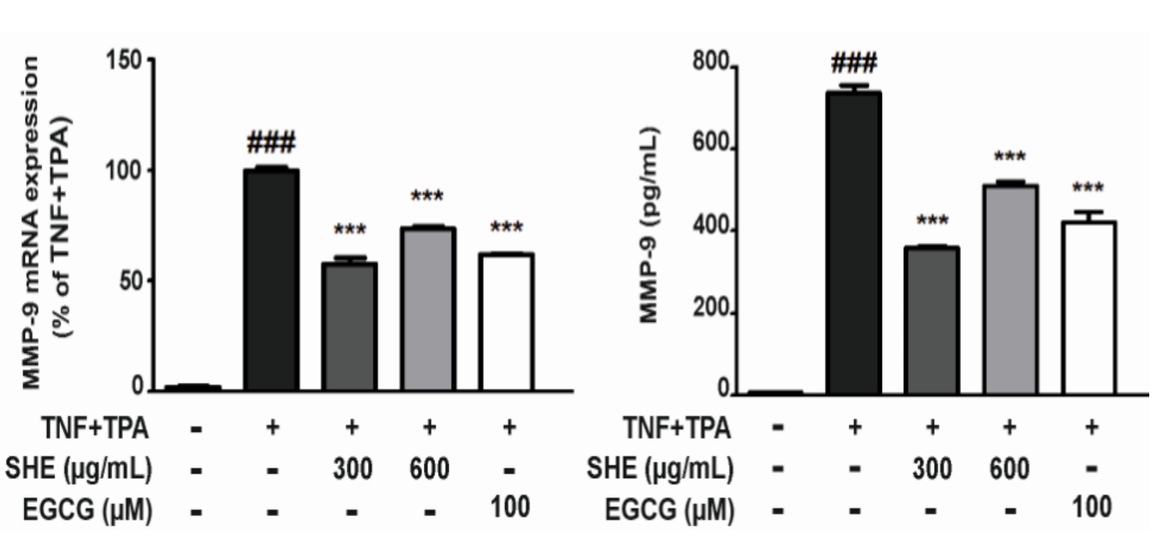

Figure 4. Effect of SHE on the TNF/TPA-stimulated mRNA and protein expression of MMP-9 in HT-29 cells determined by Q-PCR and ELISA. Data represent the mean ± SEM of three independent experiments.

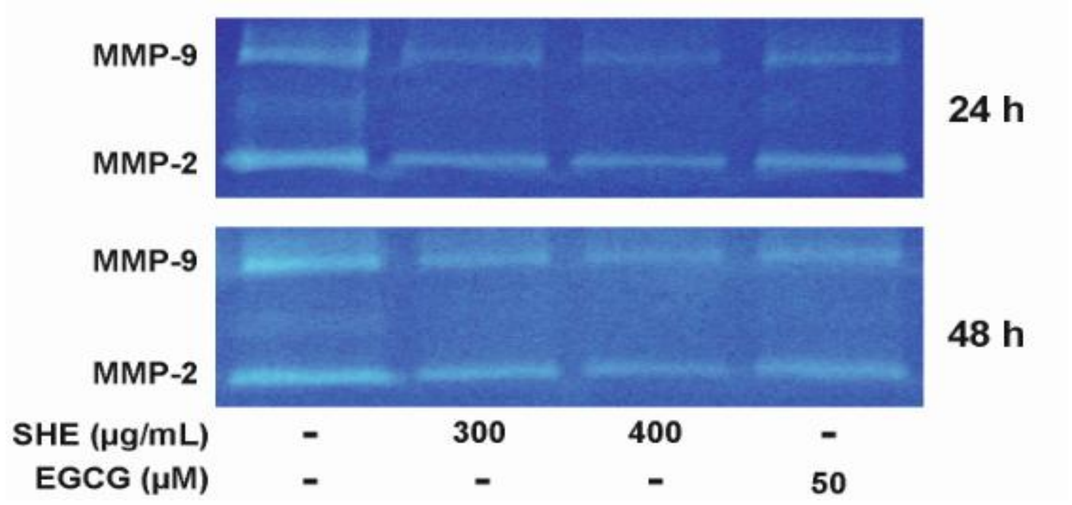

Figure 5. Effect of SHE on the activity of MMP-2 and MMP-9 in SW-480 cells determined by zymography after 24 and 48 hours.

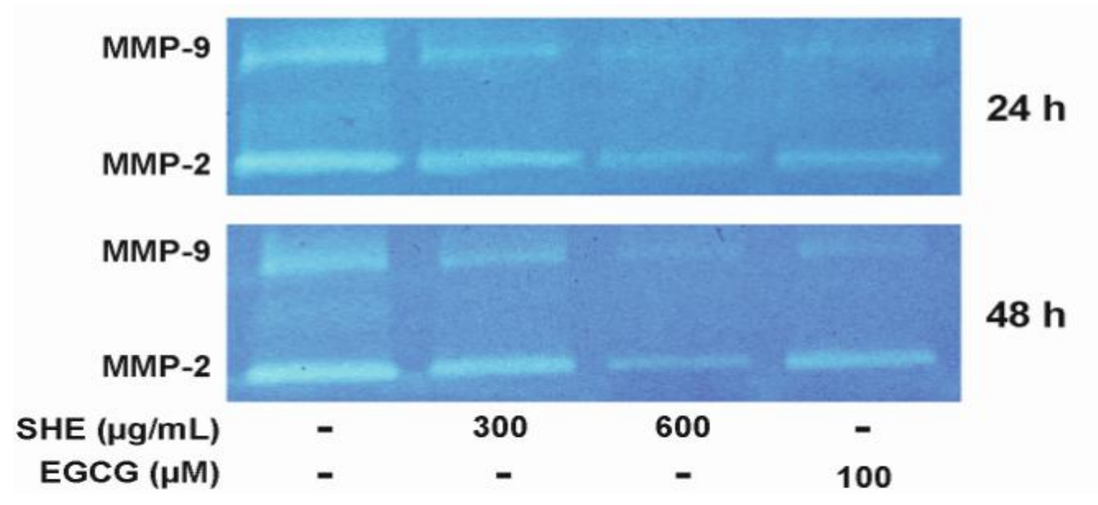

Figure 6. Effect of SHE on the activity of MMP-2 and MMP-9 in HT-29 cells determined by zymography after 24 and 48 hours.

Conclusions

Our data shows that SHE has anti-metastatic properties against colorectal cancer. The tested extract may be an effective chemopreventive agent acting *via* the inhibition of invasion and migration of colorectal cancer cells. In addition, we revealed a potential mechanism of the SHE activity.

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