



## Effects of *Teucrium polium* aquatic extract on blood cell parameters of *Candida albicans* infected in mice

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### ABSTRACT

*Teucrium polium* is an old medicinal plant which has been used due to its antimicrobial- anti fungal properties. The goal of this research was to study the effects of *Teucrium polium* aquatic extract on blood cell parameters of *Candida albicans* infected animal model. 72 female mice were divided randomly in five groups including control, candida, placebo, and three experimental groups. Aquatic extract was injected in peritoneum in 50, 100 and 200 mg/kg doses for 20 days. Physiological serum was used as placebo group and the effect of extract on cells and blood parameters and disease improvement were evaluated. Obtained data were analyzed using SPSS program and means were compared using Duncan's multiple ranges test. According to results, the extract reduced red blood cells and hemoglobin significantly. By improving infection, white blood cells were in normal level. Hematocrit amount was reduced in proportion to candida group. MCV, MCH, MCHC, and monocyte amounts were not different in experimental groups and candida group. Platelets amount was not significantly different from control and candida groups. Lymphocytes amount was increased in proportion to control group significantly. Neutrophils amount was increased in all groups significantly in proportion to candida group. In general, the extract of *Teucrium polium* could affect blood cells toward controlling *Candida albicans* pathogen.

**Keywords:** *Teucrium polium*, aquatic extract, *Candida albicans*, blood cell

### INTRODUCTION

People are surrounded worldwide by various types of diseases and infections including fungal infections [1]. *Candida* is one of the most important fungal pathogens for human which has high diversity. *Candida albicans* is the most important pathogen which causes fungal infections including mucosal or systemic infections.

Researches about anti-fungal compounds have been increased lately [2]. The role of medicinal plants in curing various pathological disorders has been proven in last decades [3].

*Teucrium polium* is a plant from mint family with more than 300 genera which are spread worldwide [4]. This plant includes compounds like monoterpenes, polyphenolic compounds, strols, saponin, iridol, flavonoids, polyphenolic compounds, alkanoides, and essential oils [5]. These compounds cause lots of benefits like: anti-oxidant, anti-inflammation, pain relieving, sugar reduction, fat reduction, Antirheumatic [6], antipyretic, and anti-fungal [5] properties. Researches about anti-fungal effects of plant extract show that alcoholic extract of plant had anti-fungal effect on NCPF3153, ATCC1675, and ATCC6206 races of *Candida albicans*. The inhibitory effect of the extract varied according to the concentration [7]. Considering mentioned anti-fungal effects of *Teucrium polium*, the effects of aquatic extract of this plant was studied on blood parameters of female mice which were infected to *Candida albicans*.

## EXPERIMENTAL SECTION

72 female mice from NMRI race were used in this study. Animals were kept for one month to adapt to environment and stress relieving. Samples had free access to food and water. Standard compact food was used. Light and humidity were normal and temperature was in 25-29c range. To prepare aquatic extract, aerial organs of plant in flowering period were used.

Experimental groups were:

Control group: This group didn't receive any injection and was used as natural criterion for comparing blood parameters of treatment groups.

Candida group: Samples of this group received suspension of *Candida albicans* (ATCC 1677) (concentration 0.5, MacFarland) to induce experimental infection and was considered as patient group.

Placebo group: Members of this group received 0.5 cc of normal saline (via injection) every other day for 20 days to study the effects of injection shock.

First treatment group: Received 10 injections of germander aquatic extract in dose of 50 mg/kg of for 20 days.

Second treatment group: Received 10 injections of germander aquatic extract in dose of 100 mg/kg of for 20 days.

Third treatment group: Received 10 injections of germander aquatic extract in dose of 200 mg/kg of for 20 days.

All injections were done in peritoneum and each group had 12 members. After the injections, blood samples were taken and used for CBC tests. Obtained data were analyzed using SPSS program. Duncan's multiple ranges test was used to compare means at 5% probability level.

## RESULTS AND DISCUSSION

**White blood cells:** According to results, Candida group was different significantly from other groups and had higher WBC amount but there was not any significant different between experimental groups and control group (Figure 1).

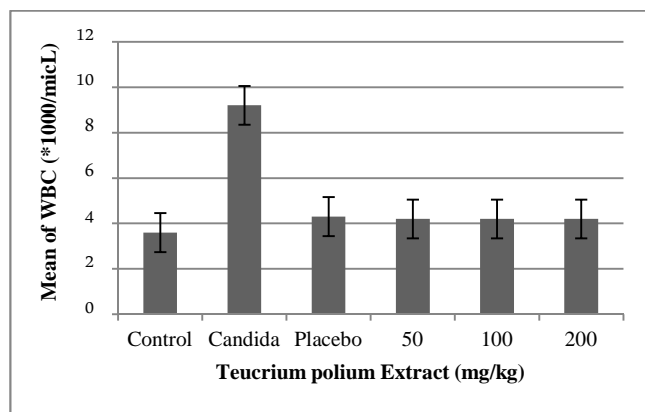


Figure1. Mean comparison of WBC

**Red blood cells:** Mean comparison of Red blood cells showed that increase in extract concentration reduced RBC significantly but Candida and placebo groups didn't show significant difference from control group (Figure 2).

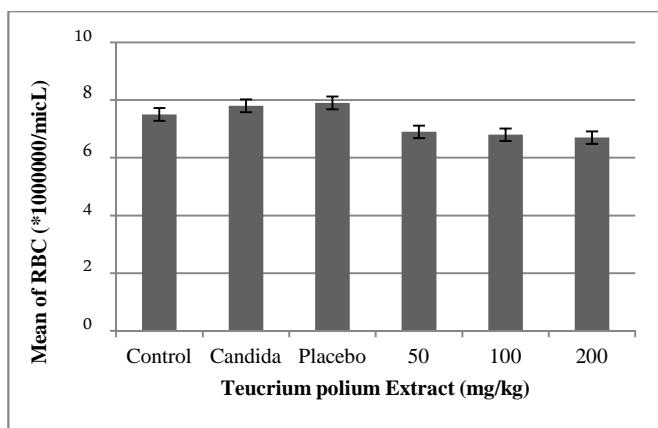


Figure 2: Mean comparison of RBC

**Hematocrit percentage:** According to results, hematocrit amount of experimental groups was less than candida group significantly (Figure 3).

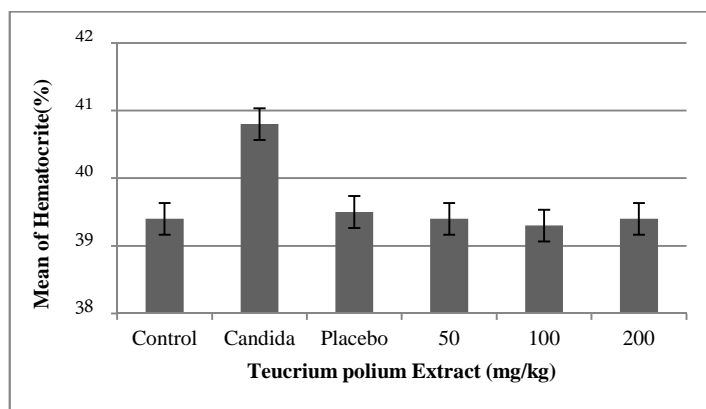


Figure 3: Mean comparison of hematocrit percentage

**Lymphocyte percentage:** Mean comparison of lymphocyte percentage showed that all groups were different from candida group significantly (Figure 4).

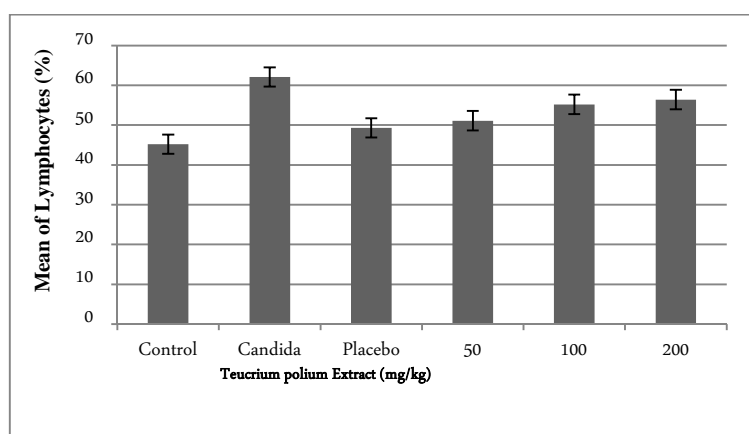


Figure 4: Mean comparison of lymphocyte percentage

The goal of this research was to study the effects of *Teucrium polium* aquatic extract on blood cell parameters of *candida albicans* infected animal model. Previous researches have shown that *Teucrium polium* extract increased WBC numbers. It seems that this is occurred in this study too because immune system has been stimulated by pathogen but after controlling the candida by extract doses, the amount of WBC returned to its normal level again.

In Modarresi and Poormatin study [8], extant saponin in licorice caused hemolysis of red blood cells. Since *Teucrium polium* has saponin also [5] reduction in RBC amount in this study can be ascribed to saponin.

MCV, MCH, and MCHC parameters are varied by hemoglobin, hematocrit and RBC, therefore, occurred changes of those parameters can be due to change in mentioned parameters amounts. Also, considering the variation it can be said that MCV amount is reduced in virulent inflammation. In this study, controlling the inflammation increased the MCV amount. Previous studies show that felty germander can increase platelet amount [9]. Since platelets can control *Candida albicans* [10] it can be said that this factor is the reason of plant ability in therapy.

Lymphocytes amount was increased in treatment groups in proportion to control group but it was less than *Candida* group. This indicates that extract, which has flavonoids and antioxidants properties [5, 11], stimulates lymphocytes via affecting cytokines to produce TH1 type which is more effective in controlling candida. Also, interleukins IL<sub>12</sub> and IL<sub>2</sub> lead to lymphocytes aggregation in the site of infection [12].

In study of Noori Ahmad Abadi et al. [13] on hydro alcoholic extract of *Ziziphus jujube*, it was announced that triterpenoids of jujube could activate hemoxxygenase-1 enzyme which reduced monocytes number finally. It seems that germander compounds induced this effect also.

Neutrophil is one of the effective key compounds in controlling *Candida albicans* which is reduced in acute infections [10]. Controlling effect of neutrophil on *Candida albicans* is induced by oxidative and non-oxidative mechanisms [14]. It can be said that some extant compounds in felty germander increased neutrophils and after that neutrophils controlled the *Candida albicans* effects.

## CONCLUSION

Considering the results, *Teucrium polium* has desirable effects on blood parameters for controlling *Candida* infection and can be used in treatment of opportunistic infections such as *Candida albicans*.

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