ABSTRACT

The aim of the study was to extract, isolate and characterize novel compounds from marine red alga ***Gelidiella acerosa*** and to investigate their antioxidant, anticancer, antimetastatic and anti-inflammatory activities. The alga was extracted sequentially and the extracts were characterized by FTIR and HPLC techniques. The crude algal extracts were screened for the presence of possible phytochemicals by qualitative and quantitative methods, analyzed for their free radical scavenging efficiency by DPPH method and influence on antioxidant enzymes in cancer cells. The ethyl acetate extract (GAE) which exhibited maximum polyphenol and flavonoid contents and potent antioxidant activity was separated by column chromatography which yielded two pure compounds and two mixtures. The isolated compounds (GACs) were identified by GC -MS and NMR. The anticancer and anti-inflammatory activities of the compounds were determined by SYBL X 1.3 docking suite. The findings from this study, revealed the ability of the algal compounds to regulate the apoptotic, cell survival and anti - inflammatory mechanisms.

Further, GAE and GACs were analyzed for their anticancer activity under *in vitro* conditions in A549 and HeLa cell lines and under *in vivo* in tumour model of Zebrafish including the A549 tumour model, HCT tumour model and the HepG2 tumour model. Further the toxicity analysis of *Gelidiella acerosa* extract was analyzed under *in vitro* (Zebra fish Tissue chip) and *in vivo* (zebrafish) conditions. The pathways such as cell survival (PI3K/Akt/GSK3β/PTEN), apoptosis (Bax, Bcl 2, Bcl-Xl, caspase 3 and caspase 8), cell migration (MMP2 and MMP9) and inflammation (NFKB/IL 1β/ TNFα/ IL 10) which are critical in controlling cancer were found to be mediated by both GAE and GACs.

Further, the results of the *in vitro* and *in vivo* studies revealed the efficacy of both GAE and GACs to induce apoptosis and thereby inhibiting proliferation, migration and inflammation in cancer. In conclusion, the outcomes of the study clearly demonstrated that it is possible to isolate and characterize new compounds from marine algae which can serve as lead molecules in cancer therapy.