

ORIGINAL RESEARCH

Knowledge and Attitude of Healthcare Professionals Towards Ozone Therapy

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ABSTRACT

In medicine, ozone therapy is used in many instances. This study aims to understand the knowledge and attitudes of healthcare professionals towards ozone therapy. We conducted a cross-sectional survey in a comprehensive hospital between November 2020 and January 2021. In addition to evaluating the sociodemographic characteristics of the healthcare professionals, we performed evaluations through a data collection form that we prepared based on the literature. A total of 544 people were included in the study. We found ozone therapy to be the fifth-most frequently heard (72.2%) and experienced (2%) application among traditional and complementary

medical applications. Of the participants, 20.8% (n = 113) correctly answered the questions regarding the methods of application of ozone therapy. We found that the most common route of administration was intravenous administration, with a rate of 56.5% (n = 307). The number of correct answers received for the questions regarding ozone therapy was related to professional experience, sex, and occupation ($P = .035$, $P < .001$, and $P < .001$, respectively). We determined that the knowledge and attitudes of healthcare professionals towards ozone therapy are not satisfactory. (*Altern Ther Health Med.* 2023;29(7):238-241).

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BACKGROUND

Ozone, which was discovered in 1839, is an inorganic molecule consisting of three oxygen molecules; it is highly soluble in water and highly oxidant.¹ In medicine, ozone treatment makes use of ozone produced from pure oxygen using a special generator. The ozone is mixed with pure oxygen in specific proportions and applied to various parts of the patient's body by mixing it with their own blood or distilled water or by using it in the gaseous form. This leads to erythrocyte metabolism activation, tissue oxygenation, and cell function restoration.² Ozone therapy consists of mixing pure oxygen and ozone in certain proportions and administering this combination to the patient in various ways. Medical ozone therapy can be administered through means that are intravenous, intramuscular, intra-articular, and intradiscal; or through rectal/vaginal insufflation,

systemic extravascular blood oxygenation-ozonation (major autohemotherapy), and topical extravascular blood oxygenation-ozonation (minor autohemotherapy).³ It is used in medicine for many indications, such as dental caries, hypercholesterolemia, ischemia, and musculoskeletal pathologies.^{4,5}

Ozone therapy is one of the procedures whose implementation was made legal by the Regulations on Traditional and Complementary Medicine Practices published in the Official Gazette No. 29158 on October 27, 2014, by the Turkish (TR) Ministry of Health.⁶ This regulation restricts the application of ozone therapy and other complementary medicine methods by non-healthcare professionals, and it specifies the health institutions where the application can be used and their working procedures and principles.⁷

Discussions regarding the place of complementary medicine methods in classical medicine in our country as well as in the world continue. As with non-healthcare professionals, there is confusion among healthcare professionals on this issue.

Primary Study Objective

Our study aims to evaluate the knowledge and attitudes of healthcare professionals towards ozone therapy, which has become widespread recently.

Table 1. Distribution of Traditional and Complementary Medicine Application Frequency

	I have heard about it	I have experienced it	I recommend it	I have not heard about it
Acupuncture	492 (90.4)	31 (5.7)	19 (3.5)	42 (7.7)
Apitherapy	113 (20.8)	8 (1.5)	10 (1.8)	425 (78.1)
Phytotherapy	272 (50.0)	12 (2.2)	15 (2.8)	266 (48.9)
Hypnosis	454 (83.5)	8 (1.5)	7 (1.3)	83 (15.3)
Leech application	474 (87.1)	18 (3.3)	28 (5.1)	65 (11.9)
Homeopathy	76 (14.0)	2 (0.4)	7 (1.3)	464 (85.3)
Chiropractic	50 (9.2)	6 (1.1)	10 (1.8)	489 (89.9)
Cup application (hijama)	460 (84.6)	44 (8.1)	33 (6.1)	71 (13.1)
Larva application (maggot treatment)	100 (18.4)	3 (0.6)	5 (0.9)	440 (80.9)
Mesotherapy	212 (39.0)	8 (1.5)	7 (1.3)	326 (59.9)
Prolotherapy	51 (9.4)	4 (0.7)	5 (0.9)	489 (89.9)
Osteopathy	109 (20.0)	5 (0.9)	7 (1.3)	429 (78.9)
Ozone therapy	393 (72.2)	11 (2.0)	13 (2.4)	142 (26.1)
Reflexology	150 (27.6)	6 (1.1)	10 (1.8)	389 (71.5)
Music therapy	364 (67.0)	11 (2)	17 (3.1)	172 (31.7)

Table 2. Distribution of Answers to Questions Regarding Ozone Therapy

	Yes	No	I do not know
Ozone therapy is a traditional practice	91 (16.7)	210 (38.6)	243 (44.7)
Ozone therapy is a method of complementary medicine	278 (51.1)	35 (6.4)	231 (42.5)
Ozone therapy is an alternative application	320 (58.8)	25 (4.6)	199 (36.6)
Ozone therapy can be performed by certified physicians	360 (66.2)	8 (1.5)	176 (32.4)
Ozone therapy can be performed by certified non-physician healthcare professionals	96 (17.6)	187 (34.4)	261 (48)
No certificate is required to administer ozone therapy	21 (3.9)	274 (50.4)	249 (45.8)
Ozone is an anti-oxidant substance	193 (35.5)	23 (4.2)	328 (60.3)
Ozone can be used for joint, tendon or ligament injuries	205 (37.7)	17 (3.1)	322 (59.2)
Ozone can be used for vertebral and vertebral disc-related pathologies and pain	188 (34.6)	12 (2.2)	344 (63.2)
Ozone can be used in treating myofascial pain, fibromyalgia	230 (42.3)	12 (2.2)	302 (55.5)
Ozone can be used in treating diabetic wounds	221 (40.6)	17 (3.1)	306 (56.3)
Ozone can be used in treating infected diabetic wounds	201 (36.9)	18 (3.3)	325 (59.7)
Ozone can also be used in treating gingivitis, periodontitis (gingival inflammation, etc.)	157 (28.9)	25 (4.6)	362 (66.5)
Ozone can be used in treating neuropathic pain	224 (41.2)	12 (2.2)	308 (56.6)
Ozone can be used in treating extremity wounds with critical ischemia	154 (28.3)	12 (2.2)	378 (69.5)
Ozone therapy strengthens the immune system	230 (42.3)	13 (2.4)	301 (55.3)
Ozone therapy has anti-microbial effects	165 (30.3)	17 (3.1)	362 (66.5)
Ozone is a chemical gas consisting of two oxygen atoms	136 (25)	50 (9.2)	358 (65.8)
Ozone has been used since 3000 BC Ancient Egyptian times	50 (9.2)	20 (3.7)	474 (87.1)
Ozone can be used for water disinfection	70 (12.9)	38 (7)	436 (80.1)
Ozone therapy alone is sufficient for improving health	15 (2.8)	222 (40.8)	307 (56.4)
Ozone therapy has few proven medical benefits	28 (5.1)	117 (21.5)	399 (73.3)

Note: Bold fonts indicate correct answer percentages.

METHODS

This cross-sectional survey was conducted in a comprehensive hospital. We tried to include all healthcare workers; therefore, power analysis was not required.

Setting

We conducted this study between November 2020 and January 2021 in Samsun Training and Research Hospital Maternity Unit.

Participants

The study participants were the healthcare professionals (n = 709) in the institution. During the data collection process, we could not reach 64 people because they were on quarantine or resting leave due to COVID-19; 27 people were on annual leave or post-shift leave; 21 people were on flexible working leave during the COVID-19 pandemic; and 53 people did not want to participate in the study. We included the remaining healthcare professionals in the study.

In addition to the sociodemographic characteristics of the participants, we evaluated their knowledge and attitude towards ozone therapy through a data collection form that we prepared in accordance with the literature. We included three main questions with 46 multiple-choice items, of which 15 multiple-choice items concerned practices that are applied within the scope of complementary medicine regulations in Turkey. The awareness-related questions were included separately; there were nine items regarding how ozone therapy can be applied and 22 multiple-choice items that examine basic information regarding ozone therapy. We, acting as interviewers, filled the forms face-to-face with the respondents. It took an average of 15 minutes to fill out a form.

Healthcare professionals include doctors, nurses, midwives, health officers, cleaning and security personnel, secretaries, and administrative staff. While analyzing the participants, we grouped them as doctors, nurses/midwives, and other personnel.

We analyzed the data using IBM SPSS V23 and examined conformity to the normal distribution using the Kolmogorov-Smirnov test. We used the Chi-square test to compare categorical variables according to groups and the Mann-Whitney U test to compare data that were not normally distributed according to the paired groups. We used the Kruskal-Wallis test to compare the number of answers that were not normally distributed in groups categorized by occupation and examined multiple comparisons via Dunn's test. Furthermore, we used Spearman's correlation coefficient (rho) to examine the relationship between data that were not normally distributed. We present the analysis results as mean ± standard deviation and median (minimum-maximum) for quantitative data and frequency (percentage) for categorical data. The significance level was evaluated as $P < .05$.

We obtained approval for the study from the local ethics committee in August 2020 (approval number GOKA/2020/12/5).

RESULTS

We were able to reach 76.7% of the population (n = 544), and 75.9% (n = 413) of the participants were female. In terms of occupation, 8.1% (n = 44) of the participants were doctors, 49.4% (n = 269) were nurses/midwives, and 42.5% (n = 231) were employed in other occupations. The mean age was 40.6 ± 7.6 years, and the mean duration of professional experience was 17.5 ± 8.2 years.

Primary Outcome Measures

Ozone therapy is the fifth-most frequently heard (72.2%) and experienced (2%) application among traditional and complementary medicine applications (Table 1). In this study, 20.8% of the participants (n = 113) provided correct answers to the questions regarding the methods of ozone therapy application. We found that the most common route of administration was intravenous administration (rate: 56.5%, n = 307). The most correctly answered item (66.2%), was the question on whether "ozone therapy can be performed by certified physicians" (Table 2). There was no significant

difference between sex and occupation in terms of the distribution of correct answers for the question, “In what forms or ways can ozone therapy be applied?” ($P = .298$, $P = .536$). Further, there was no significant difference between the median values of age and years of professional experience of the participants who answered this question correctly and incorrectly ($P = .178$, $P = .340$, respectively).

While there was no statistical relationship between age and the number of correct answers we received for the questions regarding ozone therapy ($P = .597$), we found a significant positive correlation between professional experience and the number of correct answers ($r = 0.090$; $P = .035$).

We found a significant difference between the median values of the number of correct answers received for the questions regarding ozone therapy in terms of sex ($P < .001$). While the median value for females was 8, the median value for males was 3. Additionally, in the case of the occupation-based groups, we found a significant difference between the median values of the number of correct answers received for the questions regarding ozone therapy ($P < .001$). The median number of correct answers provided by doctors was 11, nurses/midwives was 9, and other personnel was 3 (Table 3).

DISCUSSION

To our knowledge, our study is the first in the medical literature to evaluate awareness of ozone therapy among health professionals. Several studies evaluate physicians, students, and the public’s knowledge regarding methods used in complementary medicine,⁸⁻¹⁰ but studies that specifically evaluate any of these methods are limited.

Complementary medicine is not progressing as fast in Turkey as in the rest of the world. Due to the inadequate and reluctant approach of the medical community towards this area, people from non-medical sectors have unconsciously started using instruments of complementary medicine with the intent of receiving financial gains. At this point, the complementary medicine regulation came to the rescue of complementary medicine professionals and their patients.¹¹ Ozone therapy is one of the practices mentioned in the regulation, and articles reporting that it can be effective against Ebola and COVID-19 infections are increasing in popularity day by day¹²⁻¹⁴—which is an important factor in the development of our study.

We reviewed the literature to evaluate healthcare personnel’s awareness of complementary medicine practices. According to a study by Dagci and Ozturk, the method of complementary medicine most frequently recommended (27%) by family physicians to their patients is ozone therapy, and this rate is even higher for physicians with five years or less of family medicine experience.⁷ Our data shows that there is a positive correlation between professional experience and knowledge of ozone therapy, and this is not consistent with the literature. Differences in the occupations of our participants may have contributed to this. Al-Rowais et al, in a study that included primary care physicians, observed that familiarity with ozone therapy remained at a rate of 4%.⁸ In a

Table 3. Comparison Between Sex and Occupation Groups in Terms of the Number of Correct Answers Given to Questions Regarding Ozone Therapy

	Mean ± Standard deviation	Median (min-max)	Test statistics	P value
Gender				
Female	7.5 ± 5.7	8.0 (0.0 - 18.0)	21237.0*	<.001
Male	5.5 ± 5.8	3.0 (0.0 - 18.0)		
Occupation-based group				
Doctor	10.4 ± 5.7	11.0 (0.0 - 18.0) ^b	41.242*	<.001
Nurse/midwife	8.0 ± 5.8	9.0 (0.0 - 18.0) ^b		
Other personnel	5.3 ± 5.2	3.0 (0.0 - 18.0) ^b		

*Mann-Whitney U test

^bThere is no difference between the occupations indicated by the same letter

^cKruskal-Wallis test

study by Ayraler et al, which included medical faculty, ozone therapy ranks in the middle in terms of awareness of the methods of complementary medicine used in Turkey.¹⁵ This data coincides with our study, as the studies were conducted in the same country and with participants employed in similar occupations. Although ozone therapy is used in many countries, it is mostly used by physicians engaged in private practice and is severely hindered by the lack of sponsors, the indifference of health authorities, and prejudices among clinical scientists.¹⁶ This undeniable fact may prevent the perspective on ozone therapy from reaching more positive levels.

Major autohemotherapy is safer than other forms of application. It is usually administered using citrate as the anti-coagulant in a concentration ranging 20–40 µg/ml or using 5000 units of heparin per 200 ml of blood. It has been reported that Rowen and Re used major autohemotherapy approximately 60 000 times in humans in the last 30 years without any adverse effects.¹⁷ This application is the most commonly known form of ozone therapy among our participants.

The lack of knowledge among our participants regarding who can administer ozone therapy is noteworthy; almost one-third of the participants did not know about the obligation of being a certified physician to perform ozone therapy. Again, the number of participants unaware of the proven medical benefits of ozone therapy in our study is alarmingly high, but Re et al emphasize that it can be a promising ally in the use of orthodox medicine.¹⁸ When we take into account the other questions evaluating awareness of ozone therapy, we see that doctors and nurses/midwives answered the questions more correctly than healthcare professionals engaged in other occupations, and this may be because these professional groups are more experience in observing medical practices and tracking academic publications. This is supported by the findings of Gardiner et al, who show a positive correlation between health literacy and complementary medicine experience.¹⁹

Despite the large number of supportive scientific studies on the breadth of its influence,²⁰⁻²² awareness of ozone therapy among healthcare professionals is low, as our study shows. In light of this information, it is essential to include ozone therapy in the curriculum, increase the number of

ozone therapists, contribute research articles, and periodically organize national and international congresses that can help increase the awareness of healthcare providers.

Our study was limited to a single center and was restricted by measures introduced during the COVID-19 pandemic. This prevented us from increasing the number of participants to the desired level and generalizing the results. The absence of a valid questionnaire regarding ozone therapy required us to use a data collection form that we created on our own. In addition, limited literature made it difficult to interpret some parameters.

CONCLUSION

Ozone therapy is used to treat many medical conditions, as reported in the literature. However, healthcare professionals' awareness and attitudes towards ozone therapy are not satisfactory. Therefore, identifying the factors that lead healthcare professionals to, or draw them away from, ozone therapy can benefit all stakeholders. Further research specific to ozone therapy awareness is needed.

DECLARATION OF FINANCIAL/OTHER RELATIONSHIPS

The authors have no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties.

ETHICS APPROVAL

Ethics committee approval, dated August 2020, and protocol numbered GOKA/2020/12/5, was obtained from Samsun Provincial Health Directorate Scientific Research Evaluation Commission and Samsun Training and Research Hospital Non-Interventional Clinical Research Committee. At every stage of the study, the principles of the Declaration of Helsinki were followed.

AUTHOR CONTRIBUTIONS

- Main idea of the study: BY, OO
- Design: BY, MAO, OO
- Data collection: BY, MAO, MEG
- Analysis and interpretation of data: BY, OO
- Article drafting: BY, MAO, MEG, OO
- Review of the final version of the article: BY, MAO, MEG, OO

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