Journal of Taibah University Medical Sciences (2017) ■(■), 1–9

Taibah University

Journal of Taibah University Medical Sciences

www.sciencedirect.com

Original Article

# Phytochemical profiling of *Turbinaria ornata* and its antioxidant and anti-proliferative effects

Q3 Deepak Paramasivam, M.Phil, Sowmiya Rajamani, M.Phil, Balasubramani Govindasamy, M.Phil and Perumal Pachiappan, PhD *

*Department of Biotechnology, School of Biosciences, Periyar University, Salem, India*

Received 11 December 2016; revised 11 February 2017; accepted 12 February 2017; Available online ■ ■ ■

**الملخص**

**أهداف البحث:** لتحليل المواد الكيميائية النباتية، وتقييم القدرات المضادة للأكسدة والمضادة للتكاثر لـ "تربيناريا أورناتا" ( ترنر) أجارد ١٨٤٨.

**طرق البحث:** أجريت التحاليل الكيميائية النباتية للمستخلص الهكساني، والمستخلص الماني لـ "تربيناريا أورناتا". تم تحليل المستخلصات باستخدام تقنيات؛ الطيف الكتلي اللوني للغاز، وجهاز "فوريه" للتحويل الطيفي للأشعة تحت الحمراء، وفاصل الألوان السائل عالي الكفاءة. تم تحديد الخاصية المضادة للأكسدة للمستخلص الهكساني والمستخلص الماني لـ "تربيناريا أورناتا" باستخدام فحص بكرايل هايدرزايل ثنائي الفينايل للكسح الجذري وفحص قوة اختزال أيون الحديديك. بالإضافة إلى ذلك تم تقييم الخاصية المضادة للتكاثر داخل الخلية على الخلايا الظهارية الكلوية للقرد الأفريقي الأخضر (فيرو)، والخلايا الظهارية القاعدية السنخية البشرية السرطانية باستخدام فحص إم تي تي.

**النتائج:** كشف الفحص الكيميائي النباتي لـ "تربيناريا أورناتا" وجود سابونين، وقلويدات وأحماض أمينية، وزيت ودهن ثابتين، ومركبات فينولية (العفص وفلافونيدات والفينول الكلي). وجدت الخاصية المضادة للتكاثر الأعلى في المستخلص الهكساني ويليها المستخلص الماني لـ "تربيناريا أورناتا". كانت قيم فعالية مكافحة التكاثر (بالـ مايكروجرام/ مليلتر) بالنسبة للمستخلص الهكساني والمستخلص الماني على الخلايا الظهارية القاعدية السنخية البشرية السرطانية وخلايا فيرو: ٦٢،٩١ و٩٣،٠٠ و٧٢،٦٤ و١٠٦،٦ على التوالي. وقد أظهر التحليل باستخدام جهاز "فوريه" للتحويل الطيفي للأشعة تحت الحمراء وجود مجموعات وظيفية هي: الكحول، الأميدات والعطريات، والأمينات، وهاليدات الألكيل، والألكاينات، والألكانات، والأحماض الكربوكسيلية. كما كشف الطيف الكتلي اللوني للغاز عند تحليل المستخلص الهكساني لـ "تربيناريا أورناتا" عن وجود ١٣ مركبا نشطا.

**الاستنتاجات:** بناء على الخاصية المضادة للتكاثر المسجلة فإن هناك حاجة للمزيد من الدراسات الدوائية في سبيل تحضير دواء مضاد للسرطان.

**الكلمات المفتاحية:** A٥٤٩؛ مضاد الأكسدة؛ مضاد التكاثر؛ هينترياكونتان؛ تربيناريا أورناتا

**Abstract**

**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- 2yl)-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

* Corresponding address: Department of Biotechnology, School of Biosciences, Periyar University, Salem, 636 011, India.
E-mail: perumalarticles@gmail.com (P. Pachiappan)

Peer review under responsibility of Taibah University.

ELSEVIER Production and hosting by Elsevier

 http://dx.doi.org/10.1016/j.jtumed.2017.02.002

Please cite this article in press as: Paramasivam D, et al., Phytochemical profiling of *Turbinaria ornata* and its antioxidant and anti-proliferative effects, Journal of Taibah University Medical Sciences (2017), http://dx.doi.org/10.1016/j.jtumed.2017.02.002

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.

**Keywords:** A549; Antioxidant; Anti-proliferative; Hentriacontane; *T. ornata*



## Introduction

Q1 Cancer is a group of diseases characterized by the uncontrolled growth of cells that can lead to death. Despite many therapeutic treatments available for cancer, the survival rate and disease curative percentage are very low. It has become an increasing public health problem that accounts for 6 million cases every year throughout the world.[1] Of the various types of cancer, lung cancer is the second most important cause of death worldwide that accounts for 75–80% of the deaths.[2] Current cancer chemotherapy can damage or kill the rapidly dividing and healthy cells, which causes serious side effects such as anaemia, hair loss, and nausea. In addition, the costs of chemotherapeutic drugs are high compared to those of the natural compounds derived from medicinal plants.[3] Therefore, the use of natural products could be an alternative method to control and eradicate cancer.[4] Natural sources such as plants, microorganisms and marine organisms are potential bioresources for anticancer compounds.[5] Earlier studies reported that the seaweeds *Undaria pinnatifida*,[6] *Gracilaria edulis*,[7] *Turbinaria conoides*,[8] and *Sargassum pallidum*[9] exhibit anti-proliferative effects against human lung cancer cells (A549).

*Turbinaria ornata* (Turner) J. Agardh, 1848 is an extensive species of marine green alga belonging to the family Phaeophyceae and is rich in fucoids and sulphated polysaccharides.[10] It is widely distributed on the southeast coast of Tamil Nadu (India) and is reported to be used as an animal food, food ingredient and fertilizer. This alga is widely distributed in tropical and subtropical areas of the central and western Pacific and in the Indian Ocean.[11] A wide range of biological properties of this seaweed, including antibacterial,[12] anti-coagulant,[13] anti-inflammatory[14] and antioxidant properties, have been reported.[15] In addition, studies on fucoidan isolated from *Turbinaria* spp. have shown therapeutic benefits such as the prevention of myocardial injury,[16] along with hepatoprotective,[17] anticancer[9] and neuroprotective activities.[18] In view of these findings, the present study aims to evaluate the *in vitro* antioxidant and anti-proliferative effects of *T. ornata*-hexane extract (To-HE) and *T. ornata*-aqueous extract (To-AE) against A549 and *Vero*.

## Materials and Methods

### *Collection of seaweed material and processing*

Algal samples of *T. ornata* (Figure 1) were collected from Mandapam, Ramanathapuram District, Tamil Nadu, southeastern India (9° 22′ N, 78° 52′ E). The samples were washed thoroughly with tap water and then distilled water to remove the associated biota and salt debris and then shade dried for 2–3 weeks. Finally, the seaweed was powdered using a kitchen electric blender. The seaweeds were identified based on standard keys[19] and further confirmed by Dr. N. Kaliaperumal, Principal Scientist (Retd.), Central Marine Fisheries Research Institute, Mandapam Camp, Ramanathapuram District (India). The reference specimens have been kept in the Department of Biotechnology, Periyar University (Salem). All the chemicals used in this study were of analytical grade with maximum purity.

### *Preparation of To-HE*

Approximately 10 g of powdered seaweed material was initially soaked in 50 mL of hexane for three days with mild shaking. Then, the extract was filtered through Whatman filter paper and concentrated in a Rotary evaporator. This extract was stored in refrigerator until use.

### *Preparation of To-AE*

Aqueous extract was prepared by mixing 10 g of dry seaweed powder in 100 mL of sterile double distilled water and boiling at 60 °C for 30 min. Finally, the extract was filtered with Whatman no. 1 filter paper and stored in a refrigerator until use.

### *Phytochemical screening*

The samples (To-HE and To-AE) were subjected to preliminary phytochemical screening as described by Harborne (1973).[20]

**Figure 1:** *Turbinaria ornata* (Turner) J. Agardh, 1848.