Phytochemicals

*NPARR, 8(2), 2017-372* Use of potential dietary phytochemicals to target miRNA: Promising option for breast cancer prevention and treatment?

Breast cancer is one of the most common forms of cancers in females. Traditional therapies are associated with adverse side effects, and drug resistance, recurrence, and lack of treatment in metastasis are the major problems. Accumulating evidence indicates that dietary phytochemicals may exert therapeutic effects by regulating miRNA expression. A number of dietary phytochemicals have been tested as miRNA regulatory agents against breast cancer, and some other numbers of dietary phytochemicals have not yet been tested. Our aim is to introduce some of the potential dietary phytochemicals (benzyl isothiocyanate, capsaicin, epigallocatechin gallate, oleanolic acid, phenethyl isothiocyanate, and ursolic acid) that have shown miRNA regulatory activities, and have not yet been tested against breast cancer miRNAs. We also discuss the effects of curcumin, diallyl disulphide, 3,3′-diindolylmethane, ellagic acid, genistein, indole-3-carbinol, quercetin, resveratrol, and sulforaphane on regulation of expression of breast cancer miRNAs in various *in vitro* and *in vivo* models


*NPARR, 8(2), 2017-374* Phytochemicals accumulation and antioxidant activity in callus and suspension cultures of *Cynara scolymus* L.

The antioxidative phytochemicals in globe artichoke (*Cynara scolymus* L.) have received increasing attention for their health-promoting properties related to the high levels of caffeoylquinic acids and flavones in capitula and leaves. Since phytochemicals in plants vary in relation to both biotic and abiotic factors, we explored the possibility to use *in vitro*-derived materials as a source of antioxidant compounds. Two suspension cultures, anthocyanin-producing and not-producing cultures, and the sourced callus were evaluated in terms of their total polyphenol (TP) content and qualitative profile, total anthocyanin (TA) content and antioxidant activity (AA). TP and TA content were quantified by spectrophotometric assays, while the polyphenol profile was estimated by HPLC analysis. AA was evaluated by 2, 2-diphenyl-1-picrylhydrazyl (DPPH) and ferric reducing antioxidant power (FRAP) assays. Growth kinetics and polyphenol accumulation were investigated for 25 days in red suspension cultures. The latter accumulated a higher TP and TA content (25.7 and 2.61 g kg$^{-1}$ of DM, respectively) than calluses and green suspension cultures. During cell growth, the TA content in red suspension cultures ranged from...
1.43 to 2.41 g kg$^{-1}$ of DM. Optimum production of polyphenols was achieved on day 25 of culture; a positive correlation existed between TP and both DPPH ($r = 0.84$) and FRAP ($r = 0.85$). The 1,5-0-dicaffeoylquinic acid and cyanidin malonylglucoside (21.18 and 1.24 g kg$^{-1}$ of DM, respectively) were the primary compounds. The results of this investigation indicate that cell suspension of globe artichoke could represent a potential source of bioactive compounds with high antioxidant properties for industrial applications [Pandino, G., Meneghini, M., Tavazza, R.*, Lombardo, S. and Mauromicale, G (Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), Casaccia Research Center, Via Anguillarese 301, Rome, Italy) Plant Cell, Tissue and Organ Culture, 2017, 128(1), 223-230].

NPARR, 8(2), 2017-375 Phytochemical screening, phenolic and flavonoid contents, antioxidant and cytotoxic activities of Graftophyllum pictum (L.) Griff.

The phytochemical screening of the leaves of Graftophyllum pictum (L.) Griff. was carried out using the standard procedures which revealed the presence of flavonoids, steroids, tannins, coumarins, saponins, anthraquinones, phenolics and sugars. In vitro antioxidant activity, total phenolic and total flavonoid contents of four different fractions from the ethanolic leave extract of G. pictum (L.) Griff. were determined using spectrophotometric methods. The ethyl acetate fraction showed the highest total phenolic content (102.57 ± 0.19 mg gallic acid equivalent/g) and the hexane fraction contained the highest flavonoid (28.21 ± 0.04 mg quercetin equivalent/g). The ethyl acetate fraction also exhibited the highest antioxidant capacities in the DPPH radical scavenging assay with the IC$_{50}$ value of 0.78 ± 0.01 mg/mL and was found 69.19 ± 0.73 mg trolox equivalent capacity/g and 48.04 ± 0.49 mg ascorbic acid equivalent capacity/g when investigating by the ABTS radical scavenging assay. Moreover, the hexane, the ethyl acetate and the aqueous fractions exhibited significant cytotoxicity against MCF-7 cell lines with IC$_{50}$ values of 38.66, 26.01 and 20.41 µg/mL, respectively. All fractions were non-cytotoxic against Vero cells. The results of all experiments suggest that the leaves of G. pictum (L.) Griff. can be a natural candidate for rich source of antioxidants for further chemical investigation [Jiangseubchatveera, N., Liawruangrath, S., Teerawutgulrag, A., Santiarworn, D., Pyne, S.G. and Liawruangrath, B* (Department of Pharmaceutical Science, Faculty of Pharmacy, Chiang Mai University, Chiang Mai, Thailand) Chiang Mai Journal of Science, 2017, 44(1), 193-202].

NPARR, 8(2), 2017-376 Phytochemical investigation of Trichosanthes cucumerina Linn for analgesic activity

Trichosanthes cucumerina Linn is used as a traditional medicine for various diseases. In the present study was conducted to evaluate the analgesic activity for Petroleum ether and Methanol extract of Trichosanthes cucumerinalinn and the activity was compared with diclofenac sodium as a standard and assessed using acetic acid induced abdominal writhing in mice. The methanolic extract exhibited significant value (P<0.001) analgesic activity as evidenced by increased the percentage of reduction in reaction time. The results thus support the Trichosanthes cucumerina Linn used as an analgesic agent. The plant showed no sign of toxicity up to the dose of 100 mg/kg in mice [Fathima, M.Z., Shanmugarajan, T.S.*, Somasundharam, L., Anisha Ebens, J. and Neethu, T.T (Department of Pharmaceutics, School of Pharmaceutical Sciences, Vels University (VISTAS), Pallavaram, Tamilnadu, India) Research Journal of Pharmacy and Technology, 2017, 10(1), 177-182].
Introduction: Several species that belong to the genus *Astragalus* have been used in Palestinian folk medicine to treat various infectious and non-infectious diseases. This study aimed to assess the phytochemical and biological activities of four *Astragalus* species growing wild in Jerusalem. Methods: Phytochemical screening, estimation of total phenols, flavonoids and tannin contents, as well as antimicrobial and antioxidant activities were investigated for *Astragalus aleppicus*, *Astragalus angustifolius*, *Astragalus annularis*, and *Astragalus boeticus*. Phytochemical screening, evaluation of total phenols, flavonoids, tannins contents as well as antioxidant properties were investigated by using standard phytochemical methods. Detection of antimicrobial activities for both the aqueous and the methanolic extracts were performed using the broth micro-dilution method. The antimicrobial activities were examined against *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa* American Type Culture Collection reference strains, as well as against Methicillin Resistant *Staphylococcus aureus* and *Candida albicans* clinical isolates. Results: A mixture of phytochemical compounds was found in the extracts of all tested *Astragalus* species. *A. boeticus* was found to contain high levels of total phenols, flavonoids and tannins contents as well as antioxidant properties were investigated by using standard phytochemical methods. Detection of antimicrobial activities for both the aqueous and the methanolic extracts were performed using the broth micro-dilution method. The antimicrobial activities were examined against *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa* American Type Culture Collection reference strains, as well as against Methicillin Resistant *Staphylococcus aureus* and *Candida albicans* clinical isolates. Results: A mixture of phytochemical compounds was found in the extracts of all tested Astragalus species. A. boeticus was found to contain high levels of total phenols, flavonoids and tannins with remarkable potential of antioxidant and antimicrobial activities. The current study provides initial data that justify the use and importance of Astragalus species in Palestinian folkloric medicine. Conclusion: Our results showed that *A. boeticus* was superior to the other 3 species in all the conducted tests. In fact, it had the highest polyphenolic content. In addition, its aqueous extract showed the highest antibacterial activity, while the methanolic extract showed the highest antifungal and antioxidant activities. Further studies are needed to identify and characterize these constituents [Jaradat, N.A*, Zaid, A.N., Abuzant, A., Khalf, S. and Abu-Hassan, N (Department of Pharmacy, Faculty of Medicine and Health Sciences, An-Najah National University, P.O. Box 7, Nablus, Palestine) *European Journal of Integrative Medicine*, 2017, 9, 1-8].

**NPARR, 8(2), 2017-378 Phytochemical and biological investigations of Amaryllidaceae alkaloids: A review**

Amaryllidaceae is a family that includes 75 genera and about 1100 species, which have a long history of medicinal use. Many plants have been proven to possess efficacy for neurological injury and inflammatory conditions. This article summarizes 357 Amaryllidaceae alkaloids, and cites 166 174 references over the last three decades. These alkaloids are classified into 14 skeleton types, and their abundant sources are also included. Modern pharmacology studies demonstrate that alkaloids that exclusively occur in Amaryllidaceae plant possess wide-ranging pharmacological actions, especially effects on the central nervous system, as well as antitumor, antimicrobial, and anti-inflammatory activities. Effective monomeric compounds from Amaryllidaceae screened for pharmacological activity *in vivo* and *in vitro* are also summarized [Ding, Y*, Qu, D., Zhang, K.-M., Cang, X.-X., Kou, Z.-N., Xiao, W. and Zhu, J.-B (School of Food Science and Technology, Dalian Polytechnic University, Dalian, China) *Journal of Asian Natural Products Research*, 2017, 19(1), 53-100].

**NPARR, 8(2), 2017-379 Phytochemical investigations of three Rhodocodon (Hyacinthaceae sensu APG II) species**

The genus Rhodocodon (*Hyacinthaceae sensu APG II*) is endemic to Madagascar, and its phytochemistry has not been described previously. The phytochemistry of three species in this genus has been investigated, and eight
compounds, including three bufadienolides (compounds 1, 4, and 5), a norlignan (2), and four homoisoflavonoids (compounds 3 and 6-8), have been isolated and identified. Compounds 1-3 and 6-8 have not been described previously. The COX-2 inhibitory activity of compound 6 and compound 7 acetate (compound 7A) was investigated on isolated colorectal cancer cells. Compounds 6 and 7A inhibited COX-2 by 10% and 8%, respectively, at a concentration of 12.5 μM compared to 12% for 1 mM aspirin (the positive control). (Chemical Equation Presented) [Schwikkard, S.*, Alqahtani, A., Knirsch, W., Wetschnig, W., Jaksevicius, A., Opara, E.I., Langat, M.K., Andriantiana, J.L. and Mulholland, D.A (Natural Products Research Group, Department of Chemistry, Faculty of Engineering and Physical Sciences, University of Surrey, Guildford, United Kingdom) Journal of Natural Products, 2017, 80(1), 30-37].

NPARR, 8(2), 2017-380 Impacts of dietary phytochemicals in the presence and absence of pesticides on longevity of honey bees (Apis mellifera)

Because certain flavonols and phenolic acids are found in pollen and nectar of most angiosperms, they are routinely ingested by Apis mellifera, the western honey bee. The flavonol quercetin and the phenolic acid p-coumaric acid are known to upregulate detoxification enzymes in adult bees; their presence or absence in the diet may thus affect the toxicity of ingested pesticides. We conducted a series of longevity assays with one-day-old adult workers to test if dietary phytochemicals enhance longevity and pesticide tolerance. One-day-old bees were maintained on sugar syrup with or without casein (a phytochemical-free protein source) in the presence or absence of quercetin and p-coumaric acid as well as in the presence or absence of two pyrethroid insecticides, bifenthrin and β-cyfluthrin. Dietary quercetin (hazard ratio, HR = 0.82), p-coumaric acid (HR = 0.91) and casein (HR = 0.74) were associated with extended lifespan and the two pyrethroid insecticides, 4 ppm bifenthrin (HR = 9.17) and 0.5 ppm (β-cyfluthrin (HR = 1.34), reduced lifespan. Dietary quercetin enhanced tolerance of both pyrethroids; p-coumaric acid had a similar effect trend, although of reduced magnitude. Casein in the diet appears to eliminate the life-prolonging effect of p-coumaric acid in the absence of quercetin. Collectively, these assays demonstrate that dietary phytochemicals influence honey bee longevity and pesticide stress; substituting sugar syrups for honey or yeast/soy flour patties may thus have hitherto unrecognized impacts on adult bee health [Liao, L.-H.*, Wu, W.-Y. and Berenbaum, M.R* (Department of Entomology, University of Illinois at Urbana-Champaign, 505 S. Goodwin, Urbana, IL, United States) Insects, 2017, 8(1), 22].

NPARR, 8(2), 2017-381 Phytochemical profiles and biological activities of Curcuma species subjected to different drying methods and solvent systems: NMR-based metabolomics approach

Curcuma species (Zingiberaceae) have been used in traditional medicine in India and Southeast Asia to treat many human ailments and are believed to possess many biological activities. In this study, four Curcuma species (C. zedoaria, C. xanthorrhiza, C. aeruginosa and C. mangga) were compared in terms of their total phenolic contents (TPC), and bioactivities including free radical scavenging, α-glucosidase and nitric oxide (NO) inhibition. Their phytochemical constituents were also determined by a proton nuclear magnetic resonance (1H NMR) based metabolomics approach. The species were dried using three drying methods (air, freeze and oven) and extracted with two ethanol ratios (50 and 100%). The correlations between TPC and bioactivities, with phytochemical constituents were obtained using partial least square (PLS) regression. The results showed that C. xanthorrhiza had the highest TPC, antioxidant and NO inhibitory activities, whereas C. mangga
showed the highest α-glucosidase inhibitory activity. Notable and clear separations among the four species and the three drying methods for *C. xanthorrhiza* and *C. mangga* were revealed by principal component analysis (PCA). The PCA scores plot showed close relationship between *C. xanthorrhiza* and *C. mangga*, and were separated from *C. zedoaria* and *C. aeruginosa*. The PLS model indicated that curcumin, xanthorrhizol, 1-(4-hydroxy-3,5-dimethoxyphenyl)-7-(4-hydroxy-3-methoxyphenyl)-(IE,6E)-1,6-heptadiene-3,4-dione and demethoxycurcumin were significantly correlated with the higher antioxidant and NO inhibitory activities as demonstrated by *C. xanthorrhiza*. Meanwhile, zerumin B, dehydrocurdione, (E)-labda-8(17),12-diene-15,16-dial, calcaratins A and curcuzederone were present in *C. mangga* contributed to the α-glucosidase inhibitory activity. The freeze dried samples of all the absolute ethanol extracts of Curcuma species exhibited significant bioactivities with the highest contents of metabolites [Awin, T., Mediani, A., Maulidiani, Shaari, K., Faudzi, S.M.M., Sukari, M.A.H., Lajis, N.H. and Abas, F* (Laboratory of Natural Products, Institute of Bioscience, Universiti Putra Malaysia, Serdang, Selangor, Malaysia) *Industrial Crops and Products*, 2016, 94, 342-352].

*NPARR*, 8(2), 2017-382 **Phytochemical constituents and radical scavenging properties of *Borago officinalis* and *Malva sylvestris***

In order to find possible sources for future novel antioxidants in food and pharmaceutical formulations, phytochemical constituents and antioxidant activities of methanol extract polar and nonpolar subfractions of Borage (*Borago officinalis*) and Common mallow (*Malva sylvestris*) were determined. Identification of two alkaloids (Sanguinarine and Berberine) and water-soluble vitamins in HPLC chromatograms have been settled in comparison of the retention time and peak area with those observed for authentic standards. Antioxidant activities were evaluated by 2,2-Diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging (FRS), ferrous ion (Fe^{2+}) metal chelating and ferric ion (Fe^{3+}) reducing power (FRAP). Hydrogen peroxide was also disposed by catalases (CAT) and peroxidase (POX) activities. The total content of tannins, flavonoids, phenolic acids and polyphenols have been expressed as tannic acid (TA), (+)-catechin (CE), gallic acid (GAE) and pyrogallol (PyE), respectively. In addition, *M. sylvestris* exhibited stronger ferrous ion chelating and peroxidase activity compared with *B. officinalis*. A relatively high concentration of vitamin C was also recorded in *M. sylvestris* with 38.01 mg/100 g DW. The findings suggest that the pigments derived from natural plants may have direct relation with biological activities and exhibit different properties. Also all other soluble compounds present in the extracts, their possible antioxidant activity and interactions need to be elucidated in order to fully explain the final antioxidant capacity of the extracts [Mohajer, S*., Taha, R.M., Ramli, R.B. and Mohajer, M (Institute of Biological Sciences, Faculty of Science, University of Malaya, Kuala Lumpur, Malaysia) *Industrial Crops and Products*, 2016, 94, 673-681].

*NPARR*, 8(2), 2017-383 **Key phytochemicals contributing to the bitter off-taste of oat (*Avena sativa* L.)**

Sensory-directed fractionation of extracts prepared from oat flour (*Avena sativa* L.) followed by LC-TOF-MS, LC-MS/MS, and 1D/2D-NMR experiments revealed avenanthramides and saponins as the key phytochemicals contributing to the typical astringent and bitter off-taste of oat. Besides avenacosides A and B, two previously unreported bitter-tasting bidesmosidic saponins were identified, namely, 3-(O-α-l-rhamnopyranosyl (1→2)-β-d-glucopyranosyl (1→3)-β-d-glucopyranosyl,(1→4))-β-d-glucopyranosid-26-O-[β-d-glucopyranosyl-(25R)-furost-5-ene-3β,22,26-triol, and 3-(O-α-l-rhamnopyranosyl (1→2)-[β-d-glucopyranosyl(1→4)]-β-d-glucopy-
ranosid)-26-O-β-d-glucopyranosyl-(25R)-furost-5-ene-3β,22,26-triol. Depending on the chemical structure of the saponins and avenanthramides, sensory studies revealed human orosensory recognition thresholds of these phytochemicals to range between 3 and 170 μmol/L [Günther-Jordanland, K., Dawid, C.a., Dietz, M. and Hofmann, T* (Department of Food Chemistry and Molecular Sensory Science, Technische Universität München, Lise-Meitner-Straße 34, Freising, Germany) Journal of Agricultural and Food Chemistry, 2016, 64(51), 9639-9652].

NPARR, 8(2), 2017-384 Dietary phytochemicals and cancer chemoprevention: A perspective on oxidative stress, inflammation, and epigenetics

Oxidative stress occurs when cellular reactive oxygen species levels exceed the self-antioxidant capacity of the body. Oxidative stress induces many pathological changes, including inflammation and cancer. Chronic inflammation is believed to be strongly associated with the major stages of carcinogenesis. The nuclear factor erythroid 2-related factor 2 (Nrf2) pathway plays a crucial role in regulating oxidative stress and inflammation by manipulating key antioxidant and detoxification enzyme genes via the antioxidant response element. Many dietary phytochemicals with cancer chemopreventive properties, such as polyphenols, isothiocyanates, and triterpenoids, exert antioxidant and anti-inflammatory functions by activating the Nrf2 pathway. Furthermore, epigenetic changes, including DNA methylation, histone post-translational modifications, and miRNA-mediated post-transcriptional alterations, also lead to various carcinogenesis processes by suppressing cancer repressor gene transcription. Using epigenetic research tools, including next-generation sequencing technologies, many dietary phytochemicals are shown to modify and reverse aberrant epigenetic/epigenome changes, potentially leading to cancer prevention/treatment. Thus, the beneficial effects of dietary phytochemicals on cancer development warrant further investigation to provide additional impetus for clinical translational studies [Li, W., Guo, Y., Zhang, C., Wu, R., Yang, A.Y., Gaspar, J. and Kong, A.-N.T (Center for Cancer Prevention Research, Ernest Mario School of Pharmacy, Rutgers, State University of New Jersey, Piscataway, NJ, United States) Chemical Research in Toxicology, 2016, 29(12), 2071-2095].

NPARR, 8(2), 2017-385 Phytochemical pharmacokinetics and bioactivity of oat and barley flour: A randomized crossover trial

While dietary fiber plays an important role in the health benefits associated with whole grain consumption, other ingredients concentrated in the outer bran layer, including alkylresorcinols, lignans, phenolic acids, phytosterols, and tocols, may also contribute to these outcomes. To determine the acute bioavailability and pharmacokinetics of the major phytochemicals found in barley and oats, we conducted a randomized, three-way crossover trial in 13 healthy subjects, aged 40–70 years with a body mass index (BMI) of 27–35.9 kg/m². After a two-day run-in period following a diet low in phytochemicals, subjects were randomized to receive muffins made with either 48 g whole oat flour, whole barley flour, or refined wheat flour plus cellulose (control), with a one-week washout period between each intervention. At the same time, an oral glucose tolerance test was administered. In addition to plasma phytochemical concentrations, glucose and insulin responses, biomarkers of antioxidant activity, lipid peroxidation, inflammation, and vascular remodeling were determined over a 24-h period. There was no significant effect on acute bioavailability or pharmacokinetics of major phytochemicals. Administered concurrently with a glucose bolus, the source of whole grains did not attenuate the post-prandial response of markers of glucoregulation and insulin sensitivity, inflammation, nor did vascular remodeling compare to the refined grain control. No significant differences were observed in the bioavailability or postprandial effects between
whole-oat and whole-barley compared to a refined wheat control when administered with a glucose challenge. These null results may be due, in part, to the inclusion criteria for the subjects, dose of the whole grains, and concurrent acute administration of the whole grains with the glucose bolus [Sawicki, C.M.*, McKay, D.L., McKeown, N.M., Dallal, G., Chen, C.-Y.O. and Blumberg, J.B (Nutritional Epidemiology, Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts University, Boston, MA, United States) *Nutrients, 2016, 8(12), 813].

NPARR, 8(2), 2017-386 Phytochemical profiling of Turbinaria ornata and its antioxidant and anti-proliferative effects

Objectives: To analyse the phytochemicals and evaluate the antioxidant and anti-proliferative ability of Turbinaria ornata (Turner) J. Agardh, 1848. Methods: A phytochemical analysis of the T. ornata-hexane extract (To-HE) and T. ornata-aqueous extract (To-AE) was performed. T. ornata extracts were analysed by gas chromatography-mass spectrometry (GC-MS), Fourier transform infrared spectroscopy (FTIR) and high-performance liquid chromatography (HPLC). The antioxidant properties of To-HE and To-AE were determined by 2,2-diphenyl-1-picrylhydrazyl radical scavenging (DPPH) and ferric ion reducing power (FRAP) assays. In addition, the in vitro anti-proliferative properties of To-HE and To-AE were assessed in kidney epithelial cells from the African green monkey (Vero) and in adenocarcinomic human alveolar basal epithelial cells (A549) using the MTT (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide, a yellow tetrazole) assay. Results: The phytochemical screening of T. ornata revealed the presence of saponin, alkaloids, amino acids, fixed oil and fat and phenolic compounds (tannins, flavonoids and total phenol). A higher antioxidant ability was found in To-HE than in To-AE. The anti-proliferative efficacy values (μg/mL) of To-HE and To-AE for A549 and Vero cells were 62.91 and 93.00 and 72.64 and 106.6, respectively. The FTIR analysis revealed the presence of functional groups such as alcohols, amides, aromatics, amines, alkyl halides, alkynes, alkanes and carboxylic acids. The GC-MS analysis of To-HE revealed the presence of 13 active compounds. Conclusion: Owing to its recorded anti-proliferative effect, further pharmaceutical studies on the development of this anticancer drug are merited [Deepak, P., Sowmiya, R., Balasubramani, G. and Perumal, P (Department of Biotechnology, School of Biosciences, Periyar University, Salem, India) *Journal of Taibah University Medical Sciences, 2017, doi.org/10.1016/j.jtu.2017.02.002].

NPARR, 8(2), 2017-387 Phytochemical and ethnomedicinal study of Huperzia species used in the traditional medicine of Saraguros in Southern Ecuador; AChE and MAO inhibitory activity

Ethnobotanical and ethnomedicinal relevance This study concerns seven Huperzia species (Lycopodiaceae), namely H. brevifolia, H. columnaris, H. compacta, H. crassa, H. espinosana, H. tetragona, H. weberbaueri, which are considered sacred plants by the Saraguro community, living in the Southern Andes of Ecuador; these plants are widely used in traditional medicine and ritual ceremonies. Material and methods: The plants were selected on the basis of written interviews with 10 visionary healers (yachak) (2 women, 8 men), indicated as the most credible by the Saraguro Healers Council. The Informant Consensus Factor (Fic) was determined. The first phytochemical study of the plants was performed by standard procedures, while the AChE and MAO-A inhibition by fractions enriched in high MW alkaloids, was measured in vitro. Aims of the study: i) to investigate the uses of some Huperzia plants in healing and magical-religious practices of Saraguros; ii) to identify the main components of plant hydromethanolic extracts; iii) to test the effects of alkaloidal fractions on the activity of...
two enzymes linked to mental health. Results: All the interviewed Saraguro yachak showed a high consensus about the uses of the seven *Huperzia* plants as purgatives and against supernatural diseases, such as the “espanto” (startle). In admixtures with other plants, some species also induce a state of trance or hallucinations in participants in magical-religious rituals. GC–MS of the volatile alkaloid fractions allowed the identification of some lycodine-type and lycopodine-type alkaloids (1-5) in *H. compacta*, *H. columnaris*, and *H. tetragona*. The flavones selgin (6) and tricin (7) were isolated from *H. brevifolia* and *H. espinosana*. Tricin (7) was also detected in the other five species. The rare serratene triterpenes serratenediol (8) serratenediol-3-O-acetate (9), 21-episserratenediol (10), and 21-episserratenediol-3-O-acetate (11) were isolated from *H. crassa*. In addition, the presence of an unprecedented group of high molecular weight alkaloids has been determined. Alkaloid fractions of *H. brevifolia*, *H. compacta*, *H. espinosana*, and *H. tetragona* significantly inhibited AChE and MAO-A activities in vitro. Conclusions: The first phytochemical and ethnopharmacological study of seven *Huperzia* plants, widely used by Saraguro healers, led to the identification of several alkaloids and triterpenoids with different remarkable biological activities. In addition, alkaloid fractions exhibited a significant AChE and MAO-A inhibitory activity. These results may support the use of these plants in brews prepared for inducing psychoactive effects in participants in magical-religious ceremonies. This study confirms the rich traditional medical knowledge of Saraguro healers which must be documented and preserved for future generations [Armijos, C*., Gilardoni, G., Amay, L., Lozano, A., Bracco, F., Ramirez, J., Bec, N., Larroque, C., Finzi, P.V. and Vidari, G (Universidad Técnica Particular de Loja, Departamento de Química, San Cayetano Alto, s/n. AP, Loja, Ecuador) *Journal of Ethnopharmacology*, 2016, 193, 546-554].

**Phytochemicals and overall quality of leafy Lettuce (Lactuca sativa L.) varieties grown in closed hydroponic system**

Lettuce (*Lactuca sativa L.*) is a popular salad vegetable and consumption of lettuce has many health benefits. The objective of this study was to select lettuce varieties grown in a closed hydroponic system based on their morphological parameters, phytochemical and mineral content for mixed fresh cut salads or as whole product. Principal component analysis illustrated three separate groups based on the bioactive compounds, color values and fresh leaf mass for the 16 lettuce varieties. Group 1; Multired 4 contained the highest concentrations of total phenols, flavonoids (isohamnetin, quercetin, kaempferol, epicatechin, mycertin, anthocyanin), β-carotene, ascorbic acid and higher antioxidant property and lower leaf fresh mass. Group 2; included the green lettuce varieties (Multigreen 3 and Multigreen 1) and the red varieties (Cantarix, Lunix, Soltero, Veneza Roxa, Feska) revealed moderately higher in bioactive compounds and fresh leaf mass. Group 3 contained the green lettuce varieties (Smile, Palmir, Hardy, Nasir, Monary, Atlantis and Vera Green Frilly) and showed lower bioactive compounds with leaf higher fresh mass. Red lettuce varieties are rich in bioactive compounds and antioxidant property mainly due to higher total phenols and flavonoid compounds. Multired 4 (red), Multigreen 3 (green) and Multigreen 1 (green) and other red lettuce varieties can be recommended for mixed lettuce salads or as whole product. Practical Applications: Lettuce consumption is determined by color, size, texture, taste and nutritional properties. Choice of lettuce varieties is important for lettuce mixed fresh cuts or as a whole product. Therefore, it is important to profile the phytochemical composition in different lettuce varieties to improve the antioxidant and nutrient intake in the diet [Mampholo, B.M., Maboko, M.M., Soundy, P. and Sivakumar, D*.
Moringa oleifera Lam., also known as the ‘drumstick tree,’ is recognized as a vibrant and affordable source of phytochemicals, having potential applications in medicines, functional food preparations, water purification, and biodiesel production. The multiple biological activities including antiproliferation, hepatoprotective, anti-inflammatory, antiinociceptive, antiatherosclerotic, oxidative DNA damage protective, antiperoxidative, cardioprotective, as well as folk medicinal uses of M. oleifera (MO) are attributed to the presence of functional bioactive compounds, such as phenolic acids, flavonoids, alkaloids, phytosterols, natural sugars, vitamins, minerals, and organic acids. The low molecular weight of M. oleifera cationic proteins (MOCP) extracted from the seeds is very useful and is used in water purification, because of its potent antimicrobial and coagulant properties. Also, the M. oleifera methyl esters (MOME) produced from the oil of the seeds meet the major specifications of the biodiesel standard of Germany, Europe, and United States (US). Thus, MO is emerging as one of the prominent industrial crops for sustainable biodiesel production in tropical and subtropical countries. Viewed in the high nutritional, nutraceutical, and industrial values, it is important to compile an updated comprehensive review on the related aspects of this multipurpose and miracle tree. Hence, the present study is focused on the nutritionally significant bioactives and medicinal and biological properties, to explore the potential applications of MO in nutritionally rich food preparations. Furthermore, water coagulation, proteins, and fatty acid methyl esters from the MO seeds are reviewed, to explore their possible industrial applications in biodiesel production and water purification. In addition, the future perspectives in these areas are suggested [Saini, R.K., Sivanesan, I. and Keum, Y.-S* (Department of Bioresources and Food Science, College of Life and Environmental Sciences, Konkuk University, Seoul, South Korea) J Biotech, 2016, 6(2), 203].

NPARR, 8(2), 2017-390 Phytochemical overview and medicinal importance of Coffea species from the past until now

Coffea (coffee) species are grown in almost all countries along the Equator. Many members of the genus have a large production history and an important role both in the global market and researches. Seeds (Coffeae semen) are successfully used in food, cosmetic, and pharmaceutical industries due to its caffeine and high polyphenol content. Nowadays, the three best-known coffee species are Arabic (Coffea arabica L.), Robusta (Coffea robusta L. Linden), and Liberian coffees (Coffea liberica Hiern.). Even though, many records are available on coffee in scientific literature, wild coffee species like Bengal coffee (Coffea benghalensis Roxb. Ex Schult.) could offer many new opportunities and challenges for phytochemical and medical studies. In this comprehensive summary, we focused on the ethnomedicinal, phytochemical, and medical significance of coffee species up to the present [Patay, É.B*, Bencsik, T. and Papp, N (Department of Pharmacognosy, Faculty of Pharmacy, University of Pécs, Rókus 2, Pécs, Hungary) Asian Pacific Journal of Tropical Medicine, 2016, 9(12), 1127-1135].

NPARR, 8(2), 2017-391 Phytochemical profiles of marine phytoplanktons: An evaluation of their: In vitro antioxidant and anti-proliferative activities

Marine microorganisms such as phytoplanktons are a rich resource of bioactive components with antioxidant and anti-proliferative activities that can act as novel functional food
ingredients. In this study, the pigment profiles, total mycosporine-like amino acids (MAAs) and total phenolic contents (TPCs) in solvent extracts including 90% acetone and methanol from five marine phytoplanktons including *Nitzschia closterium* (Bacillariophyta), *Isochrysis zhangjiangensis* (Haptophyta), *Platymonas subcordiformis* (Chlorophyta), *Porphyridium cruentum* (Rhodophyta) and *Synechocystis pevalekii* (Cyanobacteria) were analyzed. Each phytoplankton from different phyla had its unique compositions of carotenoids and chlorophylls. The 90% acetone extract from *I. zhangjiangensis* had the highest MAA content (508.30 μg per g DW) while the methanol extract from *N. closterium* had the highest level of TPCs (6.15 mg GAE per g DW) among all the phytoplanktons investigated. The amounts of total carotenoids in all the 90% acetone extracts from the five phytoplanktons as well as total MAAs in those from within the four microalgae except *S. pevalekii* were found to be strongly correlated with their antioxidant activities evaluated by the DPPH, TEAC and FRAP assays. Only the level of total carotenoids in the phytoplanktons was correlated with their anti-proliferative activities assessed by the MTT assays using MCF-7 cells. Therefore, individual carotenoid pigments seemed to be mainly responsible for the antioxidant and anti-proliferative (or anticancer) activities found in the solvent extracts of the five phytoplanktons. Hence these phytoplanktons have the potential as novel sources of natural food antioxidants and anticancer agents to be used as active ingredients in functional food products [Huang, J.J.-H., Xu, W.-W., Lin, S.-L. and Cheung, P.C.-K* (Food and Nutritional Sciences Programme, School of Life Sciences, Chinese University of Hong Kong, Shatin, Hong Kong) *Food and Function*, 2016, 7(12), 5002-5017].