Anti-proliferative and Apoptosis Inducing Effects of Gallic Acid on Human Acute Myeloid Leukaemia Cell Lines (HL-60)

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Received: 25th July 2022        Accepted: 23rd August 2022        Published: 30th October 2022

Abstract

Gallic acid (GA) comes from benzoic acid or, more specifically, 3,4,5-trihydroxybenzoic, which derives from the phenolic acid of the non-flavonoid part of the polyphenol compound. It is found ubiquitously in various plants and fruits, such as grapes, gallnuts, pomegranates, and tea leaves [1]. Many scientific journals and articles reported on the pharmacological properties of the photochemical like GA, which has antioxidant properties, antimicrobial, anti-inflammatory, anticancer, cardioprotective, gastroprotective, and neuroprotective activity [2]. Moreover, the anticancer properties of GA have been recognised in several cancers, such as lung cancers, oesophageal cancer cells and leukaemia [3].

The objective of this study is to examine the anti-proliferative and apoptosis inducing effects of GA on HL-60 cell lines. Six concentrations of GA were made using the stock solution of GA compound dissolved in dimethyl sulfoxide (DMSO). HL-60 cells were treated with concentrations of 100, 50, 25, 12.5, 6.25, and 3.125 µg/mL and was incubated at three incubation period which were 24, 48, and 72 hours. The quantitative measure was determined with cytotoxicity assay of 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide (MTT) assay and was read by microplate reader at 570 nm. For qualitative measure was through staining with acridine orang (AO) and propidium iodide (PI) and observed the morphological changes of the treated cells.

Results from the MTT assays show that GA has cytotoxicity effect on HL-60 cells especially for 72 hours incubation period. The maximal half inhibitory concentrations (IC₅₀) value of GA decreases as incubation period increases. The IC₅₀ of GA were 9.03, 6.76, and 3.65 µg/ml for 24-, 48-, and 72-hours incubation, respectively. The IC₅₀ value of GA (p<0.05) was significantly different for different incubation periods. The morphological changes were seen through the AO/PI staining with the appearance of the cell blebbing, early apoptosis, and late apoptosis.
Figure 1 shows early apoptosis (EA), late apoptosis (LA), cell blebbing (CB), membrane loose (MB), nuclear fragmentation (NF), and apoptotic bodies (AB).

These findings show that GA has potential as anti-proliferative and apoptosis inducing effects on HL-60 cells line. More research is needed to determine the pathways of apoptosis in HL-60 treated with GA.

24 hours (GA concentration 9.03µg/mL)

48 hours (GA concentration 6.76 µg/mL)

72 hours (GA concentration 3.65 µg/mL)

Figure 1: Cells Treated with IC50 of Gallic Acid at 24, 48, and 72 hours

Keywords
Gallic acid, HL-60, Acute myeloid leukaemia

Acknowledgement
This study is supported by Universiti Sultan Zainal Abidin (Grant no. UniSZA/LABMAT/2018/06 – R0044-R006).


Official Journal of Faculty of Medicine, Universiti Sultan Zainal Abidin, Malaysia.