Folk Medicine, Pharmacological and Biological Activities

Infusion of *Narcissus tazetta* is used in traditional medicine of Jordan as anticancer, antiinflammatory, memorigenic and sedative (Talib and Mahasneh, 2010a). The plant extracts are extremely effective as part of anti-aging treatments by slowing cell proliferation in skin (Kern, 2005; von Oppen-Bezalel, 2009). A cream containing peeled *Narcissus tazetta* and other plant species is effective in promoting development of mammary gland tissue, and has breast enlarging effect (Chu, 2004).

A Chinese beverage which has dissolved *Narcissus tazetta* (or *Lavandula angustifolia*) components can nourish skin, regulate incretion, sooth the nerves, improve sleep, relieve female diseases, eliminate depression, and release pressure (Li, 2012). Several traditional medicine compositions (containing *Narcissus tazetta* and other herbs or ingredients) are used for treating infantile malnutrition (Pang, 2010; Zhu, 2012) and as cosmetics for skin care (e.g. skin-lightening, anti-aging and anti-wrinkle) (Kern, 2009a,b; Kern and Meadows, 2009a,b; Yamada, 2009; Yoon *et al*., 2009; Park *et al*., 2011; Shin *et al*., 2011; Chen *et al*., 2012a,b) and for back pain, prostatic diseases, gynecological diseases, arthritis and cold feet (Gayiti, 2010), antipuritic and mosquito repellent (Li, 2008).

Narcissus tazetta has been found to possess diuretic activity (Masuzawa, 1940). The antiviral activity of *Narcissus tazetta* extract (Furusawa *et al.*, 1967) as well as the alkaloids, narcissine and narciclasine (Ramananthan *et al*., 1968) has been reported. The supernatants from *Narcissus tazetta* had effective antiviral activity. *Narcissus tazetta* had a significant protective effect as antiviral agent against lymphocytic choriomeningitis infection when infected subcutaneously into mice (Furusawa and Cutting. 1966; Furusawa *et al*., 1968,1970). The fetutin-binding peptide, isolated from *Narcissus tazetta* var. *chinensis* could significantly inhibit the plaque formation by respiratory syncytial virus (RSV) and the cytopathic effect induced by influenza (H1N1) virus, as well as the proliferation of human acute promyelocytic leukemia cells (HL-60) (Ooi *et al*., 2008).

The butanol extract of *Narcissus tazetta* aerial parts was active against *Candida albicans* and against 5 Gram positive and Gram negative bacteria (Talib and Mahasneh, 2010a).

Both quaternary alkaloids (*N*-methyl-8,9-methylenedioxy-phenantridinium sulphate and

N-methylenedioxy-phenantridinium malate) isolated from the flowers showed cytotoxic activity (IC_{50} = 5 μg/ml) against cancer cell lines including mouse lymphoma (P-388, ATCC, CCL 46), human colon carcinoma (HT-29, ATTC, HTB 38) and human lung carcinoma (A-549, ATTC:CCL 8) (Youssef and Khalifa, 2001). *Narcissus tazetta*, used traditionally as anticancer agent, showed weak activity against Hep-2, MCF-7 and Vero cancer cell lines (Talib and Mahasneh, 2010b). The total alkaloids of the bulbs of *Narcissus tazetta* showed considerable activity on leukemic process in BALB/c mice infected with murine leukemia strain Rauscher virus. A crystalline alkaloid (2-X) isolated from the bulbs of *Narcissus tazetta* showed antivirus activity against Japanese encephalitis, lymphocytic choriomeningitis and encephalomyo-carditis (Fukusawa *et al*., 1979). Extracts of *Narcissus tazetta*, were very active against Coxsackie, Semliki forest, and measles viruses (Van den Berghe *et al*., 1978).

An alkaloid, tentatively identified as pseudolycorine, isolated from *Narcissus tazetta* exerted a greater prolongation effect on the life span of established Rauscher leukemic mice having palpable splenomegaly, than the standard antileukemic drugs, cyclophosphamide and vincristine. It suppressed the development of splenomegaly and the increase in number of nucleated blood cells, and dropped the virus titer in plasma without apparent toxicity. A second alkaloidal complex, called residual alkaloid, also showed remarkable antileukemic activity (Furusawa *et al*., 1971).

Daily subcutaneous injections of narcissus alkaloid (tentatively identified as pseudolycorine and a water-soluble residue) at well tolerated doses were markedly effective in prolonging the survival of leukemic mice, in comparison with standard antileukemic drugs. Combinations of the alkaloid with cyclophosphamide or 6-mercaptopurine were more effective than the single administration of either drug. Combinations with vincristine or interferon inducers did not show synergism. Further, the alkaloid did not inhibit humoral antibody production in the leukemic mice, whereas the standard drugs were immunosuppressive during long-term treatment. The alkaloid also did not suppress interferon induction by poly I:C in the leukemic mice (Furusawa *et al*., 1972). Pseudolycorine (I), isolated from 3 varieties of *Narcissus tazetta*, inhibited the growth of W-256 carcinosarcoma but not hepatoma, S.C. Ehrlich ascites, or S-180 in mice. The i.p. LD_{50} was 110 mg/kg in rats. Pseudolyconine I had a hypotensive effect in cats. In dogs, I produced nausea, vomiting, and anorexia. Autopsy of the dogs showed no pathological changes in viscera (Pan *et al*., 1979).

The mannose-binding lectin isolated from *Narcissus tazetta* var. *chinensis* significantly inhibit plaque formation by the human respiratory syncytial virus (RSV) with an IC_{50} of 2.30 μg/mL and exhibit strong antiviral properties against influenza A (H1N1, H3N2, H5N1) and influenza B viruses with IC50 values ranging from 0.20 μg/mL to 1.33 μg/mL in a dose-dependent manner (Ooi *et al*., 2010). The lectin preserves cord blood hematopoietic stem progenitor cells in long-term culture and enhances their *ex vivo* expansion (Li *et al*., 2008).

The total alkaloids of *Narcissus tazetta* var. *chinensis* inhibited significantly the growth of Jensen sarcoma in rats and Crocker sarcoma and Ehrlich ascites carcinoma in mice. In mice, the acute intraperitoneal LD_{50} was 182 mg/kg. The subacute LD_{50} values after 10 intraperitoneal injections of alkaloids into mice and rats were 59 and 23 mg/kg/day, respectively. Total alkaloids might cause emesis in dogs until after 2-3 injections, and at dose levels of 16 mg/kg or lower, might produce leukocytosis for about a month (Wu *et al*., 1965). The extracts from *Narcissus tazetta* var. *chinensis* (ENT) strongly decreased the survival rate of the following tumor cell lines: HL-60, K562, KT1/A3, and A3R. The cytotoxic effects of ENT on non-cancer cells lines (NHBE and NIH3T3) were smaller than on leukemia cell lines (Liu *et al*., 2006). The peptide, nartazin (7.1 kDa), isolated from *Narcissus tazetta* var. *chinensis* possessed antifungal, immunomodulatory and antiproliferative activities (Chu and

Ng, 2004).

The antinociceptive effect of the ether extract of *Narcissus tazetta* subsp. *tazetta* was proved (Cakici *et al*., 1997). The anticholinesterase (Orhan and Sener, 2003) and antimalarial (Sener *et al*., 2003) activities of *Narcissus tazetta* subsp. *tazetta* have been reported.

Other Uses

The essence manufactured from *Narcissus tazetta* flavor substances can relieve uneasiness of mind and body tranqulilization, develop intelligence, regulate nervous system, refresh the brain, stimulate mental functions and regain consciousness, with fragrant aroma (Liu, 2011; Qiao, 2011). The plant, like some other aquatic plants can remove unpleasant gases and absorb small amount of radiation (Yuan and Yin, 2007).