PharmacologyOnLine

Archives • 2021 • vol.3 • 1544-1550

INFLUENCE OF SESAME OIL ON IMMUNOGENESIS AND HEMOPOIESIS IN IMURAN INDUCED IMMUNODEFICIENCY

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Abstract

Sesame oil has distinguished activities which have been already reported in the different articles with active treatment as antioxidant, blood pressure-lowering, antitumor, and serum lipid-lowering agents. Beside this they also have various types of essential amino acids, minerals, vitamins, niacin, and lignans which differentiate them from other plants for the treatment of different diseases. The immunopathological disorders occur in various systems like in hematopoietic system, which requires adequate correction [2-5]. In the present work, immunogenesis and hemopoiesis have been initiated with the help of sesame oil to eliminate the condition like immunosuppression caused by commercialized drug Imuran (Azathioprine), which is generally used in the treatment of Crohn's disease and rheumatoid arthritis. Moreover, this work concluded that the sesame oil (Uzbekistan) increases the number of AOCs for the entire spleen as well as the number of AOCs per 1 million splenocytes in the treated mice groups. The sesame oil also increases the number of erythrocytes and leukocytes in the peripheral blood in mice. The black seed oil (Egypt) has been used in this study as a reference which is already reported for the immunopathological conditions caused by Imuran. The outcome of this proposed work suggested that the sesame oils have been more effective than black seed oil and better option for the development of immunogenesis and hemopoiesis in the immunodeficient patients induced by Imuran.

Keywords: *Sesame oil, Imuran, antioxidant, immunodeficiency, black seed oil, erythrocytes, leukocytes*

Introduction

Immunosuppressive treatment is required for patients with autoimmune disorders or those who have had a transplant to lower the rate of rejection and the autoreactive cell activity. Also, they have enhanced the clinical state and life expectancy of the patients [1, 2].

Imuran is the brand name of Azathioprine (Aza) which is a purine analogy. This drug was discovered in the mid-1950s which revolutionized the therapy of organ transplantation [3]. Aza incorporates their metabolites inside the cell genome and block the replication of cell. They also inhibit the synthesis of T-cells during the immune responses [4]. This drug is very useful in the prevention of organ transplant rejection with different kind of organs like the kidneys, lung and liver. They also reduce the inflammatory responses developed due to the autoimmune diseases which include inflammation of bowel disease and the rheumatoid arthritis [5-9]. Excessive use of Aza has been linked to major side effects, demanding patient monitoring to reduce the risk of catastrophic events connected with its usage [3, 10].

For decades, natural products (herbs) have been utilized as traditional medicine. They have been intensively researched owing to their critical role in the treatment of human sickness, despite the fact that their safety and efficacy have yet to be proven scientifically. As per the World Health Organization (WHO), approximately to 70 to 80% of the world's population still uses alternative medicines to improve their quality of life [11]. Nigella sativa (black seed) is one of the natural plants which carry various types of properties like antioxidant, antibacterial, anti-inflammatory, antidiabetic, anticancer, antifungal, and antiviral properties in the past [11-13].

Sesame (Sesamum indicum L.) seeds have been utilised for thousands of years because of its extremely stable oil and large amounts of essential amino acids (tryptophan, methionine, and valine), minerals, vitamins, niacin, lignans, and pleasant nutty roasted flavours. Furthermore, it seems to have a strong tradition of therapeutic usage, particularly in eastern nations [14]. Sesamin compound has been reported for antioxidant, blood pressure-lowering, antitumor, and serum lipid-lowering properties [15]. Toorani and colleagues reported that the sesamol contains higher antioxidant activity in the methyl esters of fatty acid as compared to their triacylglycerols [16]. Due to the presence of sesamin, sesamolin, sesaminol, sesamol, and α-tocopherol **(figure 1)**, sesame oil has been shown to be more resistant to oxidative alterations than other vegetable oils [15, 17, 18].

However, many studies have been reported earlier which showed the different pharmacological activities of the sesame oil, but it seems there is no information on the impacts of sesame oil on immunogenesis and hemopoiesis to modulate immune system. As a result, the current research was planned and carried out to investigate the effects of sesame oil on immunogenesis and hemopoiesis in Imuran-induced immunodeficiency.

Methods

During the experiment white outbred mice of both sexes weighing 20-22 gm have been used. Secondary immunodeficiency was induced using the immunosuppressant Imuran (azathioprine). The drug in a dose of 50 mg/kg was injected daily intraperitoneally for 3 days. On the last day of the dosing of Imuran, mice were intraperitoneally immunized with sheep erythrocytes (EB) at a dose of 2x108/mice.

Then the mice were divided into 4 groups and each group has 8 mice. The first groups (control group) of mice were immunized with EB; the second groups of mice were treated with Imuran and were immunized with EB; the third groups of mice were treated with Imuran and were immunized with EB; and the last fourth groups of mice were treated with Imuran and were immunized with EB. While the third groups of mice were received sesame oil (Uzbekistan) at a dose of 0.25 ml/weight (12.5 ml/kg), orally for 3 days. On the other hand, the fourth groups of mice were received black cumin oil (Egypt) at a dose of 0.25 ml/weight (12.5 ml/kg), orally for 3 days.

On the fourth day after the immunization with EB, mice of all groups were sacrificed and the number of antibody-forming cells (AFC) in the spleens was determined [19]. The number of AFCs was calculated for the whole organ (absolute value) and per 1

million spleen cells (relative value). The total number of nucleated spleen cells (NSCC) was counted. In the peripheral blood of the immunized mice, the number of erythrocytes and leukocytes were determined.

Results

The results of study based on oral dosing of sesame oil and black cumin oil to check the immune response to EB in different groups of mice treated with Imuran are summarized in the table 1. After the calculation, AOCs found in the control groups was 2531.3 ± 175.0, for the entire spleen (absolute value). Under the influence of Imuran, the immunological reactivity of the organ decreases sharply, as evidenced by a decrease in the number of AOCs in the spleen of mice; their number was 587.5 ± 42.0, which was 4.31 times lower than in the control.

If mice having secondary immunodeficiency, has been given sesame oil, then the number of AOCs per spleen in comparison with the previous group significantly increases by 1.85 times. However, the influence of black cumin oil, the number of AOCs in the spleen of mice treated with Imuran significantly increased by 1.77 times. Thus, the oil samples are able to stimulate the suppressed immune response to EB in mice treated with Imuran.

In the control group the numbers of AOCs per 1 million splenocytes are 14.9 ± 0.9, and in mice treated with Imuran, it decreases by 3.04 times. According to the relative indicator of the number of AFCs, immunosuppression is less pronounced when calculating the AFC based on the absolute indicator (IS = -4.31). In the groups of mice treated with Imuran and sesame oil and black cumin oil, the number of AFCs per 1 million spleen cells increased significantly by 1.53 times.

Consequently, the oil samples possess the ability to increase the number of AOCs both when calculating for the entire spleen and per 1 million splenocytes in mice with a secondary immunodeficiency state induced by Imuran.

The total number of JASCs in the control group was 169.7 ± 6.7□106, and in mice treated with Imuran, their level decreases significantly by 1.40 times **(Table 1)**. In mice with secondary immunodeficiency, which received sesame oil, the number of JASCs increased significantly by 1.20 times in comparison with the previous group, whereas black cumin oil obtained mice experienced the rise of JASC by 1.16 times.

Thus, the samples of sesame oils and black cumin oils could be significantly increasing the immune response to EB and the number of JASCs in mice treated with Imuran. Moreover, in terms of activity in relation to the studied indicators, sesame oil is not inferior to black cumin oil.

The effect of sesame oils and black cumin oils on the number of erythrocytes and leukocytes in the blood of mice treated with Imuran have also been investigated **(Table 2)**. In the control group, the number of erythrocytes was 5.9 ± 0.2x109 /ml, and in mice treated with Imuran, the number of erythrocytes decreases by 1.74 times.

The results have displayed that mice treated with Imuran, sesame oil significantly increased the number of erythrocytes by 1.29 times, and black cumin oil by 1.24 times ($p < 0.05$). As for the white sprout of hematopoiesis, in the control, the number of leukocytes was 7.7 ± 0.2x106 /ml, and in mice treated with Imuran, their level is reduced by 1.51 times ($p < 0.05$). In mice treated with Imuran and receiving sesame oil and black cumin oil, the number of leukocytes increased significantly by 1.27 and 1.24 times respectively in comparison with the previous group.

Discussion

Sesame oil has eminent pharmacological activities which have been already reported in the different articles in the context of antioxidant, blood pressure-lowering, antitumor, and serum lipid-lowering properties. They have various essential amino acids, minerals, vitamins, niacin, and lignans which make them first choice of natural compound for the treatment of different diseases. Based on the experiment done and the data obtained, sesame oil showed that this could be useful in the case of secondary immunodeficiency in mice caused by Imuran, an immunosuppressant drug. The treatment of mice groups with sesame oil increases the number of AOCs for the entire spleen by 1.85 times whereas the number of AOCs per 1 million splenocytes by 1.53 times. Also, this oil increases the number of erythrocytes by 1.29 times and

leukocytes by 1.27 times in the peripheral blood in mice. Sesame oil (Uzbekistan) was used with the reference of black seed oil (Egypt) in terms of its corrective activity in the immunopathological condition caused by Imuran, in relation to immunological and hematological parameters.

Acknowledgments

Text

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Table 1: Effect of sesame oils and black cumin oils on the immune response to red blood cells in mice treated with Imuran (M ± m, n = 8)

S. No.	Group	Dosage (ml/kg)	Quantity of NSC × 10^6	RI	Number of AFs per			
					Spleen	RI	10^6 cells spleen	RI
1.	Control	-	169.7± 6.7	-	2531.3±175.0	-	14.9±0.9	-
2.	Imuran	-	120.4± 4.7[a]	-1.40	587.5±42.0[a]	-4.31	4.9±0.3[a]	-3.04
3.	Imuran + Sesame oil (Uzbekistan)	12.5	144.4± 5.7[ab]	+1.20	1087.5±74.3[a] [b]	+1.85	7.5±0.4[ab]	+1.53
4.	Imuran+ Black seed oil (Egypt)	12.5	139.6± 5.5[ab]	+1.16	1037.5±62.5[a] [b]	+1.77	7.5±0.4[ab]	+1.53

AFS: antibody-forming cells; NSC: nucleated spleen cells; RI: ratio index; (-): in relation to 1 gr.; (+): in relation to 2 gr.

[a]Significantly to 1 gr.;

[b]Reliably to 2 gr.

Table 2: Effect of sesame oils and black seed oils on red blood cell count and leukocytes in the blood of mice treated with Imuran (M ± m, n = 8)

S. No.	Group	Dosage (ml/kg)	Erythrocytes× 10^9/ml	RI	Leukocytes×10^6/ml	RI
1.	Control	-	5.9 ± 0.2	-	7.7 ± 0.2	-
2.	Imuran	-	3.4 ± 0.1[a]	-1.74	5.1 ± 0.2[a]	-1.51
3.	Imuran + Sesame oil (Uzbekistan)	12.5	4.4 ± 0.2[ab]	+1.29	6.5 ± 0.2[ab]	+1.27
4.	Imuran + Black seed oil (Egypt)	12.5	4.2 ± 0.2[ab]	+1.24	6.3 ± 0.2[ab]	+1.24

RI: ratio index; (-): in relation to 1 gr.; (+): in relation to 2 gr.

[a]Reliably to 1 gr.;

[b]Reliably to 2 gr.

Figure 1. Different chemical constituents of sesame oil with their chemical structures.