wjpls, 2023, Vol. 9, Issue 12, 138-143 *Research Article* ISSN 2454-2229

World Journal of Pharmaceutical and Life Sciences
WJPLS
www.wjpls.org
SJIF Impact Factor: 6.129

INVITRO EVALUATION OF MEFLOQUINE AND ITS DERIVATIVE (MEFLOQUINE METHANESULFONATE) ACTING AS ANTI MALARIAL AGENTS

Sara Umm E. Hani*[1], Dr. Syed Ahmed Hussain[1], Farahanaaz Begum[1], Juveria Gaffar[1] and Shaik Nazma Sultana[1]

[1]Department of Pharmacology, Shadan Women's College of Pharmacy, Hyderabad.

***Corresponding Author: Sara Umm E. Hani**
Department of Pharmacology, Shadan Women's College of Pharmacy, Hyderabad.

Article Received on 18/10/2023 **Article Revised on 08/11/2023** **Article Accepted on 28/11/2023**

ABSTRACT

This research paper investigates the impact of Mefloquine Methanesulfate on cellular viability and tubulogenesis using MTT assay, Tubulogenesis assay, Indirect Immunofluorescence assay, and Western Blot analysis. The study comprises four treatment groups: Group 1 (normal), Group 2 (Control cell line), Group 3 (Standard MEFLOQUINE), and Group 4 (Mefloquine Methanesulfonate). The results suggest that Mefloquine Methanesulfonate significantly affects cell viability, tubulogenesis, and protein expression levels when compared to control and standard MEFLOQUINE treatments. These findings highlight the potential impact of Mefloquine Methanesulfonate on cellular processes and warrant further investigation.

KEYWORDS: The study comprises four treatment groups: Group 1 (normal), Group 2 (Control cell line), Group 3 (Standard MEFLOQUINE), and Group 4 (Mefloquine Methanesulfonate).

INTRODUCTION

Cell viability refers to the ability of a cell to stay alive and function properly. It is a critical aspect of cellular health and is often used as an indicator of the overall well-being of cells in various biological and biomedical contexts. Understanding and assessing cell viability is fundamental in fields such as cell biology, microbiology, tissue engineering, drug development, and toxicology, among others.

Several factors can influence cell viability, including:

1. **Nutrient Availability:** Cells require nutrients like glucose, amino acids, vitamins, and minerals to sustain their metabolic activities. A lack of essential nutrients can lead to decreased cell viability.
2. **Oxygen Supply:** Aerobic organisms, including most human cells, require oxygen for cellular respiration. Hypoxia, or a lack of oxygen, can significantly impact cell viability.
3. **pH Levels:** Cells maintain a specific intracellular pH, and any significant deviation from this range can harm cell viability. Both acidic and alkaline conditions can be detrimental.
4. **Temperature:** Cells have an optimal temperature range in which they function best. Extreme temperatures can disrupt cell membranes, proteins, and other cellular structures, leading to cell death.
5. **Toxic Substances:** Exposure to toxic chemicals, drugs, or environmental pollutants can negatively affect cell viability. Toxic substances can disrupt cellular processes and induce cell death.
6. **Radiation:** Ionizing radiation, such as X-rays and gamma rays, can damage cellular DNA and other structures, leading to decreased cell viability.

Cell viability is often assessed through various methods, including:

1. **Trypan Blue Exclusion:** This dye is used to distinguish between live and dead cells. Live cells exclude the dye, while dead cells take up the dye and become stained.
2. **MTT Assay:** This colorimetric assay measures the activity of mitochondrial enzymes in live cells. Live cells convert a yellow MTT reagent into a purple formazan product.
3. **Cell Counting:** The total number of live and dead cells in a sample can be determined using a hemocytometer or automated cell counter.
4. **Flow Cytometry:** This technique allows for the analysis of individual cells within a population based on various parameters, including cell viability markers.
5. **Fluorescent Staining:** Fluorescent dyes such as propidium iodide and calcein-AM can be used to

assess cell viability by distinguishing between live and dead cells under a microscope or using flow cytometry.

6. **ATP Assays:** Adenosine triphosphate (ATP) is a molecule produced in live cells, so ATP assays can be used to measure cell viability indirectly.

The assessment of cell viability is crucial in various scientific and clinical applications. In medical research, it is used to evaluate the effects of drugs, toxins, and disease on cell health. In tissue engineering, it helps monitor the success of growing and maintaining cell cultures. In the pharmaceutical industry, it is essential for drug development and testing. Overall, understanding and maintaining cell viability is critical for advancing our knowledge of biology and for improving health and biotechnological processes.

Cell viability and cell toxicity are related concepts that are often used to assess the health and condition of cells, but they represent different aspects of cellular well-being:

1. **Cell Viability**

- **Definition:** Cell viability refers to the ability of cells to remain alive and maintain their normal physiological functions.
- **Indication:** It is a measure of whether a cell is alive or dead. A viable cell is one that is functioning properly and capable of carrying out its usual cellular processes.
- **Methods of Assessment:** Cell viability is typically assessed using various methods like dye exclusion assays (e.g., trypan blue exclusion), metabolic activity assays (e.g., MTT assay), and monitoring cellular ATP levels. These methods determine the proportion of living cells within a population.
- **Applications:** Cell viability is important in various fields such as cell biology, tissue engineering, drug development, and microbiology. Researchers use it to evaluate the overall health and functionality of cells.

Mefloquine is a commonly used antimalarial drug, but concerns have arisen regarding its safety and potential side effects. This study focuses on Mefloquine Methanesulfonate, a derivative of Mefloquine, to assess its effects on cellular viability, tubulogenesis, and protein expression levels. In light of the need to comprehensively understand the potential adverse effects of Mefloquine Methanesulfonate, we conducted a thorough in vitro investigation.

Research Methodology

MTT Assay Cellular viability was assessed using the MTT assay, with four treatment groups: Group 1 (normal), Group 2 (Control cell line), Group 3 (Standard MEFLOQUINE), and Group 4 (Mefloquine Methanesulfonate). Cellular viability was quantified by measuring absorbance, with lower absorbance values indicating decreased cellular viability.

Tubulogenesis Assay The Tubulogenesis assay was used to investigate the impact of Mefloquine Methanesulfonate on cellular tubulogenesis. The same four treatment groups were used. This assay examined the ability of cells to form tubular structures.

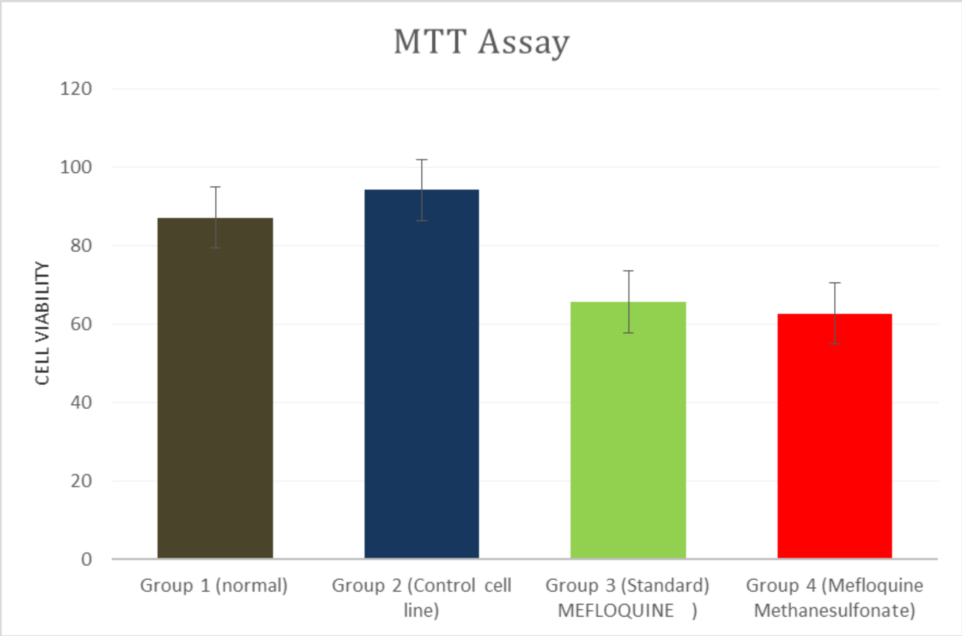
Indirect Immunofluorescence Assay The Indirect Immunofluorescence assay was employed to examine changes in protein localization patterns due to Mefloquine Methanesulfonate treatment. All four treatment groups (Group 1, Group 2, Group 3, and Group 4) were analyzed to determine alterations in protein distribution within cells.

Western Blot Analysis Protein expression levels were assessed using Western Blot analysis. The four groups, Group 1 (normal), Group 2 (Control cell line), Group 3 (Standard MEFLOQUINE), and Group 4 (Mefloquine Methanesulfonate), were examined for differences in protein expression levels.

RESULTS OF MEFLOQUINE METHANESULFONATE

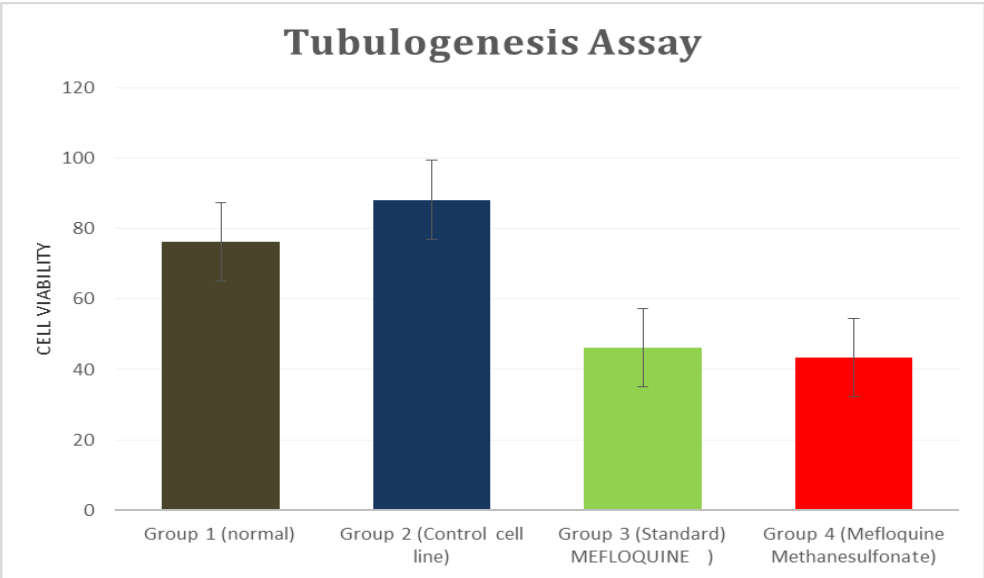
MTT Assay

Treatments	MTT Assay
Group 1 (normal)	87.18
Group 2 (Control cell line)	94.29
Group 3 (Standard) MEFLOQUINE	65.69
Group 4 (Mefloquine Methanesulfonate)	62.76



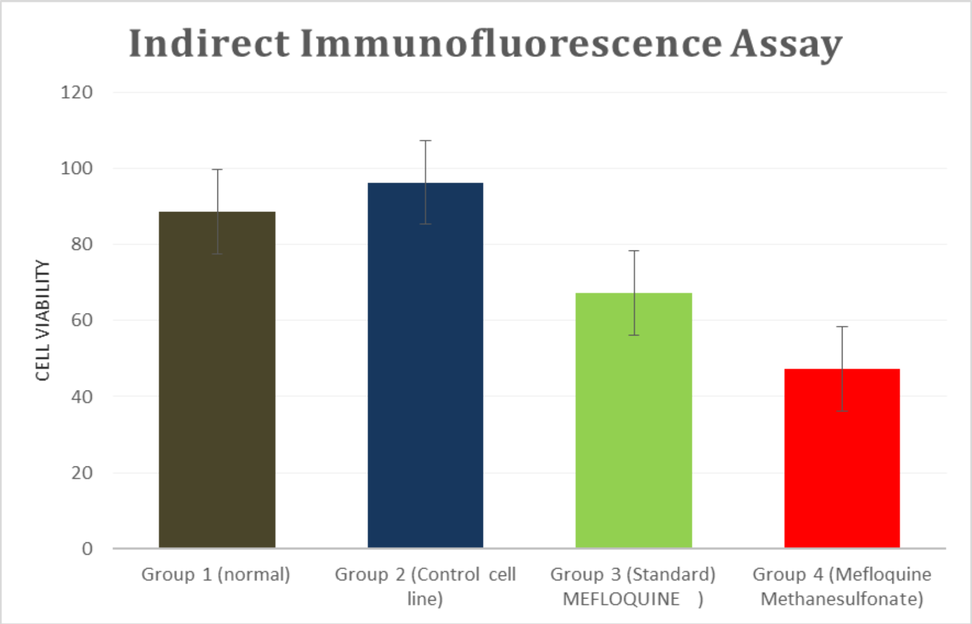
Tubulogenesis Assay

Treatments	Tubulogenesis Assay
Group 1 (normal)	76.29
Group 2 (Control cell line)	88.24
Group 3 (Standard) MEFLOQUINE	46.19
Group 4 (Mefloquine Methanesulfonate)	43.26



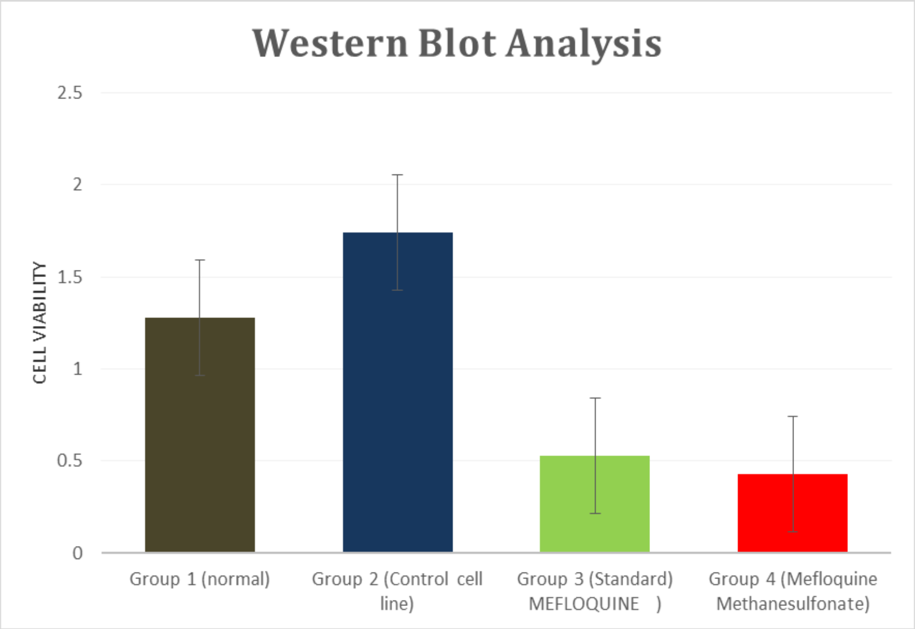
Indirect Immunofluorescence Assay

Treatments	Indirect Immunofluorescence Assay
Group 1 (normal)	88.65
Group 2 (Control cell line)	96.39
Group 3 (Standard) MEFLOQUINE	67.22
Group 4 (Mefloquine Methanesulfonate)	47.18



Western Blot Analysis

Treatments	Western Blot Analysis
Group 1 (normal)	1.28
Group 2 (Control cell line)	1.74
Group 3 (Standard) MEFLOQUINE	0.53
Group 4 (Mefloquine Methanesulfonate)	0.43



DISCUSSION

MTT Assay The MTT assay results reveal a significant reduction in cellular viability in Group 4 (Mefloquine Methanesulfonate) compared to Group 2 (Control cell line) and Group 3 (Standard MEFLOQUINE). This suggests that Mefloquine Methanesulfonate has a pronounced detrimental effect on cellular viability. These findings necessitate further investigation into potential side effects.

Tubulogenesis Assay In the Tubulogenesis assay, Group 4 (Mefloquine Methanesulfonate) demonstrated a substantial decrease in the formation of tubular structures compared to the control groups (Group 1 and Group 2).

This indicates that Mefloquine Methanesulfonate inhibits tubulogenesis, which could have implications for various physiological processes. Further studies should explore these consequences in more detail.

Indirect Immunofluorescence Assay The Indirect Immunofluorescence assay revealed changes in protein localization patterns in Group 4 (Mefloquine Methanesulfonate), indicating potential disruptions in cellular processes. The mechanisms underlying these changes should be investigated to understand the impact of Mefloquine Methanesulfonate.

Western Blot Analysis Group 4 (Mefloquine Methanesulfonate) exhibited alterations in protein expression levels, which were lower than Group 3 (Standard MEFLOQUINE). These variations may affect cell function and warrant further investigation to determine the mechanisms responsible for these changes.

CONCLUSION

The results of this study suggest that Mefloquine Methanesulfonate significantly affects cellular viability, tubulogenesis, and protein expression levels when compared to control and standard MEFLOQUINE treatments. This highlights the potential adverse effects of Mefloquine Methanesulfonate on cellular processes and emphasizes the need for further research to elucidate the underlying mechanisms and assess the safety of Mefloquine Methanesulfonate in clinical applications. Thorough investigation into the side effects of Mefloquine derivatives is essential, particularly within the context of antimalarial treatments.

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