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Distribution of intestinal parasites in patients applied to Inonu University Turgut Ozal Medical Center Parasitology Laboratory between 2018-2022

Abstract

Aim: Diseases caused by intestinal parasites are an important public health problem in our country as well as in the world. In this study, it was aimed to determine the distribution of intestinal parasites in patients applied to İnönü University Turgut Ozal Medical Center Parasitology Laboratory with various gastrointestinal system complaints and to show their association with variables such as gender and year.

Materials and Methods: Stool samples of 15610 patients sent to the Parasitology Laboratory between January 2018 and March 2022 were included in the study. Stool samples of the patients were analyzed first macroscopically and then microscopically by native-lugol methods. Cellophane tape method was used in 917 patients according to the complaints of rectal itching and growth retardation. Demographic data of the patients were obtained through the hospital and laboratory information operating system.

Results: Intestinal parasites were detected in 5.5% (861) of the 15610 patients analyzed. Of 15610 stool samples, 7232 (46.33%) belonged to female and 8378 (53.67%) to male patients. When the distribution of intestinal parasites detected by years is analyzed, the highest number of patients and positivity rate were in 2018 [4265 (28.92%) of 4526 samples were negative, and 261 (30.31%) were positive], and the lowest was in 2022 (679(4.60%) of 712 samples were negative, and 33 (3.83%) were positive). When the distribution of the positivity rate according to the parasites was analyzed, 221 (25.67%) *Giardia intestinalis*, 201 (23.35%) *Blastocystis hominis*, 157 (18.23%) *Entamoeba histolytica / Entamoeba dispar*, 179 (20.79%) *Entamoeba coli*, 57 (6.62%) *Enterobius vermicularis*, 19 (2.21%) *Trichomonas hominis*, 17 (1.97%) *Iodeamoeba butschlii* and 10 (1.16%) *Taenia saginata* were found.

Conclusion: Although the frequency of parasite infection in patients applied to the laboratory was found to be lower than in previous years, another reason for this is that people have started to pay more attention to hygiene conditions due to the coronavirus (COVID-19) epidemic in our country. Although there has been a statistical decrease despite the past years and it shows that intestinal parasite infections continue to be an important public health problem in our region, it is also important in terms of revealing the decrease in incidence.

Keywords: Intestinal parasites, prevalence, Malatya

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INTRODUCTION

Parasitic diseases are seen as an important public health problem, especially in developing countries and affect approximately four billion people in the world (1). Various factors such as gender,

age, socioeconomic level, personal hygiene habits, education level, nutrition, staying in communal places, traditions, eating habits, infrastructure and seasonal changes are effective on these incidence rates (2).

Infections caused by intestinal parasites can cause diarrhea, abdominal pain, constipation, nausea, weight loss, vomiting, anemia and allergic reactions, as well as malnutrition and absorption disorders, growth retardation, teeth grinding, rectal itching and night urination, especially in children (3).

Intestinal parasites are generally transmitted by ingesting eggs, cysts and oocysts, contaminated water and foods, or ingesting raw meat containing parasites. Moreover, it can be transmitted by infective helminth larvae entering the skin by contact with the soil (4).

In this study, it was aimed to retrospectively evaluate the parasites detected in people applied to İnönü University Turgut Özal Medical Center Parasitology Laboratory between January 2018 and March 2022 and the distribution of these parasites by years and gender.

This study was "Declaration of Helsinki" conducted in accordance with the ethical principles stated. Permission was obtained from İnönü University Turgut Özal Medical Center.

MATERIALS AND METHODS

Stool samples of 15610 patients applied to İnönü University Turgut Özal Medical Center Parasitology Laboratory between January 2018 and March 2022 were analyzed for intestinal parasites. Stool samples of the patients applied were analyzed macroscopically and microscopically. All samples were analyzed with the Native-Lugol method, by preparing slide-to-lamella preparations, and examining under the light microscope at 40x magnification. Stool samples were considered positive for all parasites except *Blastocystis hominis*, even if only one was seen in the microscope field at 40x magnification. As an important pathogenicity criterion for *Blastocystis hominis*, the sample was considered positive if five or more parasites were observed in each field at 40x magnification (5).

RESULTS

In the study, stool samples of a total of 15610 patients sent to İnönü University Turgut Özal Medical Center Parasitology Laboratory between January 2018 and March 2022 were evaluated. Parasites were not found in 14749 (94.48%) of the stool samples of the patients analyzed, and parasites were detected in 861 (5.5%) of them. The distribution of parasites by gender is given in Table 1.

Table 1. Distribution of parasites by gender

| Gender | Negative [n (%)] | Positive[n (%)] | p value* |
|--------|------------------|-----------------|----------|
| Female | 6889 (46.71) | 343 (39.84) | <0.001 |
| Male | 7860 (53.29) | 518 (60.16) | |

*:Pearsonchi-square test

When Table 1 was analyzed, 7232 (46.33%) of a total of 15610 stool samples belonged to female patients and 8378 (53.67%) belonged to male patients. Of 14749 patients without parasites, 6889 (46.71) were female, and 7860 (53.29%) were male. Of 861 patients with parasites, 343 (39.84%) were female patients

and 518 (60.16%) were male patients. Moreover, there was a statistically significant association with gender in terms of the presence of parasites ($p<0.05$). The presence of parasites in males was higher than in females.

The distribution of parasites detected in the patients included in the study by years was given in Table 2. When Table 2 was analyzed, 4265 (28.92%) were negative, and 261 (30.31%) were positive in 2018; 4097 (27.78%) were negative, and 275 (31.95%) were positive in 2019; 2339 (15.86%) were negative, and 127 (14.75%) are positive in 2020; 3369 (22.84%) were negative, and 165 (19.16%) were positive in 2021; 679 (4.60%) were negative, and 33 (3.83%) were positive in 2022. Considering the distribution of parasite incidence rates by years, it was observed that the highest parasite incidence rate was in 2019 and the lowest parasite incidence rate was in 2022. Accordingly, a decrease was observed in the number of patients admitted to the laboratory in the following years, and the incidence of parasites gradually decreased as the years progressed. In addition, there was a statistically significant association according to the years in terms of the presence of parasites ($p<0.05$).

Table 2. Distribution of parasites by years

| Years | Negative [n (%)] | Positive[n (%)] | p value* |
|--------------|------------------|-----------------|--------------|
| 2018 | 4265 (28.92) | 261(30.31) | 0.016 |
| 2019 | 4097 (27.78) | 275(31.95) | |
| 2020 | 2339 (15.86) | 127(14.75) | |
| 2021 | 3369 (22.84) | 165 (19.16) | |
| 2022 | 679 (4.60) | 33 (3.83) | |
| Total | 14749 (94.48) | 861 (5.52) | |

*:Pearsonchi-square test

The incidence of the patients, who were found to be positive for parasites in the study, by gender as the years progressed was given in Table 3 and Figure 1. Considering this table, of the patients with parasites, 156 (59.77%) were male, and 105 (40.23%) were female in 2018; 166 (60.36%) were male, and 109 (39.64%) were female in 2019; 78 (61.42%) were men, and 49 (38.58%) were women in 2020; 99 (60%) were male, and 66 (40%) were female in 2021; 19 (57.58%) were male, and 14 (42.42%) were female in 2022. According to these findings, while the highest parasite presence was observed in both men and women in 2019, the lowest parasite presence was found in 2022. In patients with, no statistically significant association was found according to gender in terms of years ($p>0.05$).

The parasite species and their incidence rates in the study were given in Table 4. Of 861 patients with parasites, 221 (25.67%) *Giardia intestinalis*, 201 (23.35%) *Blastocystis hominis*, 157 (18.23%) *Entamoeba histolytica / dispar*, 179 (20.79%) *Entamoebacoli*, 57 (6.62%) *Enterobius vermicularis*, 10 (1.16%) *Taenia saginata*, 19 (2.21%) *Trichomonashominis* and 17 (1.97%) *Iodeomoeba butschlii* were observed. It was determined that the most common parasite was *Giardia intestinalis* and the least common parasite was *Iodeomoeba butschlii* during the five-

year period when the study was evaluated.

Table 3. Distribution of patients with parasites by gender in terms of years

| Years | Negative [n (%)] | Positive[n (%)] | p value* |
|--------------|------------------|-----------------|----------|
| 2018 (n=261) | 156 (59.77) | 105 (40.23) | 0.995 |
| 2019 (n=275) | 166 (60.36) | 109 (39.64) | |
| 2020 (n=127) | 78 (61.42) | 49 (38.58) | |
| 2021 (n=165) | 99 (60) | 66 (40) | |
| 2022 (n=33) | 19 (57.58) | 14 (42.42) | |

*:Pearson chi-square test

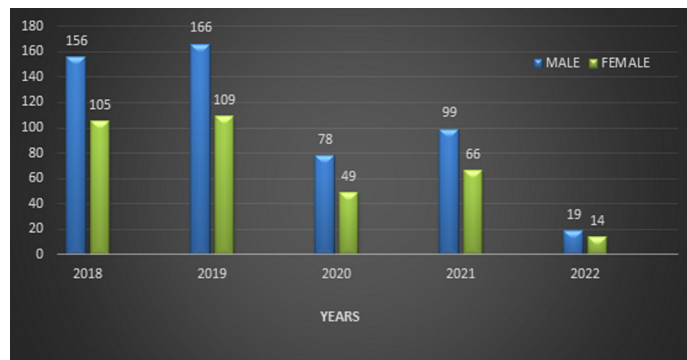


Figure 1. Distribution graph of patients with parasites by gender in terms of years

Table 4. Distribution of parasites by species

| Parasites Species | Number[Percentage (%)] |
|---------------------------------|------------------------|
| <i>Giardia intestinalis</i> | 221 (25.67) |
| <i>Blastocystis hominis</i> | 201 (23.35) |
| <i>E.histolytica – E.dispar</i> | 157 (18.23) |
| <i>Entamoeba coli</i> | 179 (20.79) |
| <i>Enterebius vermicularis</i> | 57 (6.62) |
| <i>Taenia saginata</i> | 10 (1.16) |
| <i>Trichomonas hominis</i> | 19 (2.21) |
| <i>Iodeomoeba butschlii</i> | 17 (1.97) |

*:Pearson chi-square test

The distribution of parasites detected in the stools of these patients over the years was presented in Table 5 and Figure 2. When the variation of the parasite species over a five-year period was analyzed, it was observed that the most common parasite was *G. intestinalis* in 2018 and it was in a decreasing trend after 2018. On the other hand, the least observed parasite was *Iodeomoeba butschlii* in 2022. Furthermore, a statistically significant association was found in terms of parasite species by years ($p < 0.05$).

Table 5. Distribution of parasite types detected in feces by years

| Parasites Species | 2018 | 2019 | 2020 | 2021 | 2022 | P value* |
|---------------------------------|------------|------------|------------|------------|-----------|----------|
| <i>Giardia intestinalis</i> | 91 | 63 | 25 | 34 | 8 | <0.001 |
| <i>Blastocystis hominis</i> | 40 | 56 | 35 | 58 | 12 | |
| <i>E.histolytica – E.dispar</i> | 27 | 64 | 33 | 30 | 3 | |
| <i>Entamoeba coli</i> | 82 | 43 | 19 | 26 | 9 | |
| <i>Enterebius vermicularis</i> | 13 | 32 | 4 | 8 | - | |
| <i>Taenia saginata</i> | 1 | 2 | 4 | 3 | - | |
| <i>Trichomonas hominis</i> | 3 | 7 | 4 | 4 | 1 | |
| <i>Iodeomoeba butschlii</i> | 4 | 8 | 3 | 2 | - | |
| Total | 261 | 275 | 125 | 165 | 33 | |

*:Pearson chi-square test

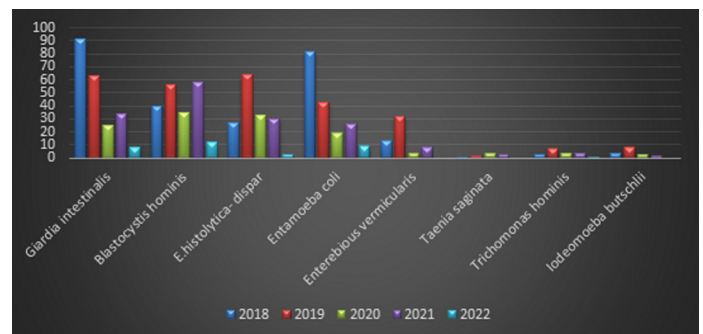


Figure 2. Distribution of Parasite Species by Years

The distribution of the detected parasite species by gender was given in Table 6 and Figure 3. The most common parasites were *G. intestinalis* and *E. coli* in males, and *G. intestinalis* in females. *T. saginata* was detected as the least common parasite in both males and females. Moreover, there was no statistically significant association with gender in terms of parasite species ($p > 0.05$).

Table 6. Distribution of parasites detected in stool by gender

| Parasite Species | Male | Female | p value* |
|----------------------------------|------------|------------|----------|
| <i>Giardia intestinalis</i> | 121 | 100 | 0.222 |
| <i>Blastocystis hominis</i> | 115 | 86 | |
| <i>E. histolytica – E.dispar</i> | 93 | 64 | |
| <i>Entamoeba coli</i> | 121 | 58 | |
| <i>Enterebius vermicularis</i> | 39 | 18 | |
| <i>Taenia saginata</i> | 6 | 4 | |
| <i>Trichomonas hominis</i> | 12 | 7 | |
| <i>Iodeomoeba butschlii</i> | 11 | 6 | |
| Toplam | 518 | 343 | |

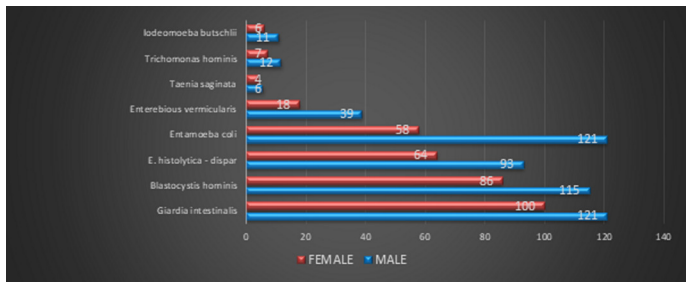


Figure 3. Distribution of parasite species by gender

DISCUSSION

The incidence of intestinal parasites varies according to the socioeconomic level, cleanliness level, nutritional habits, demographic characteristics and geographical conditions of the societies (1). There are many publications on the incidence of parasites in our country. Reported results may vary by year and by region. Many studies have been conducted to determine the prevalence of intestinal parasites in various university hospitals in our country. Parasite detection rate, which was 6.4% in patients who applied to Dokuz Eylül University Faculty of Medicine, 5.1% in Süleyman Demirel University Faculty of Medicine, 3.6% in Uludağ University Faculty of Medicine, 14.9% in Gazi University Faculty of Medicine, 10.5% in Cumhuriyet University Faculty of Medicine, 15.7% in Erciyes University Faculty of Medicine, and 1.8% in Ondokuz Mayıs University Faculty of Medicine (6,7). In our study and İnönü University, this rate was determined as 5.52%.

Macroscopic and microscopic parasitic analysis of a total of 16083 stool examinations sent to Konya Selçuk University Faculty of Medicine Microbiology and Clinical Microbiology laboratory for coproparasitological examination between 1992-1998 was performed, and parasites were detected in 1009 (6.27%) of them. Of these 1009 patients, 530 (53.05%) were female and 479 (46.95%) were male (8). Of a total of 3728 stools admitted for the microscopic examination to the parasitology laboratory of Dokuz Eylül University Training and Research Hospital between August 2000 and July 2001, 1826 (49%) belonged to female and 1902 (51%) belonged to male. Intestinal parasites were detected in a total of 323 (8.7%) cases, of which 134 (41.5%) belonged to women and 189 (58.5%) belonged to men (9). In the study conducted in Istanbul Medical Faculty Parasitology Laboratory between 1997 and 2001, 15714 stool samples were examined, and parasites were found in 760 (4.83%) of these samples, and no parasites were found in 14954 (95.17%) of them (10). In examination of 7220 people who applied to Erciyes University Faculty of Medicine Parasitology Laboratory within one year, 3459 (47.9%) of the samples belonged to male and 3761 (52.1%) belonged to female. Stool samples taken from 7220 individuals and cellophane tape preparations obtained from 1340 individuals were analyzed, and parasites were detected in 2094 (29%) (11). Stool and cellophane tape examinations were performed on 14597 people between January 1998 and June 2001 in Microbiology

Laboratory of Faculty of Medicine, Harran University, and parasites were detected in 34.86% of them (12).

In our study, 15610 stool samples admitted İnönü University Faculty of Medicine Parasitology laboratory between January 2018 and March 2022 were examined, and parasites were not found in 14749 (94.48%) of them, and parasites were detected in 861 (5.52%) of them. Of 15610 stool samples, 7232 (46.33%) belonged to female and 8378 (53.67%) belonged to male. Of 861 patients with parasites, 343 (39.84%) belonged to female and 518 (60.16%) belonged to male. Moreover, cellophane tape samples of 917 patients were examined in our study, and 57 (6.22%) of them were found to be positive.

In this study, in which the distribution of intestinal parasites was investigated, the most common protozoan was *G. intestinalis* (6.9%) and the helminth was *E.vermicularis* (10.8%) in a study conducted in Sivas (2). *E.histolytica / E.dispar* was most common according to a study performed in Gaziantep while Zeyrek et al. reported that *A.lumbricoides* was the most common in Şanlıurfa (13). The most common parasite was reported as *Blastocystis spp.* in most of the epidemiological studies. The incidence of *Blastocystis spp.* was found as 9.3% in the study conducted by Yula et al.in Mardin and its region (14), 7.64% in the study performed by Düzyol et al. in Manisa (15), and 4.8% in a study conducted at Dokuz Eylül University by Usluca et al. (16). In our study, this rate was found to be 23.35%.

It was determined in the study conducted by Çulha in Hatay between September and May 2005 that the most common parasite was *G.intestinalis* (3.5%) and the least common one was *S.stercoralis* (0.7%) (17). Yazar et al. reported that *B.hominis* (19.3%) was the most common parasite in the patients who applied to Erciyes University Faculty of Medicine, Department of Parasitology between 2000 and 2004, while *H.nana* (0.1%) was the least common parasite (18). In the study by Değirmenci et al., the most common parasite was *B.hominis* (36.7%) and the least common one was *E.histolytica / E.dispar* (0.025%) in patients who applied to Ege University Parasitology Laboratory throughout 2005 (19). According to the study performed by Doğan et al., *E.histolytica / E.dispar* was the most common parasite with the incidence of 31%, and the least common parasite was *S.stercoralis* with the incidence of 0.4% among the intestinal parasites of the patients who applied to Osmangazi University Faculty of Medicine in Eskişehir between February 2003 and December 2007 (20). Karaman et al. expressed that the most common parasite was *E.coli* with the incidence of 23.1%, and the least common one was *E.histolytica / E.dispar - A. lumbricoides* with the incidence of 0.2% among intestinal parasites found in patients who applied to the Adıyaman State Hospital Parasitology Laboratory between 2006 and 2007 (21).

In our study, the most common parasites were *G.intestinalis* with the incidence of 25.67% and *B.hominis* with the incidence of 23.35% while the least common one was *I. butschlii* with the incidence of 1.97% among intestinal parasites detected in

patients who applied to İnönü University Faculty of Medicine Parasitology laboratory between January 2018 and March 2022.

CONCLUSION

In our study, the distribution of intestinal parasites and frequently detected parasites between 2018 and 2022 were tried to be determined and reviewed. Although the incidence of parasitic infections tends to decrease compared to previous years, it continues to maintain its importance today. In our country, the incidence of parasites has decreased due to the curfews in the COVID-19 pandemic (Coronavirus) that started in the first months of 2020 and people's attention to hygiene conditions. Moreover, eliminating infrastructure problems, informing personal hygiene rules and improving socioeconomic conditions will be the most important measures to be taken to reduce the prevalence of intestinal parasites. We think that similar studies will be carried out in the future and will be important in terms of determining the distribution of current parasitic diseases..

Competing interests: The authors declare that they have no competing interest.

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Original Article

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The effect of community nutrition education on nutritional knowledge levels of students reading at a university in Somalia

Abstract

Aim: The aim of this research is to examine the effect of nutrition education given to Somali students studying in health departments at a university in Somalia on the nutritional knowledge of students.

Materials and Methods: It is a quasi-experimental study. 182 university students were included in the study. The nutritional knowledge level of the participants was measured before and after the nutrition education were given. The data were collected using a Nutrition Knowledge Level for Adults Scale (YETBID) questionnaire in which the sociodemographic characteristics and nutritional status of the participants were questioned. The lowest level of significance was accepted as $p < 0.05$.

Results: The mean scores of the participants in the YETBID basic nutrition and food preference subscales were 44.2 ± 6.0 and 29.6 ± 4.9 , respectively. The nutritional knowledge level of 52.7% in the basic nutrition scale and 48.9% in the food preference scale was found to be poor. After the nutrition education given, the mean scores of the participants in the YETBID basic nutrition and food preference subscales were 47.0 ± 7.7 and 31.5 ± 6.0 , respectively. The result shown that after the education given students' scores increased statistically for both subscales ($p < 0.05$).

Conclusion: It was concluded that the nutritional knowledge level of the students was not sufficient and the basic nutrition education was effective in increasing the nutritional knowledge level.

Keywords: Nutrition science, nutrition education, nutrition knowledge, university students, foreign domestic students, Somalia

CITATION

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INTRODUCTION

One of the most important factors affecting human health is nutrition (1). Correcting the nutritional problems which reducing the quality of life helps and exist in the society to prevent chronic diseases related to nutrition and to form healthy generations (2). Learning about adequate and balanced nutrition in youth is important both for improving their own health and for ensuring healthy nutrition for future generations (3).

With the transition to the university period, there are some changes in the nutrition of the youth of this age. This period is crucial for the later years of young people's lives. They acquire

most of their future eating habits during this period. For this reason, it is necessary to measure the nutritional habits and knowledge levels of university students, to investigate the causes of unhealthy nutrition and to prevent these problems (4).

One of the factors affecting the nutritional habits of individuals, families and societies is nutritional knowledge (5). Nutrition education is essential for acquiring correct nutritional knowledge (6). The insufficient level of knowledge of the society causes misuse of existing resources (7). At the same time, it negatively affects the health of individuals, causes erroneous practices and causes social and economic problems in the society in the long term (2).

The aim of this study is to examine the effect of basic nutrition education on the nutritional knowledge levels of students studying at Recep Tayyip Erdoğan Faculty of Health Sciences and Health Services Vocational School in Mogadishu, Somalia.

MATERIALS AND METHODS

This research was carried out with 182 students studying at Recep Tayyip Erdoğan Faculty of Health Sciences and Recep Tayyip Erdoğan Vocational School of Health Services affiliated to the University of Health Sciences in Mogadishu, Somalia in 2021. Basic knowledge about study were given to students before research were carried out and the 182 student participated in the study.

The research is a quasi-experimental research as it measures the nutritional knowledge levels before and after the nutrition education.

In the study, the general characteristics of the participants, their eating habits, and their nutritional knowledge levels were measured. Data gathering instrument was questionnaire and Adult Nutrition Knowledge Level Scale (YETBİD) scales. This scale was taken from the "Development and Validity-Reliability Study of the Nutrition Knowledge Level Scale for Adults" (8). Students filled out the questionnaire and YETBİD scales. After completion of the questionnaire and scales the educational program was designed for a month and the questionnaire and scales were repeated. The language of instruction at the faculty and vocational school is Turkish and for this reason, the nutrition education course was given to the students in Turkish.

The questionnaire form was filled in by the participants under the supervision of the researcher.

Approval was obtained from the Ethics Committee of the Somali Mogadishu Recep Tayyip Erdoğan Training and Research Hospital (Annex 1) for the study to be carried out.

The Cronbach's Alpha coefficient of the basic nutrition and food-health relationship scale is 0.72, and the Cronbach's Alpha coefficient of the food preference scale is 0.74. At the same time, the reliability of the scale was also measured with the test-retest method (8).

The data obtained as a result of the research were analyzed using SPSS20 statistical program. In the comparison of the two groups, the t-test was applied for the variables that met the parametric test conditions. In the comparison of more than two groups, ANOVA test was applied and Tukey analysis was performed to determine the difference between the groups. Pre-training and post-training scores were compared with the dependent variable t-test (paired t-test). The evaluation of the scores before and after the training according to different variables was done with the two-way ANOVA test. The chi-square test was used to compare the qualitative data. The lowest level of significance was accepted as $p < 0.05$.

RESULTS

86.3% (n=157) of the participants participating in the research were women. 48.4% (n=88) are studying preparatory, 40.1% (n=73) are undergraduate, 11.5% (n=21) are associate degree students.

The mean body mass index (BMI) of women is 21.44 ± 3.70 , while it is 20.45 ± 2.46 for men. While no one has a BMI over 25 in men, the maximum BMI in women is 32.41 (Table 1).

Table 1. Demographic characteristics of the participants

| | n | % |
|---------------------------------------|-----|------|
| Gender | | |
| Woman | 157 | 86.3 |
| Man | 25 | 13.7 |
| Major | | |
| Preparatory | 88 | 48.4 |
| Emergency Aid and Disaster Management | 16 | 8.8 |
| Nursing | 31 | 17.0 |
| Midwifery | 26 | 14.3 |
| PatientCare | 12 | 6.6 |
| Emergency Aid and Disaster Management | 9 | 4.9 |
| Income rate | | |
| Low | 4 | 2.2 |
| Medium | 135 | 74.2 |
| High | 16 | 8.8 |
| Not specified | 27 | 14.8 |
| Marital status | | |
| Married | 12 | 6.6 |
| Single | 170 | 93.4 |

Scores obtained from the scales were classified according to the study in which the scale was taken (8). Accordingly, those who scored less than 45 points in the basic nutrition scale were accepted as poor, those who scored between 45-55 were accepted as moderate, those who scored between 56-65 were accepted as good, and those who scored above 65 were accepted as very good. Those who scored below 30 points in the food preference scale are considered poor, those who scored between 30-36 are considered moderate, those who scored between 37-42 are considered good, and those who scored above 42 are considered very good (Table 2).

Table 2. Classification of the scores obtained from the basic nutrition and food preference scale before nutrition education

| | Basic Nutrition | | Food Preference | |
|------------------|-----------------|------|-----------------|------|
| | n | % | n | % |
| Poor | 96 | 52.7 | 89 | 48.9 |
| Moderate | 80 | 44.0 | 78 | 42.9 |
| Good | 6 | 3.3 | 12 | 6.6 |
| Very Good | 0 | 0 | 3 | 1.6 |

The scores obtained from the basic nutrition and food preference scales applied before the nutrition education were evaluated according to various factors. The scores obtained differ significantly according to the university level ($p < 0.05$) (Table 3).

Table 3. Comparison of the scores obtained before nutrition education according to some variables

| | Basic Nutrition | | Food Preference | |
|-------------------------|------------------|--------------|------------------|--------------|
| | $\bar{x} \pm sd$ | p | $\bar{x} \pm sd$ | p |
| Gender | | | | |
| Woman | 44.2±5.9 | 0.957 | 29.8±4.8 | 0.277 |
| Man | 44.1±7.0 | | 28.6±5.6 | |
| University Level | | | | |
| Preparatory | 44.6±5.7 | 0.001 | 30.6±4.8 | 0.000 |
| Associate degree | 48.1±6.0 | | 32.1±5.1 | |
| Licence | 42.6±5.9 | | 27.8±4.5 | |
| Income rate | | | | |
| Low | 45.5±2.1 | 0.865 | 30.0±1.2 | 0.940 |
| Medium | 44.7±6.1 | | 30.0±4.9 | |
| High | 44.0±5.8 | | 30.4±5.1 | |
| Maritalstatus | | | | |
| Married | 43.3±5.6 | 0.616 | 30.6±3.6 | 0.493 |
| Single | 44.2±6.1 | | 29.6±5.0 | |

While the mean score obtained from the basic nutrition scale was 44.2 ± 6.0 before the 4-week nutrition education given within the scope of our research, it became 47.0 ± 7.7 after the education. The difference in scores from the basic nutrition scale before and after the education was statistically significant ($p = 0.000$).

While the mean score obtained from the food preference scale was 29.6 ± 4.9 before the nutrition education given, it became 31.5 ± 6.0 after the education. The difference in the scores obtained from the food preference scale before and after the education was statistically significant ($p = 0.000$).

A two-way ANOVA test was used to determine whether the effectiveness of the nutrition education was significantly different in terms of various factors. Nutrition education was found to be more effective on married people compared to singles on the basic nutrition scale ($p = 0.027$). In both scales, pre- and post-education scores did not differ significantly between the groups according to gender, university level, income level and dieting status (Table 4).

Table 4. Comparison of the mean scores obtained from the basic nutrition and food preference scales before and after nutrition education

| | Pre-Training | | Post Training | |
|------------------------------|------------------|----------|------------------|----------|
| | $\bar{x} \pm sd$ | | $\bar{x} \pm sd$ | |
| Basic Nutrition Scale | $\bar{x} \pm sd$ | 44.2±6.0 | $\bar{x} \pm sd$ | 47.0±7.7 |
| | t | | t | 4.626 |
| | p | | p | 0.000 |
| Food Preference Scale | $\bar{x} \pm sd$ | 29.6±4.9 | $\bar{x} \pm sd$ | 31.5±6.0 |
| | t | | t | 3.982 |
| | p | | p | 0.000 |

DISCUSSION

The mean BMI of the participants in the study was found to be 21.36 ± 3.58 . The BMI level of women is higher than that of men, but the difference is not significant.

According to a study conducted in the Hargeisa region of Somaliland; The mean BMI of women aged 20-34 was found to be 25.5 ± 5.6 , and the mean BMI of men aged 20-34 was 20.8 ± 4.5 . Women in the study were found to be overweight or obese at a higher rate than men. The mean BMI of both women and men increased with age (9).

In a study conducted on Somali students studying in Turkey, 6.6% of the students were underweight, 77.8% were normal weight, 13.2% were overweight, and 2.3% were obese (10).

The reason why BMI levels were not high in our study may be due to the young age group of the participants.

The mean scores of the participants before the training were 44.2 ± 6.0 in the basic nutrition scale and 29.6 ± 4.9 in the food preference scale. The nutritional knowledge scores of 52.7% of the participants in the basic nutrition scale and 48.9% in the food preference scale were bad. The scores obtained in both scales differed significantly only according to the university level.

There are not enough studies on the level of nutrition knowledge in Somalia. This makes it difficult to determine how much the society needs nutrition education.

In a study conducted on medical students in Iran, 52.3% of the students were found to have poor knowledge of proper nutrition (11).

In another study evaluating the nutritional knowledge of university students, 32.2% of the students were found to have insufficient nutritional knowledge (12).

In a study investigating the nutrition knowledge of university students in Syria, the average nutritional knowledge score of the students was found to be 37.9 ± 0.3 . There was no significant difference between the nutritional knowledge scores of men and women (13).

In a study conducted on students studying at Pamukkale University, the nutritional knowledge level of students was measured with the YETBİD scale, which was also used in our study. When the scores of the students were compared according to their genders, there was no significant difference between the genders in the basic nutrition scale, while the scores of the female students in the food preference scale were significantly higher than the male students. Nutritional knowledge level of students who had previously received nutrition education was found to be significantly higher than those who did not receive it in both scales (14).

In a study conducted on 257 male and 263 female students aged 19-24, studying at Konya Selçuk University Alaaddin Keykubad Campus, a general nutrition knowledge questionnaire consisting of a total of 127 points was applied to the students. The average nutritional knowledge score of the students was found to be 82.9 ± 0.7 . Male students' nutritional knowledge scores were found to be higher than female students, and the difference was found to be significant (15).

Nutritional knowledge levels were found to be low in the studies and these results are compatible with our study. The reason why there was no significant difference in scores between gender groups in our study may be related to the number of groups.

In this study, the average score the participants got from the basic nutrition scale after the nutrition education was 47.0 ± 7.7 , and the average score they got from the food preference scale was 31.5 ± 6.0 . In both scales, the average score obtained after the training increased and the difference was significant.

In a study conducted at Ankara University Faculty of Health Sciences, the scores of the students before they received nutrition education were found to be significantly lower than the scores after they received it ($p < 0.001$) (16).

In a study conducted on 40 female and 41 male participants aged 16-64 working in a private institution, a nutritional knowledge test form was applied to the participants. Then, a 1-hour nutrition education was given, and the nutrition knowledge test form was applied again after 1 month. It has been determined that the nutrition education given has a significant positive effect on the level of nutrition knowledge in men and women (17).

In the study conducted on a group of information technology experts in Hyderabad, India, the nutritional information of the participants before and after the nutrition education was

compared. The increase in scores after the training was found to be statistically significant ($p < 0.05$) (18).

In a study conducted on Dutch Medical Faculty students, students were divided into experimental and control groups, and 25 hours of nutrition education was added to the curriculum of the experimental group while the control group continued the normal medical curriculum. Pretest-posttest measuring nutritional knowledge was applied to both groups. Nutritional knowledge scores in the experimental group increased statistically significantly compared to the control group ($p < 0.05$) (19).

In a study of caregivers and physical education teachers of primary school children aged 6-12 in Ghana, one day of nutrition education was given to caregivers and teachers. Nutritional knowledge of caregivers ($p = 0.009$) and teachers ($p = 0.03$) increased significantly after education compared to pre-training (20).

In a study conducted on public school educators in South Africa, the nutritional information of the participants was measured before and after a three-day nutrition education. While the mean score before the training was 64.9 ± 17.8 out of 100, it was 88.6 ± 4.0 after the training, and the difference was significant ($p = 0.028$) (21).

Many studies show that nutrition education increases the level of nutrition knowledge. These results are consistent with the results of our study.

CONCLUSION

As a result of the data obtained, it was determined that the nutrition education increased the nutritional knowledge of the students. As a result of the results reached in this study; the importance of nutrition education in the African continent, where nutrition-based diseases are becoming more and more widespread, is being understood day by day. It is very important that the students of the health department, who will work in the field of health, acquire the right nutrition information. It is known that non-communicable diseases are also increasing in Africa. One of the important factors of these diseases is malnutrition. It is very important to examine the nutritional status of the young generation, who represent the future of society, and to direct them to proper nutrition. Our work is expected to raise awareness in this area. In order to better understanding of the needs of the region, larger and more research should be conducted.

Competing interests: The authors declare that they have no competing interest.






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Ethical approval: Approval was obtained from the Ethics Committee of the Somali Mogadishu Recep Tayyip Erdoğan Training and Research Hospital (Annex 1) for the study to be carried out.

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Original Article

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Determination of oxidative stress level (malondialdehyde), some antioxidant activities (catalase and reduced glutathione) and IMA (Ischemia Modified Albumin) in gout patients

Abstract

Aim: The aim of this study was to determine the oxidative stress level and antioxidants such as malondialdehyde (MDA), reduced glutathione (GSH), ischemia modified albumin (IMA), catalase (CAT) and in patients with gout.

Materials and Methods: In the study, blood was collected from a total of 63 individuals, including 30 patients with gout and 33 healthy controls. MDA levels, IMA, GSH and CAT activities in blood serums were measured of patients and control group.

Results: CAT and GSH activity were low in gout patients, and MDA and IMA levels were statistically higher.

Conclusion: In conclusion, this study, low CAT and GSH activity, high MDA and IMA levels showed that oxidative stress may play an active role in patients with gout. Although our study is the first to determine the level of MDA, GSH, IMA and CAT activity in patients with gout, more comprehensive studies are needed to examine oxidative stress and antioxidant enzymes in patients with kidney disease, especially gout.

Keywords: CAT, IMA, GSH, MDA, oxidative stress, uric acid

CITATION

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INTRODUCTION

The gout is a type of inflammatory arthritis arises after chronic hyperuricemia that permits monosodium deposition urates in and around the joints with the subsequent painful recurrent flares and tissue damage (1,2). Inflammatory arthritis is a common form and thought to affect men more than women. In general, women become more susceptible to gout after menopause (1). Gout usually occurs as recurrent attacks resulting in painful, red, and swollen joints, the big toe joint is commonly affected, but other joints including fingers, knees, heels, and wrists may also

be affected (3). Chronic hyperuricemia predisposes individuals to gout, concentrations of urate above the solubility threshold induces monosodium urate (MSU) crystals formed in synovial joint fluid, soft tissues (4). The clinical characteristics of gout are caused by the inflammatory response to urate crystals with monosodium (5). They induce episodes that are initially infrequent, affecting the foot joint, and well responsive to anti-inflammatory medications such as colchicine and nonsteroidal anti-inflammatory drug (6). These do not, however, prevent urate deposition from progressing, so frequent and widespread attacks can develop, permanent damage to the joint may result from gout

erosions, and tophi can occur. Therefore, optimal management is required to provide a gradient for the crystal resorption (7).

Oxidative stress is a dangerous phenomenon resulting from free radicals and oxidants. Reactive Oxygen Species (ROS) is working on alteration of the cell membranes and other structures such as deoxyribonucleic acid (DNA), lipids, lipoproteins, proteins (8,9). ROS at normal conditions is maintained by different enzyme systems and is a normal fact in the body. Where it is sharing these systems at low levels contribute to the Vivo balance between oxidation and reduction. Therefore, oxidative stress is also known as a disorder between the antioxidants and prooxidants in the body (10). And as oxidative stress occurs because of imbalance between the formation of ROS, reactive nitrogen species (RNS) and the capacity of the vital system to disposal from these reactive mediums. Dangerous substances and compounds arise as a result of Biochemical modifications by ROS and RNS, like lipid peroxidation, which action on oxidize proteins, lipids and DNA damage (11). Oxidative stress can occur on short term result trauma, certain toxins, Infections, overworking, all of that cause to light injuries to different tissues. Tissues forme several enzymes that contribute to radical production like xanthine oxidase, lipogenase, cyclooxygenase, when occurring damage. They work stimulation phagocytes, lead more iron and copper ions to be liberated into circulation, and disable electron transport series. When these effects continue for a long interval of time, the ROS/antioxidant balance can be lost, that in the role can cause to develop different kinds of cancer, or lead present cancer to prevalence readily. Moreover, some studies were shown a relationship between ROS and diabetes mellitus and various age-associated diseases as such the Parkinson's disease (12). ROS also causes chronic fatigue, atherosclerosis, Alzheimer's, malaria disease (13).

IMA is a product of oxidative stress. The last amino terminal in the albumin structure is the place where metals such as cobalt, copper and nickel are attached (14). Causes such as hypoxia, acidosis, free radical damage and membrane disruption that occur in ischemia reduce the binding of these transition metals to the N-terminus of albumin. This change is called ischemic modified albumin. (15,16).

The aim of this study was to determine the oxidative stress level and antioxidants such as MDA, GSH, CAT and IMA in patients with gout.

MATERIALS AND METHODS

This study was carried out in Van Yuzuncu Yil University (YYU), Dursun Odabaşı medical center, Orthopedics and Traumatology Clinic. The study was initiated with the decision of Van YYU non-interventional clinical research ethics committee dated 08.11.2019 and numbered 2019/16-07. Individuals between

the ages of 10 and 90 were included in the study. None of the patients used cigarettes or alcohol. Smoking, alcohol and chronic diseases were accepted as exclusion criteria. Steroid drugs are used in all patient groups during the attack periods of the periods of the disease.

Blood samples

This study was carried out in Van Yüzüncü Yıl University, Dursun Odabaşı medical center, Orthopedics and Traumatology Clinic. In the study, blood was collected from a total of 63 individuals, including 30 patients with gout and 33 healthy controls. The blood samples taken from the patients were centrifuged at 5000 rpm for 5 minutes in a Nüve NF 800 brand centrifuge device in a venous biochemistry tube and separated from their serum and plasma. The serums were stored at -800°C until the day of processing. When the target number was reached, all samples were allowed to come to room temperature before the study. In these samples after thawing were spectrophotometrically measurements activity of MDA, CAT, GSH and IMA levels in clinical-biochemical laboratory. Steroid drugs are used in all patient groups during the attack periods of the disease.

Biochemical Measurements

Among the biochemical parameters, CAT enzyme activity by Aeibi, GSH level by Beutler et al., MDA level by Gutteridge and IMA level was determined according to the method developed by Sbarouni (17-20).

Data Analysis

Descriptive statistics were given as mean and standard deviation. T-Test was used in the comparison of binary groups providing the condition of normal distribution. On the other hand, the statistics of Mann Whitney U test was used when the condition of normal distribution was not provided. Significance level was taken as $p < 0.05$ and SPSS ver: 25.0 (SPSS Inc, Chicago, III, USA) package was used.

RESULTS

In study, 13 of the cases were female and 17 of the cases were male. The control group were 19 men and 14 women. There were no difference in age, length, BMI, weight, gender between subjects. The demographic, clinical and biochemical data of both groups were recorded and comparatively analyzed. Table 1 Contains descriptive statistics and comparative results for Age, length, BMI, weight, CAT, MDA, GSH, and IMA. When samples were examined, the difference between the patient and control group mean IMA, MDA, GSH and CAT were statistically significant ($P < 0.05$). Accordingly, IMA and MDA levels were found to be high in the patient group, while CAT and GSH activities were found to be low.

Table 1. Descriptive statistics and Comparison results

| Parameters | Patient (n=30) Mean±Std. Deviation | Control (n=33) Mean±Std. Deviation | P |
|---------------|---------------------------------------|---------------------------------------|--------|
| Age | 55.4333±17.50406 | 58.2121±17.06011 | 0.526 |
| Length (m) | 1.6863±0.06376 | 1.6970±0.06757 | 0.524 |
| BMI | 26.1817±2.37778 | 25.6366±3.39744 | 0.468 |
| Weight (kg) | 74.4000±7.15156 | 73.4848±7.78669 | 0.630 |
| GSH (mmol/mL) | 0.0564±0.02333 | 0.2082±0.05525 | 0.001* |
| MDA (nmol/L) | 1.7800±0.13447 | 0.8527±0.05981 | 0.001* |
| CAT (U/L) | 0.0997±0.12640 | 0.2163±0.00799 | 0.001* |
| IMA (ABSU) | 1.0573±0.01202 | 0.4797±0.02325 | 0.001* |

P values with an asterisk indicate that the Mann Whitney U test was used ($p < 0.05$).

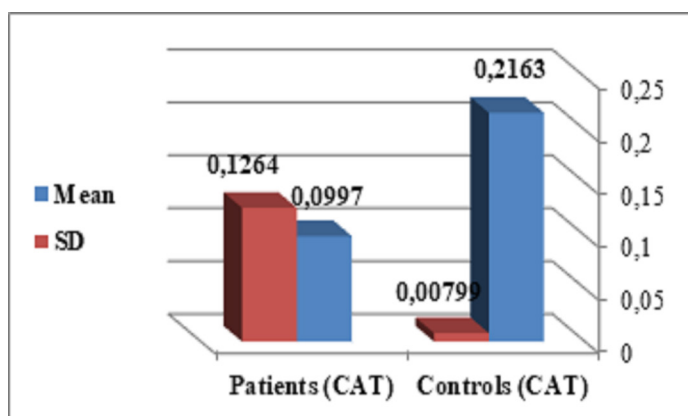


Figure 1. CAT enzyme level in patients with gout and control group

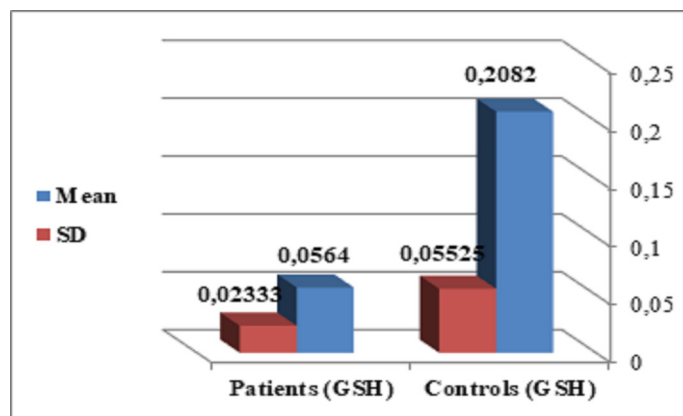


Figure 3. GSH enzyme level in patients with gout and control group

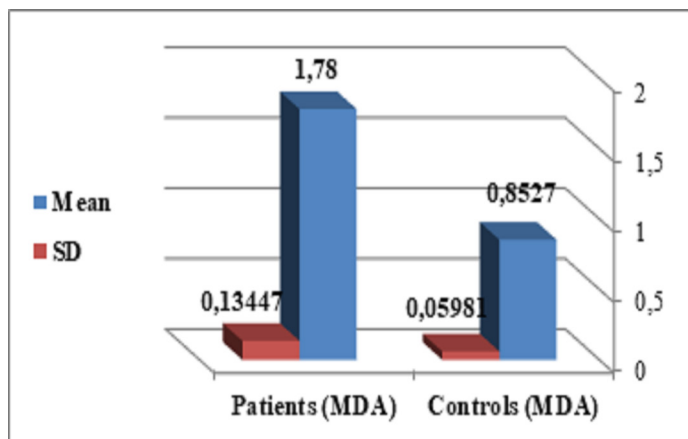


Figure 2. MDA level in patients with gout and control group

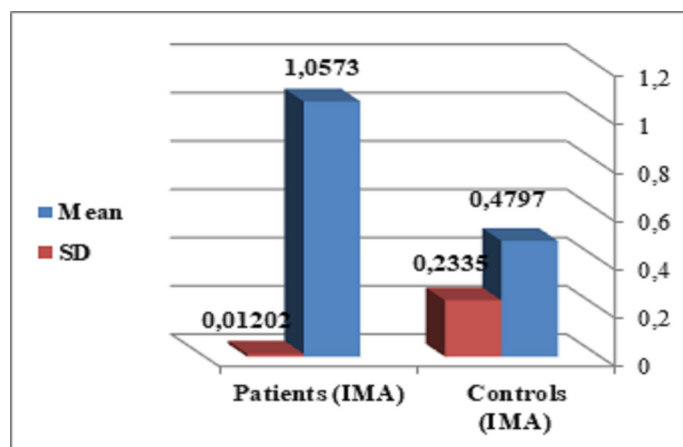


Figure 4. IMA level in patients with gout and control group

DISCUSSION

The end product of purines metabolism, uric acid, is produced by the liver and excreted by the kidney and intestines (21). Overproduction or under exertion of uric acid will cause hyperuricemia, the major etiological factor of gout, as it may lead to crystal formation and inflammation response (22). Other risk factors that predispose individuals to gout are gender, age, genetics, obesity, alcohol intake, diet, comorbidities and some drugs (23). It has been reported that hyperuricemia is significantly associated with the risk of obesity (24). Patients with gout associated with metabolic diseases such as insulin resistance, obesity, hyperlipidemia and hypertension have a high risk of death (25).

Aerobic cells, which contain a lot of CAT, are also found in high amounts in the kidney. CAT, which performs the inhibition of lipid peroxidation, also has an effective role in reducing ROS. Impairment of mitochondrial function results from a CAT disorder and causes an increase in ROS (26). Glutathione peroxidase and CAT are two effective antioxidant enzymes that help the oxidation of H₂O₂, producing water molecules and oxygen. In the literature, CAT activity has found to be low in patients with acute gout disease (27,28). In this study, CAT activity in patients with gout was lower than in the control group. Since CAT activity is low in gout, it can be said that cells are exposed to oxidative stress.

Lipid peroxidation causes many pathological conditions that damage living cells. Species of reactive oxygen contain radicals including hydroxyl radical and hydrogen peroxide (29). In one study, MDA rates in patients with acute gout disease have been shown to be elevated (27). In the literature, it has been found that MDA level is high in gout (28). In this study, MDA level was found to be high in the patient group, similar to the literature.

GSH plays an active role in the destruction of harmful reactive oxygen radicals and the continuation of enzymatic activities. GSH, which acts as a catalysis in the conversion of oxidized glutathione to glutathione, has physiological importance such as amino acid transport, coenzyme function in enzymatic reactions, detoxification of xenobiotics, protection of reduced sulfhydryl groups, as well as antioxidant defense (30). In this study, GSH level was found to be low in the patient group.

Ischemia-modified albumin (IMA) is characterized by the use of muscle destruction in cardiac hypoxic tissue, reduced coronary blood flow channels and ischemically mediated reactive oxygen species (ROS) modifications (31,32). In the study of Keshavarzi et al., significantly higher IMA and IMA/albumin levels were detected in PKU patients compared to non-PKU control subjects (33). In the study of Balik et al., IMA level was found to be higher in gout patients compared to the control group (34). In this study, IMA level was found to be high in the patient group, similar to the literature.

CONCLUSION

Oxidative stress is caused by cells because of one of three causes: the first is an increase in oxidant age, the second is a decline in antioxidant defense and the third is an inability to repair oxidant harm. The primary harm to cells results from the reactive oxygen species prompted change of macromolecules, for example, polyunsaturated unsaturated fats in membrane lipids, essential protein, and DNA. Furthermore, oxidative pressure and reactive oxygen species have been involved in diseases states, for example, rheumatoid-arthritis (RA) inflammation (35) alzheimer's disease (36) and thepathologies brought about by diabetes. Cell harm is actuated by reactive oxygen species ROS. Under ordinary condition, reactive oxygen species (ROS) are cleared from the cells by the activity of SOD, CAT, or GSH (37).

In this study, GSH, MDA, IMA and CAT activities were investigated in gout patients. High MDA and IMA levels and low GSH and CAT activity in gout patients show that oxidative stress plays an active role among the causes of gout. Although our study is the first to determine the level of MDA, GSH, IMA and CAT activity in patients with gout, more comprehensive studies are needed to examine oxidative stress and antioxidant enzymes in patients with kidney disease, especially gout.

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Original Article

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Evaluation of affective temperament of emergency medicine and family physicians

Abstract

Aim: In this study, we aimed to determine the temperaments that identify lifelong attitudes and behavior in emergency and family physicians; to give information to the literature to stress management, physician patient relationships, prevention of physical or verbal violence.

Materials and Methods: This study is a prospective, descriptive study on emergency and family physicians working in more than one center in Ankara. Participants were identified as affective temperaments according to TEMPS-A (Temperament Evaluation of Memphis, Pisa, Paris, San Diego Auto-questionnaire). Mann-Whitney U test was used for statistical differences between groups. Chi-square or Fisher's Exact test was used for the analysis of categorical data. A value of $p < 0.05$ was considered significant.

Result: 203 physicians were applied to study. Eighty emergency physicians and 71 family physicians were included in the analysis. Sixty nine (45.6%) of the physicians included in the study were female. Eighty percent of the emergency physicians and 54.9% of family physicians did not have any affective temperament, this difference was statistically significant ($p = 0.001$). Among emergency physicians, 6.3% cyclothymic and 6.3% hyperthymic temperament were found. In the family physicians, the 14.1% depressive, 14.1% anxious, 8.5% cyclothymic and 8.5% hyperthymic temperament were found. Depressive temperament was higher in family physicians than emergency physicians ($p = 0.02$).

Conclusion: In this study, it was determined that emergency physicians had less affective temperament than family physicians. Family physicians have more depressive temperament than emergency physicians. According to our results, emergency physicians are predominantly cyclothymic and hyperthymic temperament, whereas family physicians are predisposed to depressive and anxious temperament.

Keywords: Emergency physicians, family physicians, TEMPS-A, temperament, depressive, irritable, hypertymic, anxious, cyclothymic.

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INTRODUCTION

Emotions based on temperament, structure, genetics and biology are defined as affections, impulses, attitudes and behaviors, respectively (1). Akiskal divides temperament five groups: hyperthymic temperament, cyclothymic temperament, irritable temperament, depressive temperament and anxious temperament (2). Individuals living in a community may have more than one

temperament or be unable to determine any temperament (1,2).

Emergency medicine is challenging to many physicians due to low rest intervals, frequent night shifts, crowded emergency services, risks of being exposed to violence from patients and their relatives, and the necessity of conducting medical interventions urgently and effectively (3). Family medicine, which is thought to be more stable than emergency medicine,

also has some unique difficulties. Factors such as insufficient security, insufficient physical conditions, lack of personnel, and easy application without appointments create stress for family physicians (4,5). Physicians with different affective temperament characteristics will also have different tolerance levels for working in fastpaced, high workload departments. Physicians with hypertimic temperaments can handle intensive work, but doing so is more difficult for physicians with irritable, depressive, cyclothymic and anxious temperaments (6,7).

This study, therefore, aim to determine temperaments among emergency physicians (EPs) and family physicians (FPs). These data are intended to build a foundation for further studies and to help guide future situations, such as managing stress, facilitating physician patient relations, and preventing physical or verbal violence.

MATERIALS AND METHODS

This study is a prospective descriptive study conducted in education and research hospital emergency medicine in Ankara in Turkey between March 15, 2017, and December 30, 2017, following the approval of the hospital ethics committee.

103 EPs and 100 FPs, who are active in Ankara, Turkey and its surrounding districts, were included in this study. After the written informed consent of the participating physicians was received, they were asked to answer the Temperament Evaluation of Memphis, Pisa, Paris, San Diego Autoquestionnaire (TEMPS-A) Temperament Scale test for affective temperament determination. This scale was intended to examine whether there were differences between the two groups in terms of demographic characteristics, working conditions and affective temperaments. Those who did not agree to participate in the study, who submitted the questionnaire before completing the study, or who had a history of psychiatric illness and antidepressant drug use were excluded.

TEMPS-A Temperament Scale

The TEMPS-A Temperament Scale is a questionnaire test developed by Akiskal et al. (1997) to evaluate temperament (2). The scale was adapted into Turkish by Vahip et al. (2005), and the test-retest reliability of the Turkish translation was calculated as being 0.73 and 0.93, and its Cronbach's-alpha coefficient was 0.75 and 0.84 (8).

The TEMPS-A scale proposes questions about five temperament types. Their characteristics, and the number of questions on the TEMPS-A concerning them, are as follows:

1. Hyperthymic temperament: self-confidence, talkativeness, playfulness, cheerfulness, sleeping very little, high energy levels, uninhibited behavior (20 items).
2. Irritable temperament: quick temper, dysphoria, pessimism, moodiness, impulsiveness (18 items).

3. Depressive temperament: sorrowfulness, pessimism, passivity, lethargy, excessive sleeping, reproachful tendencies, self-accusation (18 items).
4. Cyclothymic temperament: biphasic dysregulation, pessimistic/optimistic, lethargy/euphoria, blunt/sharp attention, low self-esteem/excessive confidence (19 items).
5. Anxious temperament: distress when trying to relaxation, somatic anxiety, predisposition to anxiety and fear, autonomic anxiety, restlessness, nervousness (24 items) (2,8).

TEMPS-A respondents, giving consideration to their entire lives, answer each item with a "yes" or "no." "Yes" answers are given a score of "1" and "no" answers given score of "0". If the score for each subtype is above the cut-off point calculated for that subtype, it is assumed that the respondent carries that temperament. With this scale, one or more affective temperaments may be determined in an individual or may not determine any affective temperament. According to the responses from the physicians participating in this study, the researchers made temperament determination.

Statistical Analysis

Data analysis was conducted using the IBM SPSS 22.0.0 for Windows 64-bit edition package program. Whether discrete or continuous numerical variables were suitable for the normal distribution was investigated via the Shapiro Wilk test, which did not indicate normal distribution. These data were shown as median value and as 25%-75% quarters (interquartile range, IQR). The categorical data were shown as the number of observations (n) and percentages (%). Differences between the groups were determined via the Mann Whitney-U test for numerical values. Categorical values were analyzed using the chi-squared or Fisher's Exact test. A value of $p < 0.05$ was considered statistically significant.

RESULTS

The study began with 103 EPs and 100 FPs, but 24 physicians did not agree to participate because of the long questionnaire because they were too busy work, or without providing any justification. Thirteen physicians did not respond to some items either accidentally or because the items posed questions about sexual topics. Considering the exclusion criteria, 80 EPs and 71 FPs were included in the evaluation. A working flow-chart is shown in Figure 1.

While the demographic characteristics of the included EPs and FPs - such as age, gender and marital status- were similar, the monthly working hours and numbers of patients examined daily were significantly higher for EPs ($p < 0.001$; $p < 0.004$, respectively). The general characteristics of the participating physicians are summarized in Table 1.

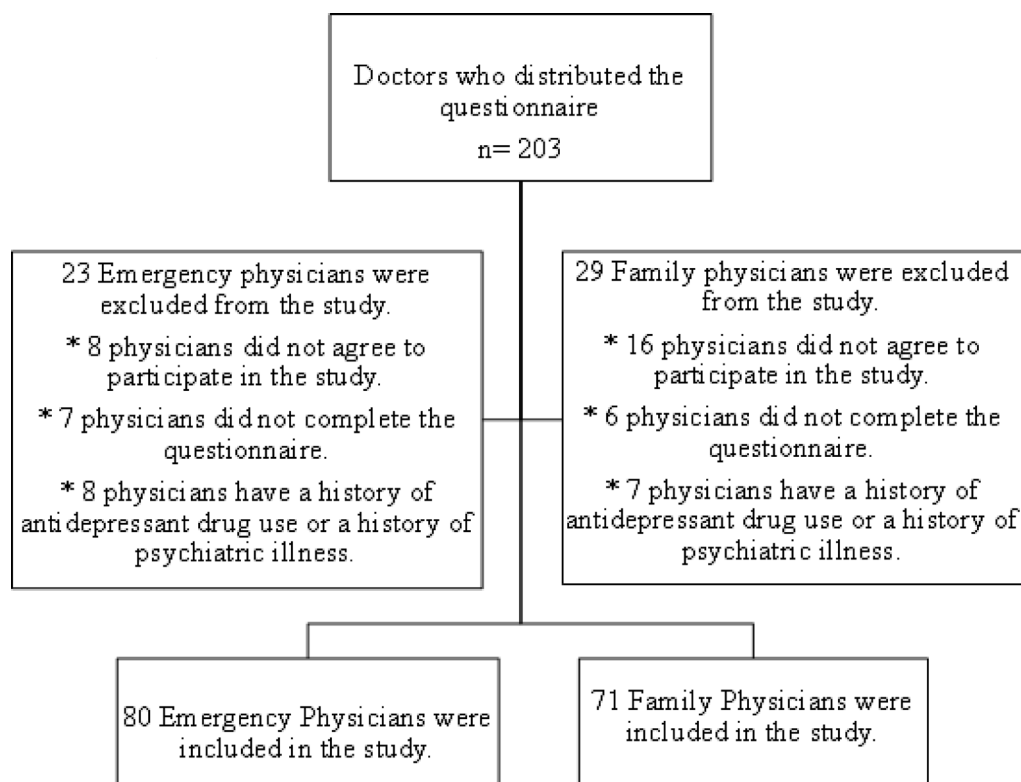
Table 1. General features of emergency physicians and family physicians

| Parameters | Emergency Physicians | Family Physicians | p value * |
|------------------------------------|----------------------|-------------------|-------------------|
| Age** | 31 (27–35) | 30 (27–35) | 0.4 |
| Gender *** | | | |
| Women | 32 (%40) | 37 (%52) | 0.1 |
| Men | 48 (%60) | 34 (%48) | 0.1 |
| Marital Status *** | | | |
| Married | 51 (%64) | 46 (%65) | 0.8 |
| Single | 29 (%36) | 25 (%35) | 0.8 |
| Disease History *** | | | |
| Hypertension | 3 (%3.8) | 4 (%5.6) | 0.7 |
| Diabetes Mellitus | 2 (%2.5) | 2 (%2.8) | 0.9 |
| Coronary Artery Disease | 0 | 1 (%1.4) | - |
| Monthly Working Hour ** | 216 (179–240) | 160 (160–160) | < 0.001 |
| Working Time *** | | | |
| 1–5 years | 53 (%66.2) | 46 (%64.8) | 0.8 |
| 6–10 years | 16 (%20) | 13 (%18.3) | 0.8 |
| 10 years and above | 11 (%13.8) | 12 (%16.9) | 0.8 |
| Daily Number of Patients ** | 80 (70–85) | 70 (50–80) | 0.004 |

* The p value was calculated using the Mann–Whitney test for continuous data and the chi-square test for categorical data.

** The datas are not normally distributed, they are written as median value and 25 - 75% quarters (IQR).

*** Categorical data are written as numbers and percentages.

**Figure 1. Working flowchart**

According to the physicians' questionnaire responses, researchers made affective temperament determination. The number of physicians without any affective temperament was 64 (80%) among EPs and 39 (54.9%) among FPs. Both the irritable and anxious temperament was detected in one EP. Both the depressive and anxious temperaments were detected in two FPs.

The depressive temperament was detected in one EP and ten FPs. While there was a statistically significant difference between the groups in terms of depressive temperament ($p = 0.02$), there was no significant difference in terms of other affective temperament types. The temperament characteristics of the participating physicians are summarized in Table 2.

Table 2. Comparison of emergency physicians and family physicians temperaments

| Parameters | Emergency Physicians | Family Physicians | p value * |
|---------------------------|----------------------|-------------------|-----------|
| Not Detected n (%) | 64 (%80) | 39 (%54.9) | 0.001 |
| Depressive n (%) | 1 (%1.3) | 10 (%14.1) | 0.02 |
| Cyclothymic n (%) | 5 (%6.3) | 6 (%8.5) | 0.6 |
| Hypertimic n (%) | 5 (%6.3) | 6 (%8.5) | 0.6 |
| Irritable n (%) | 2 (%2.5) | 1 (%1.4) | 0.6 |
| Anxious n (%) | 4 (%5) | 10 (%14.1) | 0.055 |

* Both irritable and anxious temperaments were detected in 1 emergency physician. Both depressive and anxious temperaments were detected in 2 family physicians.

In this study, the relationships between temperament types and gender and marital status variables in EPs and FPs were also examined, but no relationships were ($p > 0.05$ for all cases).

DISCUSSION

In this study, 80% of EPs and 54.9% of FPs exhibited not affective temperament. However, in general, hyperthymic, cyclothymic and anxious temperaments are more often seen in EPs, while depressive, anxious and cyclothymic temperaments are more often seen in FPs. When the two groups of physicians were compared, it was found that EPs had fewer affective temperaments, and depressive temperament rates were significantly higher in FPs. In the extant literature, no study, other than that conducted by Jaracz et al. (7), has considered emergency medicine workers and temperament. Therefore, to the best of the authors' knowledge, this work - conducted among physicians in Turkey to determine what is valuable in terms of affective temperament - is the first of its kind.

Vahip et al. (2005) could not detect any affective temperaments in 86.6% of Turkish society, and those few that were found were distributed as follows: 3.7% irritable, 3.7% anxious, 3.1% depressive, 1.7% cyclothymic temperament, 1.2% hyperthymic (8). In this research, the percentage of EPs, in which no affective temperament could be determined is similar to that found by Vahip et al. (2005).

Emergency services cause stress and depressive symptoms in many physicians due to challenging working conditions, such as insomnia, high energy consumption, too many negative events, and the necessity of making decisions quickly and correctly. Characteristics of depressive temperaments, such as excessive sleeping, lack of psychomotor energy, pessimism, cheerlessness,

and instability are not suitable for working in the emergency room. Therefore, the fact that the depressive temperament profile was found more in FPs may be because physicians with this temperament prefer to work in family medicine, rather than in emergency medicine because the emergency-working conditions are not suitable for them.

Family physicians, whose jobs are to look after primary care patients and perform preventive medicine, are used for reasons - such as seeking prescriptions, receiving reports and chatting - since their duties are not fully understood by the public. Because of that, after family medicine has applied, it has been observed that primary care patients' application rates to emergency services have increased (9). Another study found that family medicine practice has increased physicians' workloads, work stress, ethical corruption, and competition and it has reduced physicians' time for social life and professional development (10). In this study, one reason depressive temperament rates were found to be high in FPs may be related to this burnout.

Temperament does not change throughout human life and that it forms the basis of behavior (2). According to their various temperaments, people show different reactions to professional effects and stress factors. Mistakes caused by reactions to stress factors in the health sector can be fatal for patients. Therefore, people working in the health sector must use their cognitive functions correctly even under stress. One previous study has suggested that people with hyperthymic temperaments perform more successfully in emergency departments because of their high psychological resilience (7). Alternatively, emergency medicine is a specialty with a low preference rate because of the high probability of violence in emergency departments, patient density, physical disabilities, and the lack of personnel, which

increases the physician's workload (11,12). It may, therefore, be predicted that physicians with depressive and irritable temperaments cannot adapt to such stress factors.

The abilities of different temperament types to cope with work stress vary. Studies have shown that stress factors lead to negative mental effects in people with depressive and anxious temperaments (13,14) - so much so that many publications have demonstrated these temperaments'- relationships with serious psychiatric disorders such as suicide attempts (15,17). Therefore, it is critical for medical students, when choosing medical specialties, to make choices appropriate for their temperaments (18,19).

Limitations

In this study, the generalizability of the findings is limited because the sample size is also limited (selected from a single geographical area), and because the data collection method is based on a questionnaire. Few studies between physicians and temperament are another limitation. Further studies are, therefore, needed to gather more comprehensive data.

CONCLUSION

While, in this study, no affective temperaments were found among many EPs and FPs, affective temperament type for EPs was determined to be hyperthymic and, for FPs, depressive. However, if physicians working in places with high workloads and stress factors -such as emergency departments and family health centers- exhibit the hyperthymic temperament, it has been shown that they will have more psychological resilience against such stress factors and will be able to work more comfortably in these environments. Alternatively, stress factors in the work environment can cause permanent, negative mental effects in people with depressive temperaments. Therefore, it is necessary for physicians to consider their quality of life when selecting their medical specialties, considering their affective temperament characteristics.

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INTRODUCTION

The interest of nanobiotechnology is the manipulation of materials that occur at ultra-small sizes (1-100 nm). Nanomaterials, especially metallic NPs, are efficient and reactive compared to bulk materials, thanks to their unique size, distribution, and morphology, as well as their magnetic, physicochemical, and optoelectronic properties (1,2).

Metallic NPs have begun to be evaluated in diagnostic, biomarker, cell labeling, drug delivery, antimicrobial agents, cancer treatment and water treatment applications (3-7).

Many metals have been investigated in metallic NPs synthesis studies to date. Metals such as gold (Au) (8), silver (Ag) (9), iron (Fe) (10), zinc (Zn) (11), nickel (Ni) (12), platinum (Pt) (13), palladium (Pd) (14) and selenium (Se) (15) still continue to

Synthesis, characterization and determination of antimicrobial activities of silver nanoparticles derived from black cabbage (*Brassica oleracea L.*) leaf waste

Abstract

Aim: The interest of nanobiotechnology is the manipulation of materials that occur at ultra-small sizes (1-100 nm). Due to its properties such as stability, size distribution, and surface charge, interest in silver nanoparticles (AgNPs) has been increasing in recent years. In this study, it was aimed to synthesize AgNPs in an environmentally friendly, cheap and simple way using black cabbage (*Brassica oleracea L.*) (BC) green leaf extract and to determine its activity against pathogenic microorganisms.

Materials and Methods: The black cabbage used in the study was obtained from Erzurum pasinler region. AgNO₃ was used for the synthesis. Antibiotics (fluconazole, vancomycin, and colistin) together with *Escherichia coli* ATCC 25922, *Bacillus subtilis* ATCC 11774, *Staphylococcus aureus* ATCC 29213, *Pseudomonas aeruginosa* ATCC 27853, and *Candida albicans* microorganisms were used to determine the Minimum Inhibitory Concentration (MIC) of BC-AgNPs. Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Energy Dispersive X-Ray (EDX) Spectroscopy, Fourier Transform Infrared (FT-IR) Spectroscopy and Zeta sizer were used for the structural characterization of the synthesized AgNPs.

Result: SEM and TEM results revealed that the morphological structures of AgNPs were spherical and showed good distribution. The zeta potential of BC-AgNPs was measured as -23.5 mV. MIC values (mg/mL) of AgNPs on the pathogen *Staphylococcus aureus* ATCC 29213, *Pseudomonas aeruginosa* ATCC27833 *Escherichia coli* ATCC25922, *Bacillus subtilis* ATCC11774 and *Candida albicans* were 1.00, 2.00, 0.50, 0.25, 0.50, respectively.

Conclusion: Even at very low concentrations, BC-AgNPs were found to be more effective than conventional antibiotics against pathogenic yeast and bacteria. Due to their antipathogenic effects, it seems possible that nanotechnological products containing AgNPs will be used more widely in many fields such as medical applications and food technology in the near future.

Keywords: AgNPs, EDX, Food Pathogens, SEM, TEM

attract the attention of researchers.

Due to its properties such as stability, size distribution, and surface charge, interest in AgNPs has been increasing in recent years (16). It is known that silver has a suppressive effect on bacterial cells. As is known, the "Ag" ion has the potential to prevent cell division and DNA synthesis (17). Thanks to their small size, AgNPs attach to cell membrane proteins and accelerate the formation of ROS (reactive oxygen species) in bacterial cells. The resulting ROS cause oxidative stress and this results in cell death (18,19).

Silver/silver salt has long been used to treat ulcers, sepsis, chronic wounds, burns, tonsillitis, acute epididymitis, and eye diseases in infants (20). Today, AgNPs are used in dozens of products such as antimicrobial packaging, sensors, medical devices, photonic and molecular diagnostic devices, pastes, household water treatment devices, electronics, textiles, conductive inks, cosmetics and household appliances (16,20).

AgNPs can be produced by physical (heat evaporation, energy ball milling, arc discharge, direct current magnetron sputtering), chemical (chemical reduction, photochemical reduction, physicochemical reduction, electrochemical reduction, radiolysis, pyrolysis) and biological methods (21-23). There are reducing agents, metal precursors and stabilizing/covering agents in the synthesis of AgNP nanostructures by chemical methods. In these methods, hydrazine, borohydride, ascorbic acid, sodium citrate and alcohol are frequently used as reducing agents. The most important advantage of the physical methods is that the size distributions of the AgNPs produced are narrow. However, the most important disadvantage of these methods is that they require high energy. Biological synthesis of AgNPs includes environmentally friendly applications compared to other methods. In biological synthesis, stabilizers and toxic reducing agents are replaced by non-toxic molecules (carbohydrates, proteins, lipids, antioxidants, etc.) produced by living organisms such as plants, bacteria, algae, fungi and yeasts (22,24). In this synthesis, not only toxic substances harmful to the environment are used, but the synthesis is faster and more economical than physical and chemical methods (25-27).

Recently, AgNPs synthesized from different parts such as flowers, leaves, roots and fruits of many plants such as *Cleome viscosa* (28), *Berberis vulgaris* (29), *Salvia spinosa* (30), *Black Mulberry* (31), *olive* (32), *Abelmoschus esculentus* (33, 34), *Rosa damascena* (35), *Cicer arietinum* (36), *Conocarpus lancifolius* (37) *Madhuca longifolia* have been reported.

In this document, BC leaves were used for the biosynthesis of AgNPs. BC is one of the Brassica genus vegetables belonging to the Brassicaceae (Cruciferous) family. BC, which is a headless plant with smooth and wide leaves that does not swell, usually produced from seeds, is one of the cabbages of the Acephala group (38). The main phytochemicals in BC, which has anticarcinogenic and antioxidant activity, are glucosinolates, carotenoids, anthocyanins and phenylpropanoids (38,39).

In our study, we synthesized AgNPs from black cabbage leaf waste, which is usually discarded or wasted before entering the kitchen. The synthesized AgNPs were characterized and their antimicrobial activities against pathogenic yeast and bacteria were investigated.

MATERIALS AND METHODS

Material

The black cabbage used in the study was obtained from Erzurum pasinler region. AgNO₃ (99.8% purity) and antibiotics (fluconazole, vancomycin and colistin) were provided from Sigma Aldrich firm. For the antimicrobial activities of BC-AgNPs, the common food pathogens *Escherichia coli* ATCC 25922, *Bacillus subtilis* ATCC 11774, *Staphylococcus aureus* ATCC 29213, *Pseudomonas aeruginosa* ATCC 27853 and *Candida albicans* were used.

Preparation of the Plant Leaf Extract in Aqueous Medium

The waste leaves of black cabbage were thoroughly washed with distilled water and dried in room conditions. 70 g of dried leaves were mixed with 200 ml of distilled water, boiled and cooled. Then, it was filtered through filter paper and stored in the refrigerator for the synthesis.

Biosynthesis of Silver Nanoparticles from the Plant Leaf

For the synthesis of AgNPs, 30mM AgNO₃ aqueous solution was prepared with solid AgNO₃. 100 mL of extract and 20 mL of AgNO₃ solution were allowed to react in a container at room temperature. The dark solution obtained after the reaction was centrifuged at 4000 rpm for 8 minutes. The precipitate obtained by centrifugation was washed repeatedly with distilled water. Then, the final material containing AgNPs was left to dry in an oven at 80 °C for 2 days. The resulting dry fraction was pulverized in a mortar.

Structural Characterization of the Synthesized Silver Nanoparticles

Morphology, surface distribution, elemental composition and zeta potential of synthesized AgNPs were determined by SEM (EVO 40 LEQ), TEM (Quanta), EDX (Quanta FEG 240) and Zetasizer (Malvern) instruments. FT-IR was used to determine the functional groups in the black cabbage leaf extract and the phytochemicals responsible for the reduction at the end of the reaction.

Antimicrobial Activities of the Silver Nanoparticles

MIC values of biosynthesized AgNPs on yeast and bacteria were determined by microdilution method. Mueller Hinton Broth for bacteria and RPMI for yeast were added to the wells used for this purpose. The solution of biosynthetically produced AgNPs was added to microplates containing microorganisms and medium. For dilution, 100 µL was taken from each of the wells and transferred to the next well. After the transfer process was completed, microorganism solutions were added to all

microplates and incubated at 37 °C for a day. After the incubation was completed, the lowest concentration that did not grow in the microplates was determined as the MIC value (40). In addition, antibiotics and 30 mM AgNO₃ solution were used to compare the antimicrobial effects of biosynthesized AgNPs on pathogenic yeast and bacteria.

RESULTS

SEM (Figure 1) graphy was obtained to determine the morphology and surface distribution of the synthesized AgNPs. Then, TEM (Figure 2) graphy were taken to obtain more detailed results.

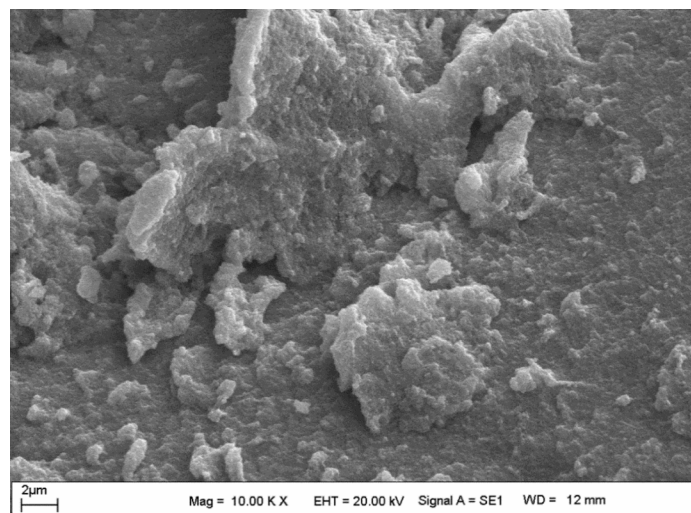


Figure 1. SEM image of AgNPs obtained by biosynthesis

Functional groups involved in plant-based reduction reactions are determined using FT-IR spectroscopy (1,30,40). FT-IR spectroscopy is shown in Figure 3.

The presence of pure silver with high elemental composition was detected in the EDX spectrum (Figure 4).

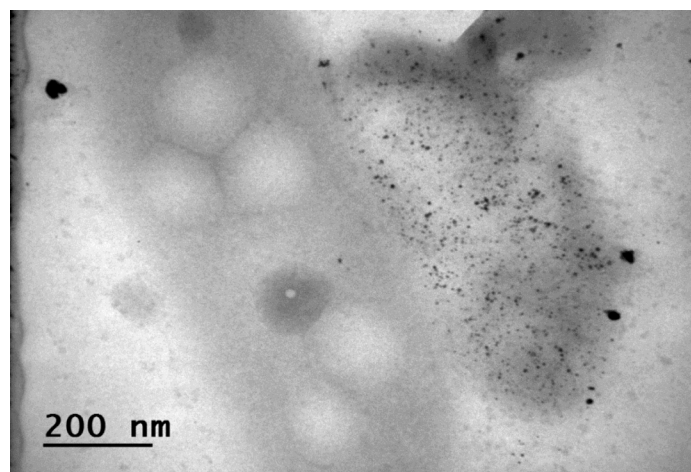


Figure 2. TEM image of AgNPs obtained by biosynthesis

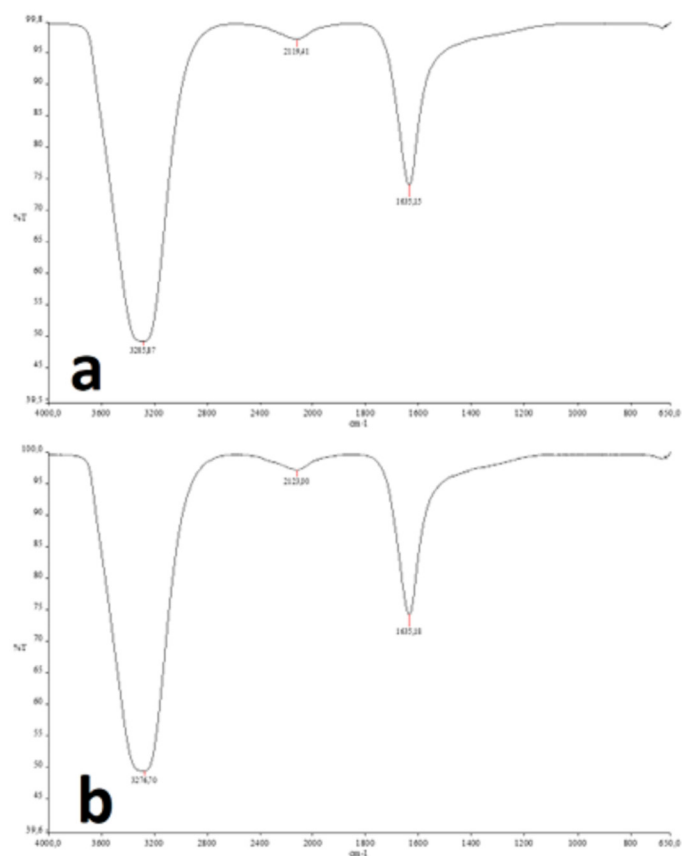


Figure 3. FT-IR spectra of black cabbage aqueous leaf extract (a) and synthesized AgNPs (b)

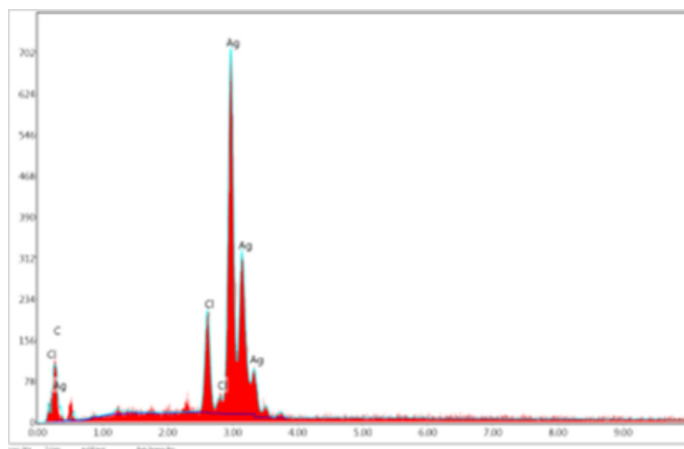


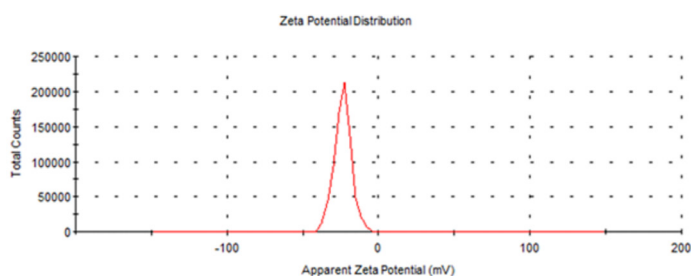
Figure 4. EDX analysis of AgNPs synthesized from black cabbage

The zeta potential of AgNPs synthesized from black cabbage leaf extract was found to be -23.5 mV (Figure 5).

According to the results of the current study, BC-AgNPs appear to have strong inhibition against common food pathogens (Table 1). Compared to both AgNO₃ and classical antibiotics, the effect of AgNPs at lower concentrations is remarkable.

Table 1. MIC values of synthesized AgNPs, AgNO₃ aqueous solution and the antibiotics (mg/mL)

| Target Organisms | AgNP's | AgNO ₃ | Antibiotics |
|---|--------|-------------------|-------------|
| <i>Staphylococcus aureus</i> ATCC 29213 | 1.00 | 2.65 | 2.00 |
| <i>Escherichia coli</i> ATCC25922 | 0.50 | 0.66 | 2.00 |
| <i>Bacillus subtilis</i> ATCC11774 | 0.25 | 1.32 | 1.00 |
| <i>Pseudomonas aeruginosa</i> ATCC27833 | 2.00 | 1.32 | 4.00 |
| <i>Candida albicans</i> | 0.50 | 0.66 | 2.00 |

**Figure 5.** Zeta potential of synthesized AgNPs

FT-IR data (Figure 3) shows that -OH groups (27) play a role in the frequency shift occurring at 3285.87-3276.70 cm⁻¹. As it is known, metal NPs are characterized by strong absorption spectra due to surface plasmon resonances (SPR), which create electron-coherent oscillations on the surface of the particles (16). Due to SPR, the synthesized AgNPs exhibited the characteristic optical absorption peak of around 3 KeV. Weak signals such as carbon and chlorine in the EDX profile are thought to originate from phytomolecules on the surface of nanoparticles (Figure 4).

The high negative value of the zeta potential, which represents the electric charge on the surface of the coated material, prevents the NPs from aggregating and sticking together. This situation reveals the stability of AgNPs in colloid form. As it is known, as the negative charge of nanoparticles increases, their entry into the cell becomes easier (9,36). The zeta potential value indicates that BC-AgNPs are stable and uniformly dispersed (Figure 5). Recently, there have been many studies documenting that AgNPs have significant negative zeta potential. In these studies, it was reported that AgNPs synthesized from the leaves and flowers of various plants had a zeta potential in the range of (-) 4.68 - (-) 23.4 mV (9,32).

As a result of intensive and unconscious use of antibiotics, microorganisms develop resistance to antibiotics. For this reason, scientists have made great efforts to develop alternative solutions to antibiotics for years. From this point of view, the antimicrobial properties of AgNPs, which have the potential to be an alternative to antibiotics, draw attention. It was observed that the synthesized nanomaterial was much more effective than

DISCUSSION

The biosynthesized AgNPs were mostly spherical in shape (Figure 1, Figure 2). AgNPs synthesized from *Crataegus monogyna* (8) *Cynara scolymus* (27) *Abelmoschus esculentus* (34) *Cicer arietinum* (36) were also reported to have spherical morphology. The TEM image proved that the biosynthesized NPs showed nano-sized and homogeneous distribution (Figure 2). BC-AgNPs of this scale are expected to have stronger antimicrobial activity, as they can penetrate the microorganism cell more easily.

AgNO₃ and antibiotic on *Bacillus subtilis* (0.25 mg/mL) bacteria and *Candida albicans* (0.50 mg/mL) yeast. This research revealed that the synthesized AgNPs were not only biocidal at lower concentrations, but also had a wider spectrum of biocidal effects (Table 1). The obtained results were found to be compatible with many AgNP green synthesis studies conducted in recent years (27,31,36).

CONCLUSION

Black cabbage leaf waste extract was used as a reducing and stabilizing agent in the synthesis of AgNPs obtained by the green synthesis method. No toxic or dangerous substances harmful to the environment were used in the study. The synthesis was not only economical, but also easy and fast. The synthesis of AgNPs was confirmed by SEM, TEM and EDX analysis. It was observed that the biosynthesized AgNPs mostly had spherical morphology. It was determined that BC-AgNPs produced in the measurements made with the Zetasizer had a significant negative surface electrical charge. The FT-IR spectrum revealed the presence of phytochemical groups in synthesis. Even at very low concentrations, AgNPs were found to be more effective than conventional antibiotics against pathogenic yeast and bacteria. Due to their antipathogenic effects, it seems possible that nanotechnological products containing AgNPs will be used more widely in many fields such as medical applications and food technology in the near future.

Competing interests: The authors declare that they have no competing interest.

Financial Disclosure: There are no financial supports.

Ethical approval: Ethics committee approval is not required.

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