Fresh ginger (Zingiber officinale) has anti-viral activity against human respiratory syncytial virus in human respiratory tract cell lines.

Ginger, *Zingiber officinale* Roscoe, is a common spice and also a widely used medicinal plant in ancient China. Ginger is an ingredient of Ge-Gen-Tang (Kakkon-to; GGT). GGT has been proved to have antiviral activity against human respiratory syncytial virus (HRSV). However, it is unknown whether ginger is effective against HRSV. To find a readily available agent to manage HRSV infection, the authors tested the hypothesis that ginger can effectively decrease HRSV-induced plaque formation in respiratory mucosal cell lines. Effect of hot water extracts of fresh and dried gingers on HRSV was tested by plaque reduction assay in both human upper (HEp-2) and low (A549) respiratory tract cell lines. Ability of ginger to stimulate anti-viral cytokines was evaluated by enzyme-linked immunosorbent assay (ELISA). Fresh ginger dose-dependently inhibited HRSV-induced plaque formation in both HEp-2 and A549 cell lines (P<0.0001). In contrast, dried ginger didn’t show any dose-dependent inhibition. 300 µg/ml fresh ginger could decrease the plaque counts to 19.7% (A549) and 27.0% (HEp-2) of that of the control group. Fresh ginger was more effective when given before viral inoculation (P<0.0001), particularly on A549 cells. 300 µg/ml fresh ginger could decrease the plaque formation to 12.9% when given before viral inoculation. Fresh ginger dose-dependently inhibited viral attachment (P<0.0001) and internalization (P<0.0001). Fresh ginger of high concentration could stimulate mucosal cells to secrete IFN-β that possibly contributed to counteracting viral infection. Fresh, but not dried, ginger is effective against HRSV-induced plaque formation on airway epithelium by blocking viral attachment and internalization [Chang, J.S.*, Wang, K.C., Yeh, C.F., Shieh, D.E. and Chiang, L.C. (Department of Renal Care, College of Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan). *Journal of Ethnopharmacology*, 2013, **145**(1), 146-151].

Preparation and storage stability of flaxseed chutney powder, a functional food adjunct

Flax (*Linum usitatissimum* L.) chutney powder (FSCP), a palatable functional food adjunct was prepared by mixing roasted and powdered flaxseeds with other selected spice ingredients. The protein content of these powders was 24.2% and 23.4% in flaxseed powder (FSP) and FSCP respectively. Total polyphenol content of FSP and FSCP was 439 and 522 mg/100 g respectively. The free fatty acid content of FSCP increased from 0.38 to 1.03 after 6 months storage. The critical moisture content for FSP and FSCP was 10.2 and 13.5%, which were equilibrated at 82 and 68% RH respectively and the ERH studies indicated both the powders are non-hygroscopic in nature. Overall sensory quality of FSCP served with cooked rice scored ‘good’ (7.4) even after 6 months of storage [Rao, P.P.*, Rao, G.N., Mala, K.S., Balaswamy, K., Satyanarayana, A. (Central Food Technological Research Institute, Resource Centre, Council of Scientific and Industrial Research, Habshiguda, Uppal Road, Hyderabad 500 007, India). *Journal of Food Science and Technology*, 2013, **50**(1), 129-134].

Ginger-garlic paste in retort pouches and its quality

Paste samples were prepared by mixing 1:1 (w/w) proportion of ginger and garlic along with sodium chloride (1%). The pH of the paste was adjusted to 4.0, 4.5 and 5.4 by the addition of citric acid. Xanthan gum (2 g/L) and sodium benzoate (0.2 g/L) were added to the paste and then filled in retort pouches. The filled pouches were subjected to thermal processing at 85°C with a holding time of 2 and 5 min at 80°C at the
centre of the paste. The color values a, and b (green and yellow) decreased, whereas the L (lightness) values increased with decrease in pH. Paste behaved like a non-Newtonian fluid, and exhibited shear-thinning behavior. Physicochemical and microbial properties did not show significant changes during storage. This study showed that ginger-garlic paste prepared in retort pouches is convenient because of its lighter weight, faster heating leading to better quality in terms of taste, color, and also environmentally acceptable. Ginger and garlic have been considered as important traditional herbal medicines due to their disease prevention effects. Ginger-garlic paste is a viscous product retaining the strong aroma and flavor of the raw materials, namely, fresh ginger and garlic. Paste is mainly used as a spice in culinary preparations for imparting a characteristic fresh ginger-garlic flavor. The product is generally creamy white in color and is microbiologically stable and free from pathogenic bacteria. It is a ready to use preparation that can be used in place of fresh ginger in homes, restaurants and institutional catering. Although, few studies have been conducted on the physicochemical characteristics of ginger and garlic pastes, no information is available on combination of ginger-garlic paste in retort pouches. The development of new packing (retort pouches) for ginger-garlic with good nutritional and functional properties (such as the one proposed in this study) may be of interest in order to diversify the market supply. Therefore, retort pouch because of its lighter weight, and faster heating leads to better quality in terms of uniform cooking, taste and color and also it is environmentally acceptable [Topno, P.N.*, Vinothini, Jayaprakash, S.H., Varadaiah, V., Sheshagiri, S.H., Srinivas P.M., and Naidu, M.M. (Plantation Products, Spices and Flavour Technology Department, India), Journal of Food Process Engineering, 2013, 36(1), 1-8].

**NPARR** 4(1), 2013-087 **Enzyme-assisted extraction of bioactive compounds from ginger (Zingiber officinale Rosco)**

Ginger (Zingiber officinale Rosc.) is a popular spice used in various foods and beverages. 6-Gingerol is the major bioactive constituent responsible for the antiinflammatory, antitumour and antioxidant activities of ginger. The effect of application of α-amylase, viscozyme, cellulase, protease and pectinase enzymes to ginger on the oleoresin yield and 6-gingerol content has been investigated. Pre-treatment of ginger with α-amylase or viscozyme followed by extraction with acetone afforded higher yield of oleoresin (20% ± 0.5) and gingerol (12.2% ± 0.4) compared to control (15% ± 0.6 oleoresin, 6.4% ± 0.4 gingerol). Extraction of ginger pre-treated with enzymes followed by extraction with ethanol provided higher yield of gingerol (6.2-6.3%) than the control (5.5%) with comparable yields of the oleoresin (31-32%). Also, ethanol extract of cellulase pre-treated ginger had the maximum polyphenol content (37.5 mg/g). Apart from 6-gingerol, 6-paradol along with 6- and 8-methyl shogaols were the other important bio-active constituents in the oleoresin from cellulase-treated ginger [Nagendra Chari*, K.L., Manasa, D., Srinivas, P., Sowbhagya, H.B. (Department of Plantation Products, Spices and Flavour Technology, CSIR-Central Food Technological Research Institute, Cheluvamba Mansion, Mysore 570 020, Karnataka, India), Food Chemistry, 2013, 139 (1-4), 509-514].