

**PENENTUAN AKTIVITI ANTIOKSIDAN DAN ANTIKANSER DI DALAM
TEH SABAH SERTA POTENSINYA SEBAGAI MAKANAN TAMBAHAN
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AKTIVITI ANTIOKSIDAN DAN ANTIKANSER DI DALAM TEH SABAH DAN POTENSINYA SEBAGAI MAKANAN TAMBAHAN.

Peningkatan minat di kalangan pengguna dan kajian saintifik mengenai kebaikan teh terhadap kesihatan telah membuka lembaran terhadap kajian ekstrak teh sebagai salah satu cabang makanan tambahan. Oleh itu, bagi kajian ini, Teh Sabah dinilai untuk menentukan komposisi fungsian yang terdapat di dalam daun Teh Sabah untuk menentukan kebaikannya sebagai makanan tambahan. Oleh kerana itu, komposisi nutrien dan kimia, aktiviti antioksidan, sifat antikanser dan kesan toksikologi ditentukan dengan menggunakan pelbagai jenis analisis berdasarkan jenis rawatan dan tahap kematangan daun teh. Kandungan flavanol (EGC, catechin hydrate, EC, EGCG dan ECG) dalam daun Teh Sabah dikaji pada daun teh segar dan fermentasi pada tiga tahap kematangan iaitu daun muda, matang dan tua dengan menggunakan analisis HPLC. Didapati jenis rawatan (segar dan fermentasi) dan tahap kematangan daun mempunyai kesan yang signifikan terhadap kandungan flavanol. Daun segar mengandungi lebih flavanol berbanding yang difermentasi dan daun muda mengandungi yang terbanyak diikuti daun matang, dan tua. Flavanol yang tertinggi kandungannya adalah EGC diikuti ECG, catechin hydrate, EGCG dan akhirnya EC dalam semua kematangan dan jenis rawatan. Bagi aktiviti antikanser, teh hijau mempunyai kesan sitotoksik yang lebih tinggi dan kaedah pengekstrakan metanol adalah lebih baik berbanding air panas. Selain itu, terdapat kesan sitotoksik di dalam teh buangan dan kaedah pengekstrakan air panas dapat memberikan kesan sitotoksik yang lebih tinggi bagi jenis teh tersebut. Bagi aktiviti antioksidan, teh hitam dan kompos teh hitam dianalisis untuk jumlah polifenol, jumlah flavonoids dan kapasiti aktiviti antioksidan. Sampel diekstrak dengan menggunakan pelarut akues metanol dan air panas. Kapasiti aktiviti antioksidan ekstrak ditentukan dengan menggunakan kaedah perencatan radikal DPPH dan ABTS serta kaedah FRAP. Keputusan menunjukkan efisiensi peratus pengekstrakan adalah lebih tinggi dalam pelarut akues metanol berbanding dengan pelarut air panas. Kandungan polifenol dan flavonoid adalah lebih tinggi dalam teh hitam daripada kompos teh hitam manakala kaedah perencatan radikal ABTS dan DPPH, ekstrak teh air panas mempunyai peratus perencatan radikal yang tinggi berbanding dengan ekstrak teh akues metanol. Semua kaedah yang digunakan mendapati teh hitam mempunyai kapasiti antioksidan yang tinggi berbanding dengan kompos teh hitam. Kajian toksisiti subkronik ekstrak teh Sabah selama 28 hari telah dijalankan terhadap tikus *Sprague Dawley* jantan dan betina (umur; 13 dan 8 minggu). Tikus jantan dan betina masing-masing terdiri daripada empat kumpulan yang diberikan kepekatan dos yang berbeza iaitu 0 (kawalan), 1250, 2500, dan 5000 mg/kg b.b./hari. Sebanyak 2.7 dan 1.4 ml ekstrak teh Sabah masing-masing telah diberikan kepada tikus jantan dan betina secara suapan paksa. Tiada sebarang kematian dan petanda perubahan klinikal yang jelas dapat diperhatikan pada tikus sepanjang tempoh kajian kecuali pengurangan berat badan tikus jantan yang diberikan dos 5000 mg/kg b.b./hari. Peningkatan enzim alanin transferase dan kreatinin pada tikus betina tidak dikira sebagai kesan toksikologi kerana tiada sebarang perubahan pada berat hati dan buah pinggang relatif diperhatikan. Berdasarkan pemerhatian, kepekatan dos paling rendah yang menampakkan kesan sampingan (*lowest observed adverse effect level*, LOAEL) terhadap tikus jantan adalah 5000 mg/kg b.b./hari. Bagi tikus betina pula, kepekatan dos 5000 mg/kg b.b./hari adalah pada paras yang tidak menampakkan sebarang kesan sampingan terhadapnya (*no observed adverse effect level*, NOAEL).



ANTIOXIDANT AND ANTICANCER ACTIVITIES OF SABAH TEA AND ITS POTENTIAL AS FOOD SUPPLEMENT

Increasing scientific and consumer interest in the health benefits of tea has led to the inclusion of tea extracts in oral nutritional supplements. So that, in this study, Sabah Tea was evaluated to determine its functional composition in order to see its benefit as food supplement. Therefore, nutrient and chemical composition, antioxidant activity, anticancer properties and toxicology effect was determined by using multiple analyses based on treatment and maturity of the tea leaves. The flavanol content (EGC, catechin hydrate, EC, EGCG and ECG) of Sabah Tea leaves of two treatments (fresh and fermented) and three maturity levels (young, mature and old) were analyzed by HPLC analysis. It was found that treatment method (fermentation and fresh) and maturity has significant effect on the flavanol contents. Fresh tea leaves contain relatively more overall flavanol than fermented tea leaves and young tea leaves contain more overall flavanol followed by mature and finally old tea leaves. However, this is not the case for catechin hydrate, EC and EGCG, which are deemed most vulnerable to degradation due to external factors such as storage temperature and period, which effects the degradation. The highest flavanol detected is EGC, followed by ECG, catechin hydrate, EGCG and finally EC in both treatment and maturity. For anticancer activity, black tea and green tea have higher cytotoxicity compared to other types of tea. On the other hand, methanol extraction was significantly better than hot water extraction. Interestingly, tea waste has cytotoxicity effect which hot water extraction give a better IC_{50} value for this particular type of tea. For antioxidant activity, black tea and black tea compost was used for the analysis of total polyphenol, total flavonoid content, dan antioxidant activity capacity. Antioxidant capacity of the extract evaluated using percentage of scavenging effect of radical ABTS and DPPH. Ferric Reducing Antioxidant Power (FRAP) method also used to determine the reducing power of black tea and tea compost. The percentage of extraction efficiency shows that aqueous methanol has highest efficiency and significantly differ compared to hot water extraction. Total polyphenols of the samples ranges from 96 GAE mg/g to 143 GAE mg/g while Total flavonoid content ranges from 345.33 QE/g to 438.33 QE/g. The total polyphenols content in the black tea is higher than black tea compost. TEAC and DPPH assays shows that hot water extraction yielded highest radical scavenging than aqueous methanol extraction. All assay simplify that antioxidant activity of black tea is higher than black tea compost. On the other hand, a 28-day subchronic toxicity study of Sabah tea extract was done in male and female Sprague Dawley rats aged 13 and 8 weeks respectively. For both sex, there were four groups given a different dosages which are 0 (control), 1250, 2500 and 5000 mg/kg b.w./day. No mortality and obvious clinical sign were observed throughout the experiment period but body weights were reduced ($p < 0.05$) from week 1 to the end of the experiment in 5000 mg/kg b.w./day males. Although there were increased in alanine transferase and creatinine in 5000 mg/kg b.w./day females, these changes not considered as toxicological sign as no changes was observed in relative liver and kidney weights. The lowest observed adverse effect level (LOAEL) of Sabah tea extract on males was 5000 mg/kg b.w./day, and the no observed adverse effect level (NOAEL) of Sabah tea extract on female was 5000 mg/kg b.w./day.