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Original article

Investigation of Antioxidant Activities of *Melissa officinalis* and *Lavandula angustifolia* Extracts against Chromium Induced Oxidative Damage in *Saccharomyces cerevisiae* with Molecular Biological and Biochemical Biomarkers

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Abstract. *Background and aim: Melissa* and *Lavandula* are known to exhibit high antioxidant and strong biological activities thanks to their rich polyphenol and aromatic content. In this study, eight groups were created to investigate whether *Melissa* and *Lavandula* have a protective role against chromium damage in *Saccharomyces cerevisiae* (*S. cerevisiae*). *Methods:* Application groups: (i) Control Group; (ii) Chromium (30 mM); (iii) *Melissa* (20%); (iv) *Lavandula* (20%); (v) *Melissa* (20%) + *Lavandula* (20%); (vi) *Melissa* (20%) + Chromium (30 mM); (vii) *Lavandula* (20%) + Chromium (30 mM); (viii) *Melissa* (20%) + *Lavandula* (20%) + Chromium (30 mM). *S. cerevisiae* cultures were grown at 30 °C for 1, 3, 5 and 24 hours. Cell growth, malondialdehyde (MDA) analyzes, glutathione (GSH) levels, catalase (CAT) activities were determined by spectrophotometer. Total protein concentrations were determined by sodium dodecyl sulphate polyacrylamide gel electrophoresis (SDS-PAGE) and bradford method. *Results:* According to the results, when compared with the chromium group, cell growth (1, 3, 5 and 24 hours), total protein synthesis, GSH level (24 hours) and CAT level (24 hours) increased in *Melissa*, *Lavandula* and *Melissa* + *Lavandula* while MDA level (24 hours) decreased. *Melissa* and *Lavandula* plant extracts, which are rich in polyphenolic compounds, were found to provide antioxidant protection and reduce oxidative damage in *S. cerevisiae* culture. *Conclusions*: Thus, it is thought that it will contribute to new treatment methodologies by providing effective protection in the treatment of many diseases thanks to its strong antioxidant and anti-inflammatory properties.

Key words: electrophoresis, cell growth, oxidative damage, protein, *Saccharomyces cerevisiae*.

Introduction

In the last few years, with the increase of Covid-19, which has become a global epidemic, as well as many deadly diseases in the world, people have started to seek various solutions for the treatment of diseases. In addition to chemical drugs, herbal treatment methods known as phytotherapy, which is one of the alternative treatment methods, also attract a lot of attention. The results obtained from many clinical and experimental studies have shown that phenolic compounds have important protective effects against oxidative damage in the treatment of various diseases. *Melissa officinalis* and *Lavandula angustifolia* are known to have numerous biological activities such as antioxidant, antiinflammatory, anticarcinogenic, antiviral, antibacterial, antimicrobial and antifungal because they contain natural bioactive compounds (caffeic, chlorogenic, gallic acid, terpenes, terpineol, camphor, lynalyl acetate, sironelal, polyphenol, phenolic compounds etc.) (1). *Melissa officinalis* is a perennial herb and a member of the Lamiaceae family. It generally spreads all the way

to Southern Europe, Central Asia and North America. It has been found that it can grow in sandy and bushy areas, but also in humid barren lands at altitudes ranging from sea level to mountains. *Melissa officinalis* contains abundant flavonoids (quercitrin, rhamnocitrine, luteolin), polyphenolic compounds (rosmarinic acid, caffeic acid and protocatechic acid), aldehydes, essential oils, glycosides, terpenes and tannins. It is known that it has an important role in protecting health and curing diseases, thanks to its many active components such as phenolic compounds, volatile organic compounds, flavonoids, terpenoids, gallic acids, rich antioxidant capacity and radical scavenging properties. In addition to all these, it helps sleep by removing mental stress (2, 3, 4). *Lavandula angustifolia*, a flowering plant from the Labiatae (Lamiacae) family, is used as an herbal medicine in traditional medicine. It has functions as antispasmodic, anticonvulsant, antidepressant, pain reliever and gas reliever. 1,5-dimethyl-1-vinyl-4-hexenyl, one of the main components of *Lavandula angustifolia* oil, shows high antioxidant activity against lipid peroxidation occurring in the cell. In addition, it is known to have healing properties for wounds and burns by modulating the balance of antiinflammatory and antiinflammatory cytokines (5). *Saccharomyces cerevisiae* (*S. cerevisiae*), known as baker's yeast, is a eukaryotic microorganism used for commercial purposes both in the food sector and in industry (alcoholic beverages, bakery products, ethanol production). Genetically similar to the human genome, it is widely used in both the food and pharmaceutical industries, and has an important place as a model organism in the field of biotechnology (6). Chromium ($K_2Cr_2O_7$), which was used as a source of oxidative stress in *S. cerevisiae* in this study, is a heavy metal and has devastating effects on humans, animals, plants and ecosystems. Chromium and similar heavy metals cause fatal effects on living things after they enter through air, water or food (7).

Oxidative stress may be the result of increased free radical production and decreased antioxidant defense. Thanks to their ability to take electrons from target molecules, free radicals cause serious damage to the cell by disrupting enzymatic functions in both the cell membrane and genetic material (DNA, RNA). Oxidative stress, lipid peroxidation end product malondialdehyde (MDA) is the marker of oxidative damage, and antioxidant enzymes such as glutathione (GSH) and catalase activity (CAT) are the markers of antioxidants (8). In this context, it is thought that plant extracts of *Melissa* and *Lavandula* which are among the important medicinal plants, it will eliminate oxidative stress and free radicals caused by chromium.

Material and Method

Herbal Materials

The *Melissa officinalis* and *Lavandula angustifolia* were used as herbal materials and they were obtained from Elazig in Turkey.

Application Groups

In this study, the therapeutic activity of plant extracts of *Melissa officinalis* and *Lavandula angustifolia* were investigated against chromium-induced oxidative damage in *S. cerevisiae*. The application groups are as follows.

i. Control Group: (Only *S. cerevisiae* cultured group),
ii. Chromium Group: The group given Chromium (30 mM),
iii. *Melissa* Group: The group given *Melissa* (20%),
iv. *Lavandula* Group: The group given *Lavandula* (20%),
v. *Melissa* + *Lavandula* Group: The group given *Melissa* (20%) and *Lavandula* (20%),
vi. *Melissa* + Chromium Group: The group given *Melissa* (20%) and Chromium (30 mM),
vii. *Lavandula* + Chromium Group: The group given *Lavandula* (20%) and Chromium (30 mM),
viii. *Melissa* + *Lavandula* + Chromium Group: The group given *Melissa* (20%), *Lavandula* (20%) and Chromium (30 mM).

Melissa, Lavandula and Chromium Application to S. cerevisiae Culture

The developmental environment of *S. cerevisiae*: YEPD (15 grams of yeast extract, 15 grams of glucose, 15 grams of tryptone for 500 ml) was prepared for the

growth and propagation of yeast. 9 flasks for 8 groups and blinds were taken and 100 ml of the stock medium prepared was added to all of them. After being autoclaved at 121 °C for 1 hour, it was removed and cooled. Next to the burner flame, 1 ml of yeast was added to each flask. After 30 minutes in the oven, the blind measurement was made.

Preparation of 20% Melissa Extract

20 grams of *Melissa* is brewed with 200 ml of distilled water.

Preparation of 20% Lavandula Extract

20 grams of *Lavandula* is brewed with 200 ml of distilled water. Then, Chromium, *Melissa* and *Lavandula* extracts were added to the other flasks removed from the oven, along with the burner flame. According to the content of the groups, 2 ml *Melissa* and *Lavandula* extracts and 0.30 grams Chromium were added and allowed to develop at 30 °C (9, 10).

Cell Growth Measurements

Culture samples were grown for 1, 3, 5 and 24 hours (overnight) at 30 °C and measured at 600 nm wavelength with a spectrophotometer (11).

Total Protein Density Measurements

Total protein density was determined using a spectrophotometer at a wavelength of 595 nm (OD_{595}) according to the Bradford method. Bovine serum albumin (BSA) protein standards were obtained at different ratios by using BSA protein. The total amount of protein in the *S. cerevisiae* groups corresponding to this standard value was calculated (12, 13).

Malondialdehyde (MDA) Analysis

0.5 ml of homogenate prepared for MDA analysis was taken and 0.5 ml of phosphate buffer, 0.5 ml of 15% trichloroacetic acid (TCA) solution was added and vortexing was performed. After centrifugation at 4000 rpm for 10 minutes, 1 ml of the supernatant formed was taken and 75 µl of 0.1M EDTA and 1% thiobarbituric acid (TBA) solution prepared in 250 µl of 0.05 N NaOH were added. It was kept in a boiling water bath for 15 minutes by performing vortkes at 10-15 second intervals. Absorbance values were measured in a spectrophotometer at a wavelength of 532 nm versus a blank (8, 14).

Glutathione (GSH) Analysis

For GSH analysis; 0.4 ml of 10% cell homogenate and 0.2 ml of 20% TCA were mixed. The supernatant was removed by centrifugation at 3000 rpm for 15 min. For the blind sample, 0.2 ml of 150 mM KCl, 0.2 ml of the supernatant and 1 ml of 0.3 M Na_2HPO_4 were mixed. After waiting for 5 min., the absorbance of the yellow color was measured in spectrophotometer at 412 nm wavelength (15, 16).

Catalase Activity (CAT)

Catalase activity was carried out according to the method determined by Aebi (17). By measuring the prepared homogenate, the rate of decomposition of the substrate H_2O_2 was measured in a spectrophotometer at a wavelength of 240 nm for 30 seconds (8, 17).

Sodium Dodecyl Sulphate Polyacrylamide Gel Electrophoresis (SDS-PAGE) Protein Isolation

1 ml of the culture sample was taken and centrifuged at 13000 rpm for 10 minutes, the pellet part was removed and 500 µl of Tris EDTA acetate (TEA /pH: 7.5) was added. Then, it was crushed twice for 10 seconds with the help of a sonicator and kept in ice for 10 minutes. The supernatant was taken by centrifugation at 13000 rpm for 10 minutes. In order to carry out the loading process of Sodium Dodecyl Sulphate Polyacrylamide Gel Electrophoresis (SDS-PAGE), an equal amount of dyeing solution and the material sample to be loaded was mixed. It was prepared for loading into the wells (10, 18).

Sodium Dodecyl Sulphate Polyacrylamide Gel Electrophoresis (SDS-PAGE) Analysis

Before loading the protein samples of *S. cerevisiae* cultures into the wells, an equal amount of SDS-PAGE

sample amplification buffer was added and boiled for 5 minutes. A current of 30 mA was applied until the end of the gel, up to the blue band of the dye (bromophenol blue), which allows the movement of proteins in the gel to be monitored by electrophoresis. After electrophoresis, the gel was stained with Coommamsie dye for 20-30 minutes. Then, the protein bands were washed 2-3 times with a stain remover solution until they were clearly visible. The protein band intensities in the groups were examined (19, 20).

Statistical Analysis

Statistical analyzes were evaluated with variance analysis in SPSS 22 package program. The values were expressed as mean ± SD. Statistical significance was detected by analysis of variance (One Way Anova *Post Hoc* LSD Test; Value of $p < 0.05$ indicated statistical difference).

Results

S. cerevisiae Cell Development Measurement Results

Statistically significant differences were observed between the groups with different developmental times in Figure 1A ($p<0.05$). It was observed that plant extracts of *Melissa* (20%) and *Lavandula* (20%) transport to the culture increased cell growth towards chromium damage in *S. cerevisiae*. Compared to the damage group treated with Chromium (30 mM), cell growth was found to be quite high in the groups treated with *Melissa* (20%), *Lavandula* (20%), *Melissa* (20%) + *Lavandula* (20%).

S. cerevisiae Total Protein Density Measurements Results

Melissa and *Lavandula* extract were determined to increase protein synthesis in *S. cerevisiae* (Table 1, Table 2, Table 3, Figure 1B, Figure 1C and Figure 1D). No statistically significant difference was observed between the control, *Melissa* (20%) and *Lavandula* (20%) groups. Total protein levels decreased in the Chromium (30 mM) group compared to the *Melissa* (20%) + Chromium (30 mM), *Lavandula* (20%) + Chromium (30 mM) and *Melissa* (20%) + *Lavandula* (20%) + Chromium (30 mM) groups.

S. cerevisiae Malondialdehyde (MDA) Results

MDA levels were significantly decreased in *Melissa* (20%) + Chromium (30 mM), *Lavandula* (20%) + Chromium (30 mM), *Melissa* (20%) + *Lavandula* (20%) + Chromium (30 mM) groups (Table 4, Figure 1E and Figure 1F).

S. cerevisiae Glutathione (GSH) Results

While there was no statistical difference in the GSH levels of the *Melissa* (20%) and *Lavandula* (20%) groups, the GSH level was found to be the lowest in the Chromium (30 mM) applied damage group (Table 5 and Figure 1G). In addition, it was determined that the GSH level was the highest in the *Melissa* (20%) + *Lavandula* (20%) group.

S. cerevisiae Catalase Activity (CAT) Results

While there was no statistical difference in the CAT activity of the *Melissa* (20%), *Lavandula* (20%) and *Melissa* (20%) + *Lavandula* (20%) groups, the CAT activity was found to be the lowest in the Chromium (30 mM) applied damage group (Table 6 and Figure 1H).

S. cerevisiae Sodium Dodecyl Sulphate Polyacrylamide Gel Electrophoresis (SDS-PAGE) Results

According to obtained results from electrophoresis gel images (Figure 2), it was observed that the protein density was the lowest in the Chromium (30 mM) group, and the highest in the *Melissa* (20%), *Lavandula* (20%) and *Melissa* (20%) + *Lavandula* (20%) groups.

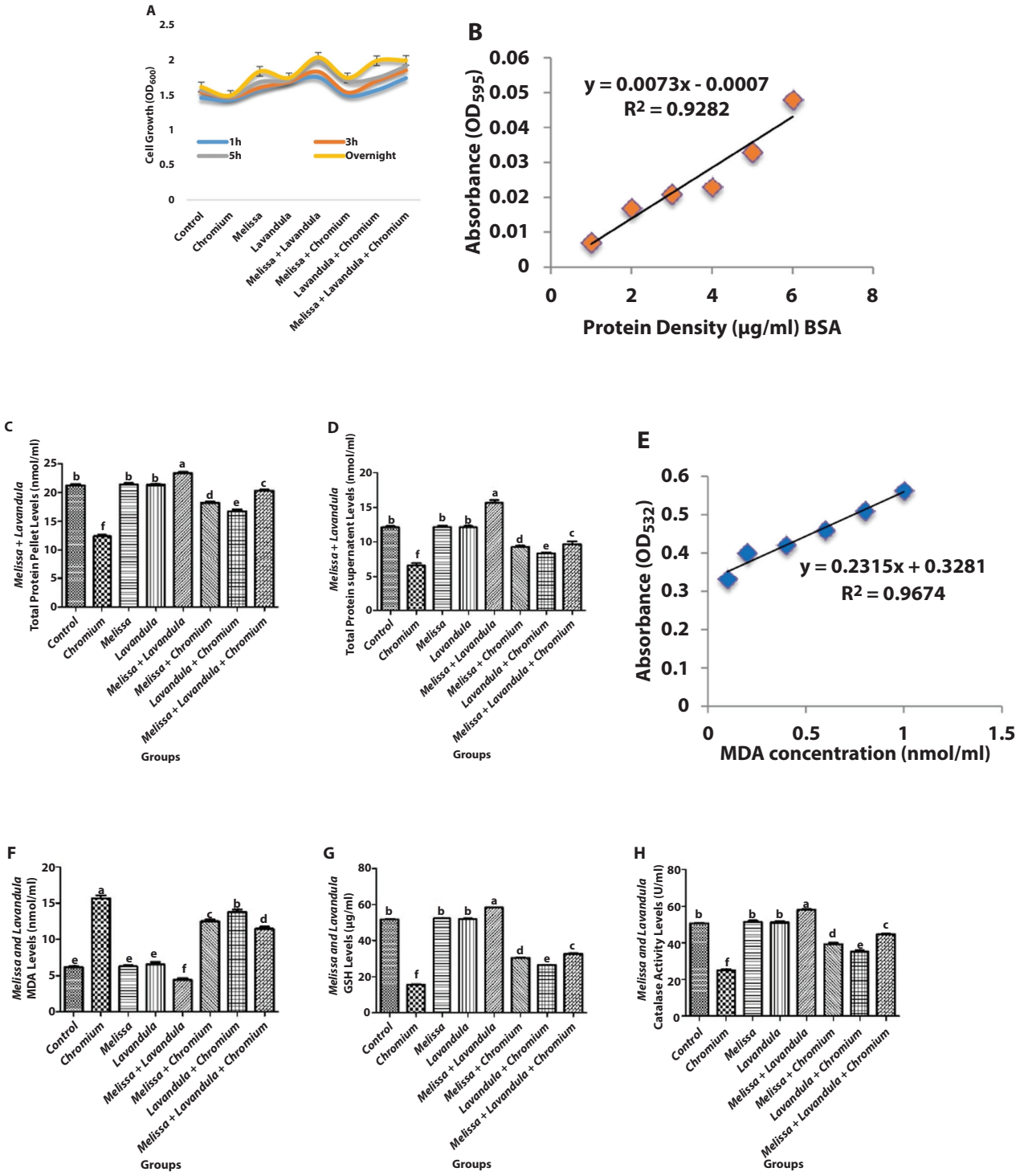

Figure 1. A) Cell development of *S. cerevisiae* at different times; B) Standard curve of bradford bovine serum albumin (BSA); C) The pellet total protein density among groups; D) The supernatant total protein density among groups; E) MDA standard curve; F) MDA level among groups; G) GSH level among groups; H) CAT level among groups

Table 1. Bradford pellet total protein density

Groups (Pellet)	Total Protein Density (µg/ml)
Control	21.09 ± 0.06[b]
Chromium	12.42 ± 0.02[f]
Melissa	21.43 ± 0.06[b]
Lavandula	21.30 ± 0.06[b]
Melissa* + *Lavandula	23.38 ± 0.07[a]
***Melissa* + Chromium**	18.09 ± 0.04[d]
***Lavandula* + Chromium**	16.67 ± 0.03[e]
***Melissa* + *Lavandula* + Chromium**	20.41 ± 0.05[c]

a-f: The difference between the groups bearing the different letters in the columns is significant (p<0.05).
One-Way ANOVA *Post Hoc* LSD Test

Table 2. Bradford supernatant total protein density

Groups (Supernatant)	Total Protein Density (µg/ml)
Control	12.03 ± 0.05[b]
Chromium	6.67 ± 0.01[f]
Melissa	12.15 ± 0.05[b]
Lavandula	12.08 ± 0.05[b]
Melissa* + *Lavandula	15.71 ± 0.06[a]
***Melissa* + Chromium**	9.27 ± 0.03[d]
***Lavandula* + Chromium**	8.31 ± 0.02[e]
***Melissa* + *Lavandula* + Chromium**	9.82 ± 0.04[c]

a-f: The difference between the groups bearing the different letters in the columns is significant (p<0.05).
One-Way ANOVA *Post Hoc* LSD Test

Table 3. Cell development of *S. Cerevisiae melissa and lavandula* at different times

Groups	1h	3h	5h	24h (Overnight)
Control	1.452 ± 0.04[b]	1.536 ± 0.05[b]	1.563 ± 0.06[b]	1.609 ± 0.07[b]
Chromium	1.423 ± 0.01[f]	1.460 ± 0.01[f]	1.471 ± 0.02[f]	1.488 ± 0.03[f]
Melissa	1.572 ± 0.04[b]	1.596 ± 0.05[b]	1.679 ± 0.06[b]	1.831 ± 0.07[b]
Lavandula	1.676 ± 0.04[b]	1.682 ± 0.05[b]	1.707 ± 0.06[b]	1.738 ± 0.07[b]
Melissa* + *Lavandula	1.746 ± 0.05[a]	1.826 ± 0.06[a]	1.984 ± 0.08[a]	2.030 ± 0.09[a]
***Melissa* + Chromium**	1.488 ± 0.03[d]	1.529 ± 0.03[d]	1.698 ± 0.04[d]	1.739 ± 0.05[d]
***Lavandula* + Chromium**	1.563 ± 0.02[e]	1.696 ± 0.02[e]	1.738 ± 0.03[e]	1.982 ± 0.04[e]
***Melissa* + *Lavandula* + Chromium**	1.735 ± 0.03[c]	1.847 ± 0.04[c]	1.902 ± 0.05[c]	1.987 ± 0.06[c]

**a,b,c,d,e,f: Among the groups which bearing of different letter are significant (p<0.05). One way Anova Post *Hoc* LSD Test

Table 4. MDA Levels

Groups	MDA Level (nmol/ml)
Control	6.10 ± 0.03[e]
Chromium	15.93 ± 0.08[a]
Melissa	6.24 ± 0.03[e]
Lavandula	6.46 ± 0.03[e]
Melissa* + *Lavandula	4.49 ± 0.02[f]
***Melissa* + Chromium**	12.65 ± 0.05[c]
***Lavandula* + Chromium**	13.99 ± 0.06[b]
***Melissa* + *Lavandula* + Chromium**	11.39 ± 0.04[d]

a-f: The difference between the groups bearing the different letters in the columns is significant (p<0.05).
One-Way ANOVA *Post Hoc* LSD Test

Table 5. GSH Levels

Groups	GSH Level (µmol/ml)
Control	51.87 ± 0.05[b]
Chromium	15.52 ± 0.01[f]
Melissa	52.28 ± 0.05[b]
Lavandula	52.06 ± 0.05[b]
Melissa* + *Lavandula	58.31 ± 0.06[a]
***Melissa* + Chromium**	30.46 ± 0.03[d]
***Lavandula* + Chromium**	26.54 ± 0.02[e]
***Melissa* + *Lavandula* + Chromium**	32.83 ± 0.04[c]

a-f: The difference between the groups bearing the different letters in the columns is significant (p <0.05).
One-Way ANOVA *Post Hoc* LSD Test

Table 6. CAT Levels

Groups	CAT Activity (U/ml)
Control	25.19 ± 0.06[b]
Chromium	12.56 ± 0.01[f]
Melissa	25.93 ± 0.06[b]
Lavandula	25.57 ± 0.06[b]
Melissa* + *Lavandula	29.10 ± 0.08[a]
***Melissa* + Chromium**	19.82 ± 0.03[d]
***Lavandula* + Chromium**	17.75 ± 0.02[e]
***Melissa* + *Lavandula* + Chromium**	22.28 ± 0.04[c]

a-f: The difference between the groups bearing the different letters in the columns is significant ($p < 0.05$).
One-Way ANOVA *Post Hoc* LSD Test

Discussion

The use of medicinal herbs has been traditionally used in the treatment of diseases for centuries. In fact, its functionality in preventing and treating diseases is important because it has natural basic chemical components in its main usage purposes. In general, *Melissa officinalis* and *Lavandula angustifolia* have been determined to have antiviral, antiinflammatory, antibacterial, antioxidant, antifungal, antiparasitic, antihypertensive, antipyretic, fatigue-relieving effects as well as neuroprotective and cardioprotective activities (1, 3).

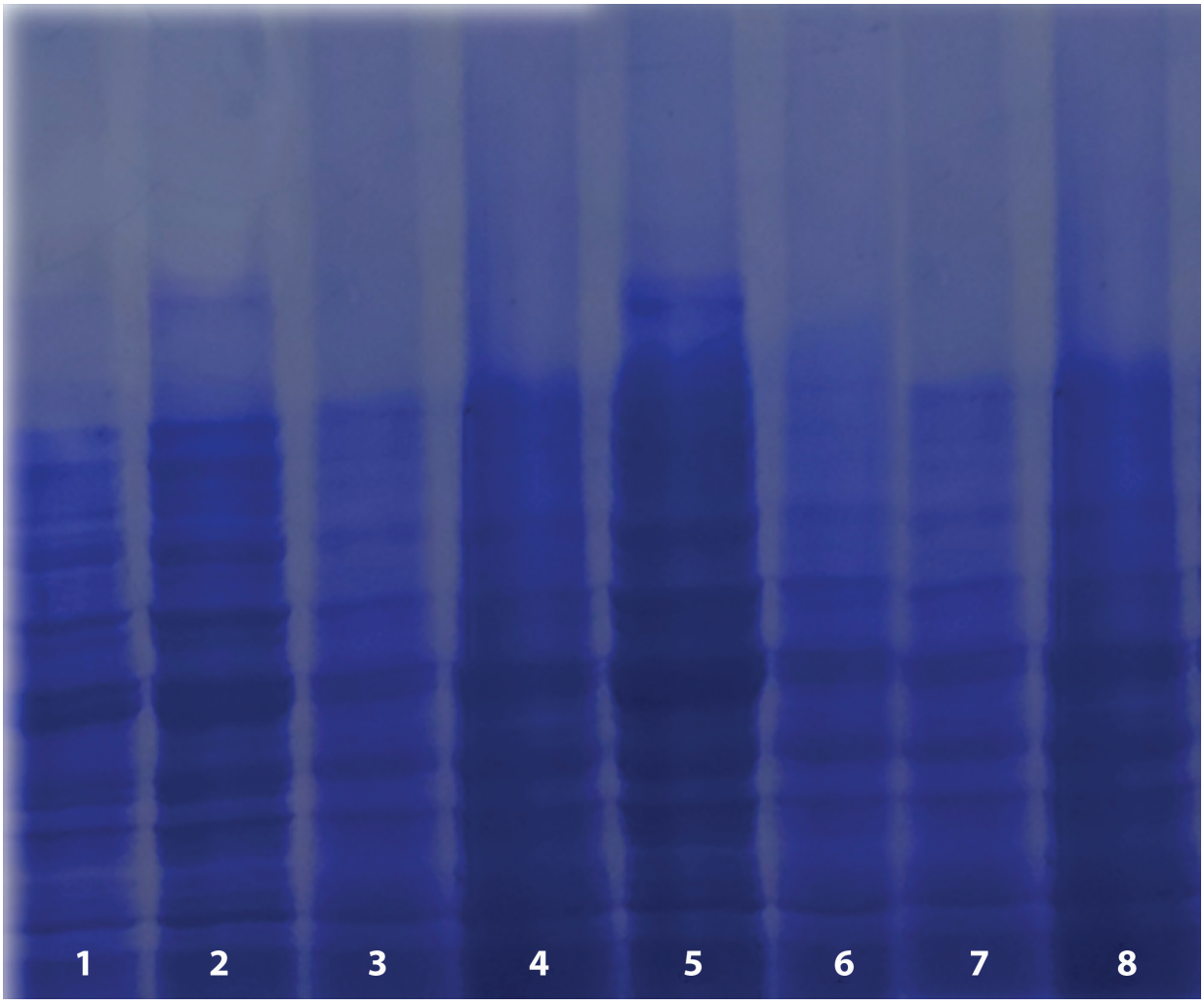

Figure 2. SDS- PAGE Pellet Protein Bands, Bands: 1: Control; 2: *Melissa,* 3: Chromium; 4: *Lavandula*; 5: *Melissa* + *Lavandula*; 6: *Melissa* + Chromium; 7: *Lavandula* + Chromium; 8: *Melissa* + *Lavandula* + Chromium.

Hajhashemi and Safaei (21) found that the combination of *Melissa* and *Lavandula* plant extracts had significant hypnotic activity in mice and was beneficial in the treatment of insomnia. Gok et al. (10) determined that sumac extract increased GSH level and CAT activities by providing antioxidant protection against oxidative damage in *S. cerevisiae* culture. Abbasijahromi et al. (22) emphasized that aromatherapy using essential oils of *Lavandula* and *Damascus* has a healing effect by reducing the level of anxiety and pain severity after cesarean section. Nasiri and Mahmodi (23) stated that aromatherapy massage with *Lavandula* essential oil applied on 90 patients with knee osteoarthritis showed a healing effect by reducing musculoskeletal injury at the end of 4 weeks. Watson et al. (24) found that these two plants are quite effective in the treatment of the disease as a result of a randomized controlled study of essential oils of *Melissa* and *Lavandula* for the treatment of agitated behaviors in elderly people with and without dementia. Naseri et al. (4) examined the impact on *Melissa* extract on learning and memory on nitric oxide synthase-induced neurotrophic factor expression in the brain hippocampus of diabetic rats and stated that it increased BDNF and NO synthase gene expression by significantly improving learning and memory. Beyaz et al. (9) stated that *Curcumin* treatment increased GSH levels by reducing hydrogen peroxide-induced oxidative damage and significantly decreased MDA levels.

Karan (25) determined that inhalation of *Lavandula* oil reduces perioperative anxiety and has potential soothing properties in patients undergoing surgery under local anesthesia in dentistry. Rafi et al. (26) found that aromatherapy massage with a combination of *Lavandula* and *Chamomile* oil increased the quality of sleep by reducing anxiety in burn patients. Sipos et al. (27) evaluated the cell viability of *Melissa* plant extract, which has antiinflammatory and anticancer properties, on normal (HaCaT-human keratinocytes) and tumor (A375-human melanoma) cells and its effect on physiology. They determined that *Melissa* extract has a potential effect in the treatment of skin disorders by reducing capillary veins. Varaei et al. (28) stated that inhalation and massage aromatherapy with *Lavandula* and sweet orange is quite effective in reducing fatigue in hemodialysis patients. Babatabar-Darzi et al. (29) found that *Lavandula* and rose aromatherapy could reduce anxiety, surgical site pain, pain severity and anxiety after open heart surgery. Ghazizadeh et al. (30) stated that the hydro-alcoholic extract of *Melissa* prevents anxiety and depression by preventing apoptosis as well as central oxidative stress. Kuo et al. (31) reported that *Melissa* antiinflammatory, antioxidation and anticancer effects inhibit migration in human colorectal cancer cells by inducing apoptosis. Kheirkhah et al. (32) stated that *Melissa* tea provides cardioprotective protection by positively affecting the frequency of early ventricular beats and cardiometabolic profile in patients with premature ventricular contraction. Araj-Khodae et al. (33) stated that *Melissa* and *Lavandula* treatment had an equal effect with fluoxetine, a widely used antidepression drug. Gokce (11) determined that *Pistacia vera* L. extract significantly increased GSH, CAT activity and cell growth by decreasing the level of MDA, which is an oxidative stress marker against CCl_4-induced oxidative stress in *S. cerevisiae*. Aslan (34) concluded that *Goji berry* extract increased cell growth of *S. cerevisiae* by eliminating chromium-induced oxidative damage in *S. cerevisiae* culture. Moreover, it was determined that the *Goji berry* extract decreased the MDA level and increased the GSH level and CAT activities significantly. Gok et al. (20) found that persimmon leaf has a therapeutic effect by increasing *S. cerevisiae* cell growth and promoting protein synthesis.

Zeraatpishe et al. (35) found that *Melissa* treatment reduced MDA levels and raised GSH levels and CAT activity significantly in radiology personnel who were constantly exposed to low-dose radiation during the study. Moreover, they concluded that *Melissa* treatment significantly improved oxidative stress status and DNA damage.

Beyaz et al. (18) stated that EGCG treatment showed biological activities such as antioxidant, antimicrobial and antiinflammatory. Gok et al. (36) stated that ellagic acid reduces oxidative damage in yeasts, increases cell growth and has a protective effect by promoting protein synthesis. Ghaderi and Solhjou (37) applied *Lavandula* aromatherapy to 24 children aged 7-9 years, and salivary cortisol and pulse rate were measured to evaluate the anxiety level of the children, and they concluded that *Lavandula* aromatherapy

reduced dental anxiety and experienced pain. Panahi et al. (38) stated that a combination of herbal drops (Lamigex) consisting of essential oils obtained from *Syzygium aromaticum, Geranium robertianum* and *Lavandula angustifolia* had a curative effect by reducing the infection of the acute otitis media symptom. Aslan et al. (39) emphasized that pomegranate juices have a protective role in reducing oxidative damage and increasing cell growth in *S. cerevisiae*. Rivaz et al. (40) investigated the effects of aromatherapy massage with *Lavandula* essential oil on neuropathic pain and quality of life in diabetic patients. They concluded that aromatherapy massage with lavender oil helped reduce neuropathic pain 2 to 4 weeks after the intervention and improved patients quality of life without causing any side effects. Aslan (41) indicated that mulberry extract increased cell growth by providing significant protection against H_2O_2 damage in *S. cerevisiae*.

Conclusion

Today, medicinal plants have an important place in many sectors such as food additives, cosmetics, herbal chemicals and paint industry, as well as modern medicine. In recent years, epidemiological studies have stated that the consumption of polyphenol-rich plants is very important for human health. *Melissa* and *Lavandula* plants, which are rich in polyphenolic compounds, are known to be very important in terms of their therapeutic effectiveness as well as their potentially beneficial bioactivity (Figure 3). When the

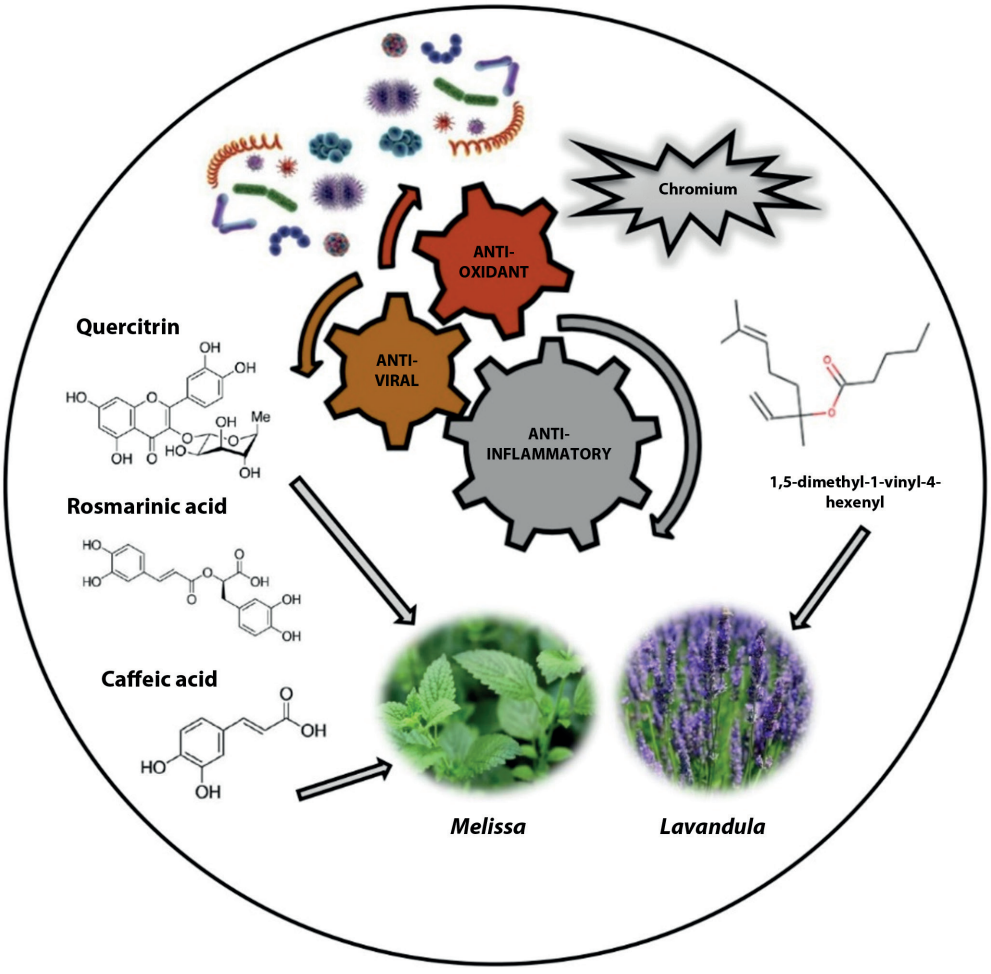

Figure 3. *Melissa* and *Lavandula* plant biological activation.

results of this study were evaluated *Melissa* and *Lavandula* plant extracts were found to promote total protein synthesis by increasing cell growth in *S. cerevisiae*. It is thought that this study will enable new treatment mechanisms for the treatment of many diseases by providing a better understanding of how *Melissa* and *Lavandula* plant extracts provide oxidative protection through scavenging and antioxidant mechanisms of reactive oxygen species. In addition, it is thought that the parameters obtained from this study will make important contributions by eliminating the deficiency in the literature.

Declaration of Conflicting Interests: There is no conflict of interest between the authors

Authorship Contribution Statement: All contributions to the article belong to me

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