



## Phytochemicals from Monty's Surprise apple are absorbed in humans, increase plasma antioxidant response, and inhibit lung and breast cancer proliferation *in vitro*

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Apples consumption is associated with improved health and reduced risk of cancer which is attributed to its phytochemical content<sup>(1)</sup>. Evidence suggests that apple phytochemicals affect different Hallmarks of cancer and reduce oxidative stress, which is involved in the pathology of cancer<sup>(2)</sup>. The limiting factor to obtain these effects in the human body is apple phytochemicals' low bioavailability. Our study is focused on a heritage apple cultivar discovered in New Zealand - Monty's Surprise. Based on our previous liquid chromatography–mass spectrometry (LC-MS) analysis this apple contains high phytochemical (mainly flavonoids) concentrations when compared to some other commercial apple cultivars available in New Zealand. This study aims to evaluate the bioavailability of Monty's Surprise apple phytochemicals in humans and Monty's Surprise phytochemicals' effects on blood total antioxidant capacity and lung, and breast cancer cell proliferation. Twelve healthy participants received either apple puree or a placebo as a control in a randomised crossover human study. Blood samples were collected after overnight fasting and at regular intervals up to eight hours post-meal consumption. The main phytochemical metabolites in the participant's plasma were evaluated by LC-MS-MS. Plasma total antioxidant capacity was evaluated by Ferric Reducing Antioxidant Power. Based on the results from the metabolomics analysis we then created a synthetic mixture of the Monty's Surprise apple phytochemical metabolites and evaluated their effects on cell proliferation using SYBR green assay *in vitro*. We were able to detect twenty-seven different phytochemical metabolites in the participant's plasma after consumption of Monty's Surprise apple puree. The main metabolites detected were metabolites of phenolic acids, and phase II metabolites, but also phloretin metabolites. Moreover, Monty's Surprise apple puree consumption significantly increased ( $p < 0.001$ ) plasma total antioxidant capacity 30 minutes post-meal intake (from the baseline to  $170.76 \mu\text{mol/L} \pm 34.58$ ), when compared to the placebo consumption. In addition, Monty's Surprise apple phytochemical metabolites inhibited lung and breast cancer cell proliferation at different concentrations. Results from this study demonstrated that Monty's Surprise apple phenolic compounds are absorbed and enter the systemic circulation after apple puree ingestion and their absorption improves plasma antioxidant status. Moreover, Monty's Surprise apple blood metabolites inhibit lung and breast cancer cell growth *in vitro*. These findings suggest that incorporating Monty's Surprise apple into the diet may improve human health and prevent cancer development.

**Keywords:** apple; phytochemicals; bioavailability; cancer

### Ethics Declaration

Yes

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### References

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2. Nezbedova L *et al.* (2021) *Nutrients* **13**, 4025.