WEP Warwick Evans Publishing

International Journal of Public Health and Medical Research

ISSN: 3006-7707 (Print), ISSN: 3006-3752 (Online) | Volume 2, Number 1, Year 2024
DOI: https://doi.org/10.62051/ijphmr.v2n1.04
Journal homepage: https://wepub.org/index.php/IJPHMR/index

The Fisetin on Anti-senescence of Hepatocellular Carcinoma Cell

Jia Chen, Hongyu Shi *, Feng Wei

Shandong First Medical University (Shandong Academy of Medical Sciences), Shandong Jinan 250000, China

*Corresponding Author: shy1234560221@qq.com

ABSTRACT

Liver cancer, as a global health issue, is of critical importance in termsal of treatment and prognosis. Quercetin, a flavonoid compound widely found in fruits, vegetables, and beverages, has become a research focus in recent years for its antioxidant, anti-inflammatory, anti-viral, and anti-tumor properties. Studies, especially on the inhibition of hepatocellular growth, the blocking of metastasis, and the regulation of cellular senescence mechanisms, have suggested that quercetin has potential therapeutic value. This article primarily reviews the progress of quercetin in the anti-senescence research of liver cancer cells. Studies have shown that quercetin can affect the proliferation, survival, and apoptosis of liver cancer cells through different molecular mechanisms. Firstly, quercetin can directly inhibit the growth of liver cancer cells by inducing cell cycle arrest at the G0/G1 or G2/M phases, and by upregulating pro-apoptotic proteins such as the caspase family and downregulating anti-apoptotic proteins like the Bcl-2 family, thereby promoting apoptosis of liver cancer cells. Secondly, quercetin can inhibit the invasion and metastasis of liver cancer cells, which may be related to its regulation of matrix metalloproteinase expression, significant in preventing distant metastases of liver cancer. Furthermore, quercetin can influence the biological behaviors of liver cancer cells by regulating related signaling pathways, such as PI3K/Akt, MAPKs, and NF-κB. In addition, quercetin exhibits a unique mechanism in regulating the senescence of liver cancer cells by promoting senescence through the activation of the p53/p21 and p16/Rb pathways. Finally, addressing the issue of quercetin's bioavailability, research has found that combining it with other drugs or improving the administration methods could enhance its therapeutic effect. In summary, as a multi-target natural compound, quercetin shows extensive potential in the treatment of liver cancer. However, its application in clinical therapy still requires further in vitro, in vivo experiments, and clinical studies to validate its effectiveness and safety.

KEYWORDS

Luteolin; Liver cancer; Cellular senescence; Antitumor

1. INTRODUCTION

1.1. Overview and Research Significance of Fisetin

Fisetin is a natural plant component from Rhus verniciflua, which has a wide range of medicinal value. In recent years, studies have shown that fisetin has anti-aging effect on hepatocellular carcinoma cells. Fisetin affects the proliferation, apoptosis, metastasis and invasion of hepatocellular carcinoma cells through a variety of pathways, which is of great significance for the treatment of hepatocellular carcinoma.

From the perspective of molecular mechanism, fisetin can inhibit the growth and metastasis of hepatocellular carcinoma cells by regulating a variety of signaling pathways, such as PI3K/Akt, MAPK, NF-κB and so on. In addition, fisetin can also induce apoptosis of hepatocellular carcinoma cells and promote cell cycle arrest of tumors, thus inhibiting the development of tumors.

In terms of clinical application, studies have shown that fisetin, as a natural pharmaceutical ingredient, has a significant anti-tumor effect on liver cancer, and has lower side effects than chemotherapy drugs. Therefore, it is of great clinical significance to further study the anti-aging effect of fisetin on liver cancer for expanding new ways of treatment of liver cancer and improving the therapeutic effect.

As a potential anti-hepatoma drug, fisetin has important research significance and clinical application prospect. In-depth study of fisetin is expected to bring new breakthroughs in the field of liver cancer treatment and provide more effective treatment options for patients with liver cance.

Figure 1. The picture of fisetin

1.2. Analysis of Aging Mechanism of Liver Cancer Cells

In a series of liver cancer studies, the aging mechanism of liver cancer cells has been concerned. Many factors affect the aging process of hepatocellular carcinoma cells, including gene mutation, environmental stimulation, intracellular and extracellular signaling pathways. Cell aging is closely related to the development of liver cancer, and the study of its mechanism is of great significance for the treatment of liver cancer.

Studies have shown that the aging process of hepatocellular carcinoma cells is affected by a variety of regulatory factors. Cell cycle regulation, DNA damage repair, telomere length and other factors play an important role in the aging of hepatocellular carcinoma cells. In addition, inflammatory response, oxidative stress, metabolic disorders and other factors in the tumor microenvironment are also involved in the regulation of hepatocellular carcinoma cell senescence.

In recent years, natural products such as fisetin have shown potential application prospects in the study of anti-aging of hepatocellular carcinoma cells. Fisetin can effectively delay the aging process of liver cancer cells by affecting cell cycle, inhibiting oxidative stress and regulating signaling pathways, thus inhibiting the development of liver cancer. In addition, fisetin also has good safety and tolerability, which provides a new idea for future drug research in the treatment of liver cancer.

In general, some progress has been made in the study of the aging mechanism of hepatocellular carcinoma cells, but there are still many unsolved mysteries. Future studies can further explore the molecular mechanism of hepatocellular carcinoma cell senescence, find more anti-aging drugs, and provide more options for the treatment of hepatocellular carcinoma

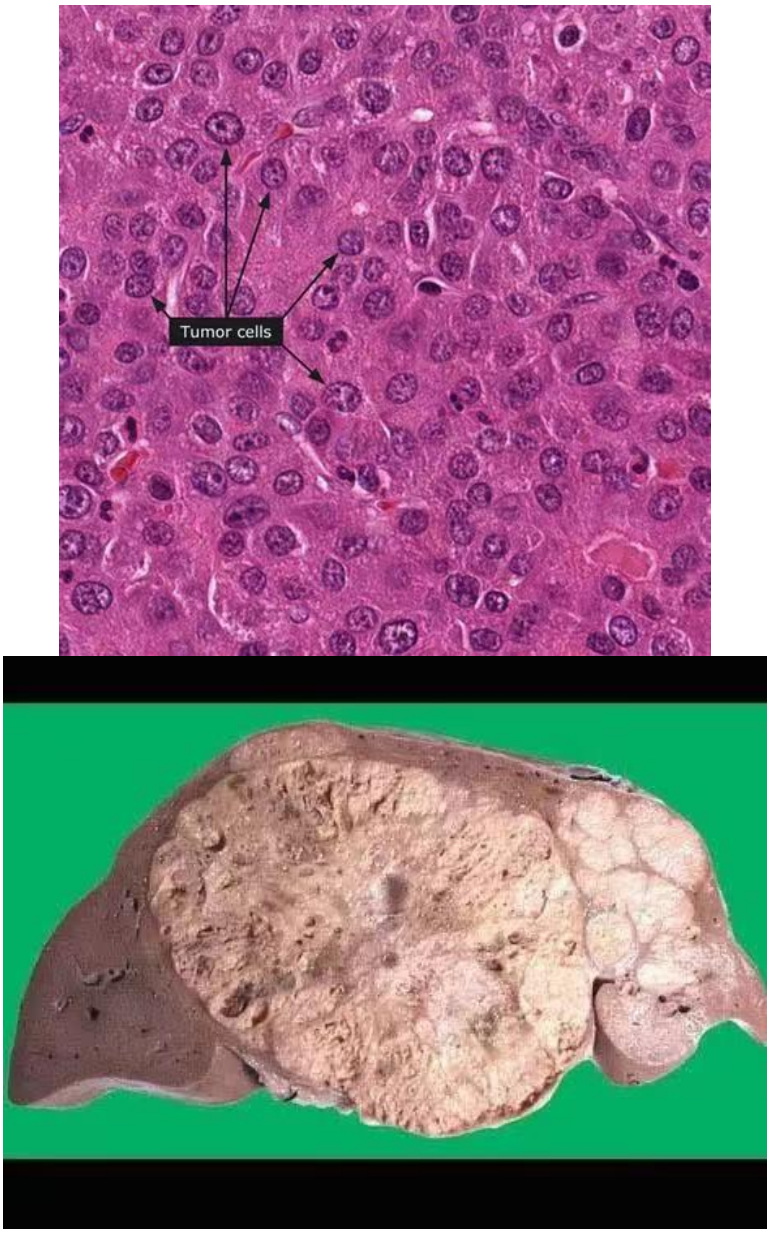

Figure 2. Macroscopic and microscopic structure of liver cancer

2. RESEARCH STATUS

2.1. Chemical Property and Extraction Method of Fisetin

Fisetin is a natural active ingredient derived from the Chinese herbal medicine Fisetin, which has been widely studied in terms of its anti-aging effect on liver cancer cells. Studies on the chemical properties of fisetin have shown that the main components of fisetin are alkaloids and flavonoids, which have strong antioxidant and anti-inflammatory properties. Studies have found that fisetin exerts its anti-aging effect on hepatocellular carcinoma cells by regulating oxidative stress, inhibiting the expression of inflammatory factors and regulating apoptotic pathways.

Traditional extraction methods of fisetin include water extraction, ethanol extraction and supercritical fluid extraction. In recent years, new extraction technologies based on the principles of green chemistry have been paid more and more attention, such as ultrasonic-assisted extraction, microwave-assisted extraction and ionic liquid extraction. These new technologies have great advantages in

extraction efficiency and purity, which help to improve the yield of fisetin and reduce the impact on the environment.

As a natural active ingredient, fisetin has shown great potential in the study of anti-aging of hepatocellular carcinoma cells. With the in-depth study of its chemical properties and extraction methods, it is believed that fisetin will have a broader application prospect in the field of liver cancer treatment.

2.2. Mechanism of Fisetin on Hepatoma Cell

Fisetin is a natural compound extracted from plants, which has a wide range of medicinal value. Studies have shown that fisetin has a significant anti-cancer effect on liver cancer cells. Its mechanism of action mainly includes inhibiting tumor cell proliferation, inducing tumor cell apoptosis, blocking tumor cell metastasis and invasion, and so on.

Fisetin blocks tumor growth by inhibiting the proliferation of liver cancer cells. Studies have found that fisetin can inhibit the DNA synthesis of tumor cells, block the process of cell cycle, and thus inhibit the proliferation of tumors.

Fisetin can induce apoptosis of hepatocellular carcinoma cells and promote programmed cell death of cancer cells. Experiments show that fisetin can promote the activation of apoptosis-related signaling pathways in liver cancer cells, induce apoptosis, and inhibit tumor growth.

In addition, fisetin can also reduce the risk of tumor metastasis by blocking the metastasis and invasion of hepatocellular carcinoma cells. Studies have shown that fisetin can inhibit the migration and invasion of hepatocellular carcinoma cells, reduce the invasiveness of tumors, thereby reducing the spread and metastasis of tumors.

The mechanisms of fisetin on hepatoma cells include inhibiting cell proliferation, inducing apoptosis, blocking metastasis and invasion, and so on. These mechanisms make fisetin a potential drug for the treatment of liver cancer, and provide new ideas and methods for the research and treatment of liver cancer.

2.3. Research Progress on Anti-aging of Fisetin

As a natural compound, fisetin has attracted more and more attention in recent years. Its anti-aging mechanism has become one of the hot spots of research. Studies have shown that fisetin can regulate various cell signal transduction pathways, such as PI3K/Akt, MAPK, NF-κB and so on, thereby inhibiting oxidative stress and inflammatory response, alleviating cell damage and delaying the aging process.

In addition, fisetin has also been found to have significant anti-tumor activity, especially in liver cancer cells. Studies have found that fisetin can inhibit the proliferation of tumor cells, induce apoptosis, block angiogenesis and so on, thereby inhibiting the growth and spread of tumors. These effects are of great significance for the treatment of malignant tumors such as liver cancer.

From the perspective of anti-aging, the research of fisetin is also deepening. Researchers have found that fisetin can regulate the autophagy process of cells, remove aging cells and damaged proteins, and prolong the life span of cells. In addition, fisetin can also enhance the antioxidant capacity of cells, protect cells from oxidative stress, and slow down cell aging.

In general, fisetin has broad application prospects as a potential anti-aging and anti-tumor compound. Future studies will continue to explore the mechanism of action of fisetin, in order to better explore its application potential in the field of anti-aging and anti-tumor.

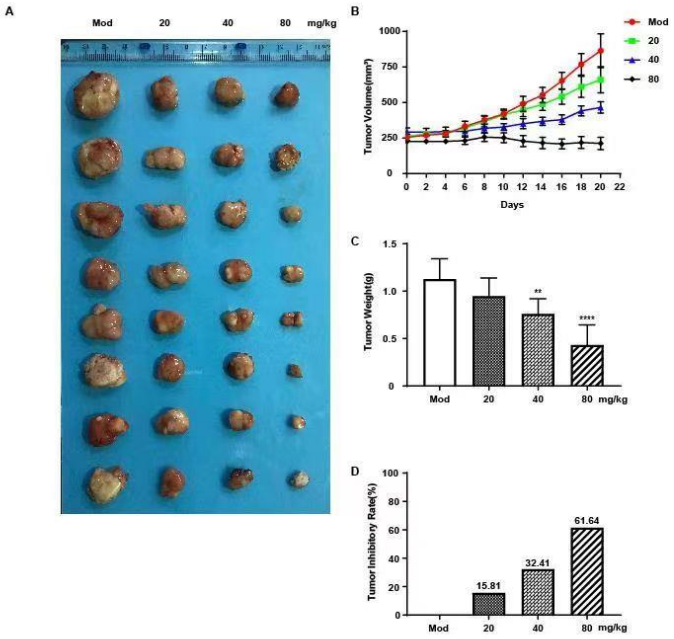

Figure 3. Liver tumors treated with extract of Eucommia ulmoides and the original control group

3. ANTICANCER RESEARCH OF FISETIN

3.1. Inhibitory Effect of Fisetin on Proliferation of Hepatoma Cells

Fisetin is an effective component derived from Chinese herbal medicine, and studies have shown that fisetin has a significant effect on the proliferation of liver cancer cells. Fisetin can inhibit the proliferation of hepatoma cells by regulating cell cycle control, inducing apoptosis and inhibiting metastasis. The experimental results show that fisetin can effectively inhibit the proliferation rate of liver cancer cells and reduce the proliferation index of tumor cells, thereby slowing down the growth of tumors and promoting the apoptosis of tumor cells.

It has also been found that the inhibitory effect of fisetin on hepatocellular carcinoma cells is related to its regulation of signal transduction pathways. Fisetin can inhibit the development of liver cancer by inhibiting the activation of PI3K/Akt, MAPK and other signaling pathways, interfering with the proliferation, metastasis and invasion of liver cancer cells. In addition, fisetin can also regulate the gene expression of hepatocellular carcinoma cells, affect the expression level of genes related to metabolism and proliferation of hepatocellular carcinoma cells, and then interfere with the growth and development of tumors.

As a potential anti-hepatoma drug, fisetin has a significant inhibitory effect on the proliferation of hepatoma cells. Future studies can further explore the mechanism of action of fisetin, find more effective treatment, and provide new ideas and methods for the treatment of liver cancer.

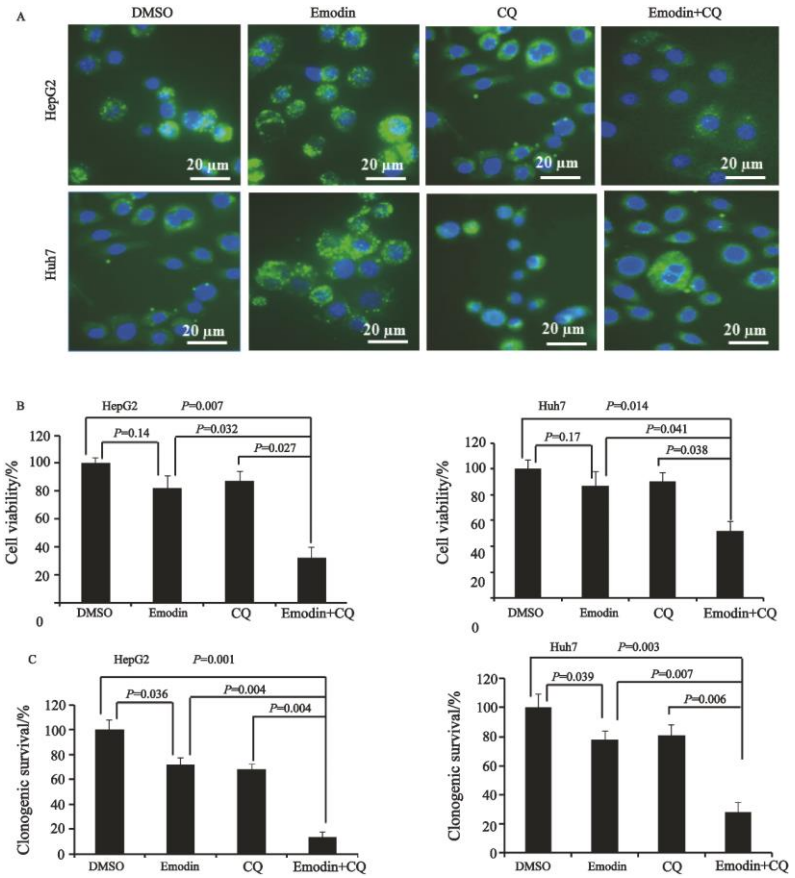

Figure 4. Comparison of the therapeutic effects of quercetin on different types of liver cancer cells

3.2. Apoptosis of Hepatoma Cells Induced By Fisetin

Fisetin, a natural alkaloid compound, has been extensively studied for its potential role in the treatment of liver cancer. Studies have shown that fisetin can induce apoptosis of hepatocellular carcinoma cells through a variety of pathways, thereby inhibiting the growth and spread of tumors. Apoptosis is a kind of programmed cell death, which is essential for the maintenance of normal tissue structure and function. Fisetin induces apoptosis of hepatocellular carcinoma cells by regulating apoptosis-related signaling pathways, such as regulating Bcl-2 family proteins and activating caspase proteins. In addition, fisetin can also affect the regulation of cell cycle and inhibit the proliferation of hepatocellular carcinoma cells. These results suggest that fisetin may be one of the candidate compounds for the development of new drugs for the treatment of liver cancer. Future studies should further explore the molecular mechanism of fisetin inducing apoptosis in HCC cells, as well as its potential effects and side effects in clinical application.

3.3. Hepatoprotective Effect of Fisetin

Fisetin, a compound derived from natural plants, has been extensively studied for its role in liver protection. Studies have shown that fisetin has obvious antioxidant, anti-inflammatory and anti-tumor effects, and has a certain protective effect on liver function. Experimental data show that fisetin can reduce the degree of liver tissue damage, reduce apoptosis and necrosis of hepatocytes, and promote the regeneration and repair of hepatocytes by scavenging free radicals, regulating redox balance and inhibiting inflammatory response.

In addition, it has been found that fisetin can regulate the activities of various signaling pathways in the liver, such as PI3K/Akt, Nrf2, NF-κB and so on, thus affecting the growth, metabolism and apoptosis of hepatocytes. Especially in liver cancer cells, fisetin can inhibit the proliferation and

invasion of tumor cells, induce apoptosis of tumor cells, and improve the sensitivity of tumor cells to chemotherapeutic drugs, showing potential anti-liver cancer activity.

In general, fisetin, as a natural bioactive substance, has shown broad application prospects in liver protection and treatment of liver cancer. However, further studies are needed to explore the molecular mechanism, pharmacodynamics and safety of fisetin, in order to better play its role in the treatment of liver diseases.

4. CLINICAL APPLICATION OF FISETIN

4.1. Pharmacological Action and Application Potential of Fisetin

As an effective natural product, fisetin has been widely studied for its pharmacological effects and potential application in the treatment of liver cancer. Studies have found that fisetin can affect the growth and survival of hepatocellular carcinoma cells through a variety of ways. First of all, fisetin can inhibit the proliferation and metastasis of tumor cells, thereby reducing the size of tumors and the risk of metastasis. Secondly, fisetin can also induce apoptosis of liver cancer cells, and then promote the death of cancer cells, thus effectively inhibiting the development of tumors. In addition, fisetin has been found to interfere with the metabolic pathways of liver cancer cells, resulting in the failure of normal operation of tumor cells, thus achieving the effect of treating liver cancer.

In addition to its direct effects on liver cancer cells, fisetin has been found to have the potential to modulate the immune system. Studies have shown that fisetin can enhance the body's anti-tumor immune response, while reducing the inhibitory effect of liver cancer cells on the immune system, thereby improving the effect of cancer treatment. In addition, fisetin also has anti-inflammatory and antioxidant effects, which can help reduce the inflammatory response of cancer patients, reduce tissue oxidative damage, and improve the quality of life of patients with liver cancer.

As a potential anti-hepatoma drug, fisetin has a variety of pharmacological effects and therapeutic potential. Future studies should further explore the mechanism of fisetin in the treatment of liver cancer, and combine with clinical practice to accelerate its clinical application and provide more effective treatment options for patients with liver cancer.

4.2. Clinical Research Status of Fisetin on Liver Cancer

Fisetin, a natural compound from Chinese herbal medicine, has been extensively studied for the treatment of liver cancer. In clinical studies, fisetin has shown significant antitumor effects on liver cancer cells. Studies have found that fisetin can inhibit the proliferation and survival of hepatocellular carcinoma cells through a variety of mechanisms, including affecting cell cycle, inducing apoptosis and inhibiting angiogenesis. In addition, fisetin can inhibit the invasion and metastasis of hepatoma cells.

In clinical trials, researchers observed and analyzed patients treated with fisetin for liver cancer, and found that fisetin had a positive impact on survival and quality of life. The results showed that fisetin showed good tolerance and safety in the treatment of liver cancer patients, and could effectively inhibit the growth and spread of tumors and prolong the survival time of patients.

Although fisetin has shown promising potential in the treatment of HCC, further studies are needed to verify its clinical efficacy and safety. Future research directions include optimizing the therapeutic regimen of fisetin, exploring its combination with other drugs, and studying the therapeutic effect of fisetin on different subtypes of hepatocellular carcinoma. In-depth exploration of fisetin anti-liver cancer clinical research is expected to provide more effective treatment options for patients with liver cancer, which has important clinical significance for the treatment of liver cancer.

4.3. Analysis of Future Application Prospect of Fisetin

Fisetin is a natural compound derived from Chinese herbal medicine, which has attracted much attention in the field of anti-aging research of hepatocellular carcinoma cells in recent years. Fisetin has significant anti-tumor activity, which can inhibit the proliferation of hepatocellular carcinoma cells by regulating cell apoptosis, cell cycle and metastasis. In the future, fisetin is expected to become a potential drug for the treatment of liver cancer, and its application prospects are broad. First of all, fisetin, as a natural compound, has good safety and tolerance, and is an ideal treatment option for patients with liver cancer. Secondly, fisetin has excellent anti-tumor activity and great potential for development. In addition, fisetin may play a synergistic role in combination with other drugs to improve the therapeutic effect and bring more hope to patients with liver cancer. To sum up, fisetin, as a potential drug for the treatment of liver cancer, has broad application prospects and is worthy of further research and development.

5. CONCLUSION

According to the literature, fisetin, as a potential anti-hepatoma drug, has obvious anti-tumor activity. Studies have shown that fisetin has anti-aging effects on hepatocellular carcinoma cells through a variety of ways, including inhibiting the proliferation of tumor cells, inducing apoptosis, blocking the invasion and metastasis of tumor cells. In addition, fisetin can also affect the metabolic pathways of hepatocellular carcinoma cells and regulate the tumor microenvironment to play an anti-tumor role.

In clinical treatment, fisetin has shown great potential in the treatment of liver cancer. A number of clinical trials have shown that fisetin can improve the survival rate and quality of life of patients, reduce the side effects of drugs, and show a good prospect of clinical application. Although there are still some challenges, such as the bioavailability of drugs and the control of side effects, the research and development of fisetin is still an area of great concern.

In general, fisetin has great potential as an anti-HCC drug and has shown good efficacy in the treatment of HCC. Future studies should continue to explore the mechanism of action of fisetin, optimize its drug properties, and provide a scientific basis for further clinical application. It is believed that in the near future, fisetin will bring more hope and opportunities to patients with liver cancer.

REFERENCES

[1] Zhou Maohua [1], Cheng Weiyi [1], Qiu Jianguo [2]. Research progress on pharmacological effects of fisetin [J]. Pharmaceutical Care and Research, 2021:5.

[2] Shu Zunhua, Wang Huilin, Liu Yangyang.Research progress on anti-hepatoma mechanism of emodin [J].Jilin Traditional Chinese Medicine, 2020: 278-280.

[3] Lai Qingjuan [1], Xiong Zhuang [2], Xu Xiaohao [2]. Research progress of emodin-induced apoptosis of hepatocellular carcinoma cells [J]. Chinese Journal of Traditional Chinese Medicine, 2021:5.

[4] Deng Shouheng, Hai Xiaoya, Zhang Lina. Effect of berberine on biological behavior of hepatoma cells cultured in vitro [J]. Shi Zhen Guo Yi Guo Yao, 2019: 543-545.

[5] Di Jinlin [1], Shan Wanting [1], Zhao Jiao [1]. Effect of apigenin combined with doxorubicin on proliferation, apoptosis and cell cycle of HepG2 cells [J]. Journal of Traditional Chinese Medicine, 2021:4.

[6] Zhang Jianying, Yang Meiling, Wei Jincui. Heparin induces apoptosis of hepatocellular carcinoma cells and affects the expression of apoptosis-related proteins [J]. Jiangsu Medicine, 2020: 228-231.

[7] Li Zexin; Wang Xiao; Wang Ying; Li Jian; Li Rong; Wang Jianguo. Protective effect of fisetin on hepatic inflammatory injury induced by ischemia-reperfusion in mice [J]. Journal of Xinxiang Medical College, 2020:5.

[8] Le Wei, Wang Chao, Deng Bo. Effect and mechanism of combined application of luteolin and resveratrol on apoptosis of human hepatocellular carcinoma cells [J]. Shandong Medicine, 2020: 35-39.

[9] Le Wei; Wang Chao; Deng Bo; Zhang Yong. Effect and mechanism of combined application of luteolin and resveratrol on apoptosis of human hepatocellular carcinoma cells [J]. Shandong Medicine, 2020:5.

[10] Chen Tiejun; Huang Wenjie; Liu Sheng; Tang Hui; Wu Yinbing; Tang Yunqiang. Effect of curcumin on proliferation and apoptosis of SMMC-7721 cells and its mechanism [J]. China Prescription Drugs, 2022:2.

[11] Xu Shiyi; Lv Chang; Li Xueying; Wang Qi; Yan Xueying. Antitumor pharmacodynamics of apigenin nanosuspension on HepG2 cells in vitro and in vivo [J]. Journal of Liaoning University of Traditional Chinese Medicine, 2020:5.

[12] Xie Pengfa; Liu Qingyang; Liu Ruiying; Huang Huixian; Qin Xiaomei; Huang Rongshi; Zhao Feilan. Research progress of curcumin intervention in liver cancer cells [J]. Science Consulting, 2021:3 (60-62).

[13] Chang Hong [1], Zhang Daowei [2], Si Guomin [3]. Research progress on molecular mechanism of curcumin and its nano-preparations against liver cancer [J]. Chinese Journal of Experimental Prescriptions, 2021:9.

[14] Chen Caiping, Xu Qi, Zhao Haifei. Intervention of curcumin on miR-29 and VEGF expression in hepatocellular carcinoma cells [J]. Zhejiang Journal of Integrated Traditional Chinese and Western Medicine, 2020: 785-790, supra 1.

[15] Chen Caiping; Xu Qi; Zhao Haifei. Intervention of curcumin on miR-29 and VEGF expression in hepatocellular carcinoma cells [J]. Zhejiang Journal of Integrated Traditional Chinese and Western Medicine, 2020:7.