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Journal of Basic Health

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ATATÜRK ÜNİVERSİTESİ YAYINLARI
ATATURK UNIVERSITY PUBLICATIONS

Research Article DOI: 10.5281/zenodo.10894254

Evidence-based practice in internal disease nursing

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ABSTRACT

Evidence-based practice is an approach that is rapidly heard in the fields of health and nursing and is important in the clinical decision-making process. While this approach, for which research centers have been established and new studies have been carried out, is expected to meet the need for quality care based on the best and most up-to-date evidence, it seems that the current situation is not at a level to meet this. In this review, the place of evidence-based practice in internal medicine nursing and the facts about evidence-based practice are investigated, and it is aimed to explain nurses' evidence-based practice attitudes and hindering factors within the framework of the literature.

Keywords: Evidence-based practice, evidence-based nursing, internal medicine nursing.

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Introduction

Evidence-based practice (EBP) movement, which started with Archie Cochrane, a British physician-epidemiologist, in the 1970s, when he said that decisions to be made in the field of health should be based on evidence, not on medical ideas or experiences, is a movement based on Evidence-Based Practice with its use in medical education and practice. It formed the basis of medicine (KDT). Thus, EBM came to the fore in solving clinical problems (Scott and McSherry, 2009; Brady and Lewin, 2007). The Cochrane Center, established in England, has been a structure that pioneers systematic evaluations (Gennaro et al., 2001). Evidence-Based Nursing (ECH), which was born under the leadership of the EBM movement, first developed with the establishment of the Evidence-Based Nursing Journal in 1998. Later, nursing evidence centers were established in European countries such as Canada and England. Stetler, who first discussed CDH in her nursing theory, defended the importance of the study findings in nursing practice. The American Medical Association (AMA) emphasized that EBP plays a key role in the field of future nursing and suggested that it should be included in the nursing curriculum (Institute of Medicine, 2011). Platin (2000) was the first nurse to address these concepts in Turkey by explaining the concepts of EBP and EBP and the barriers in practice.

Evidence-Based Practice

Evidence-Based Practice (EBP) takes account available evidence, clinical experience, and patient needs when making clinical decisions (Hu and Xing, 2015; Sin and Bliquez, 2017). This evidence can be obtained from systematic reviews, meta-analyses, or well-designed clinical studies (Sedlar et al., 2017; Sin and Bliquez, 2017). EBP for nursing; Nurses should provide the best care possible to the individual they care for, in line with their clinical experience and existing study findings, as much as available resources allow, and while doing this, they should not ignore the individual's wishes (Intas et al., 2017). The EBP approach has also been regarded as a problem-solving approach, as it ensures that the best evidence is provided together with clinical experience in the most appropriate patient and under the most appropriate conditions; It has attracted worldwide attention and taken its place in health policies (Baicker & Chandra, 2017; Chalkidou et al., 2009; Fineout-Overholt et al., 2005; Sedlar et al., 2017; Sin & Bliquez, 2017; Zhou et al., 2017). 2016). Additionally, several online databases and journals have been established to support EBP and provide a source of evidence for clinicians. These include the Cochrane Library, the National Institute of Clinical Excellence (NICE) website, UpToDate, the Trip Database, and many others (Greenhalgh, Howick, and Maskrey, 2014; Zhou et al., 2016).

Competencies Required for Evidence-Based Practice

Internationally, competencies for EBP are essential requirements in clinical practice among all healthcare professionals. These competencies of healthcare professionals constitute the five-stage model of the Sicilian Declaration. Five-step model of EBP includes competencies that include asking questions, finding evidence to answer questions, critically evaluating evidence, applying evidence, and evaluating impact. It is stated that the curriculum should be based on this five-step model to provide these competencies (Dawes et al., 2005; Burns and Foley 2005). Nurses are responsible for all the practices they perform. For this reason, every nursing practice must be accountable. One of the most ideal methods to meet this requirement is EBP (Kocaman, 2007). For this reason, when conducting EBP, nurses' attitudes, knowledge, skills and practices regarding EBP, from the stage of asking questions to the stage of evaluating the application, become important (Black et al., 2015; Wallace and Vanhook, 2016; Dalheim et al., 2012). Since nurses make up the largest group of healthcare professionals, it is stated that it is critical to find out ways to promote the use of scientific evidence in nursing care (Yost et al., 2014).

Advantages of Evidence-Based Practice

Evidence-based practice (EBP) in patient care refers to care delivered by blending clinical experience, the newest and strongest available study evidence, as well as the patient's unique values and circumstances (Straus et al., 2011). Research indicates that EBP lowers healthcare expenditures, enhances clinical results, and lessens patient outcome variation. (de Pedro-Gomez et al., 2012; Considine and McGillivray, 2010; Cosme et

al., 2018; Kocaman, 2007; Wallace and Vanhook, 2016). Therefore, nurses should use the best and most current research evidence available in their clinical decision-making (Institute of Medicine, 2010). Furthermore, it is claimed that EBP increases involvement, teamwork, and job satisfaction while also empowering clinicians. (Kim et al., 2017; Melnyk et al., 2010; Melnyk, et al., 2018). The importance of EBP has been proven, but there exist major obstacles preventing it from becoming the standard of care worldwide. These obstacles: (a) inadequate EBP knowledge and skills of clinicians, (b) misperceptions that EBP is too time-consuming, (c) organizational culture and policies, (d) lack of support from nurse leaders and managers, and (e) inadequate resources in EBP and investment (Jun, Kovner, and Stimpfel, 2016; Melnyk et al., 2016; Melnyk, et al., 2012). Although educational interventions aimed at increasing nurses' EBP knowledge and skills are predominant in the literature (Black et al., 2015; Philips et al., 2014; Wu et al., 2018; Young et al., 2014), it has been shown that access from health care systems to EBP consultants who not only increase EBP knowledge and skills but also promote the delivery of evidence-based care can play an important role in implementing EBP and improving organizational cultures (Black et al., 2015; Melnyk et al., 2004; Fineout-Overholt and Melnyk, 2015; Melnyk, 2007).

Challenges of Evidence-Based Practice

Despite the many strengths of using evidence-based practice, its application in practice is limited (Strokke et al., 2014; Duncombe, 2018). The implementation phase is considered a complex and slow process that is affected by various factors at many levels (Saunder at al., 2016). Many researchers have identified various obstacles to the practical application of research findings (Saunder at al., 2016; Bainchi et al., 2018; Gifford et al., 2018). Research continues to identify inconsistencies in its adoption and application in the clinical work environment (Curtis et al., 2017). A recent study showed that 72.1% of nurses had not tried to implement EBP before (Duncombe, 2018). Other studies on nurses' implementation of EBP in their daily clinical practice have also shown that it is suboptimal (AbuRuz et al., 2017; Verloo et al., 2017). For optimal execution, professionals need to have timely access to information. This is challenging as there are often delays between research being conducted and published, and then from publication to implementation or policy. As with any research method, EBPs are subject to biases that may affect the reliability of a particular treatment, such as sponsorship of the study, methodologies used, subjects selected, and publications.

Evidence-Based Practice and Internal Medicine Nursing

Patients who are cared for in Internal Medicine units have chronic diseases such as heart failure, cancer, chronic obstructive pulmonary disease, and diabetes. These are end-stage patients who may require ongoing hospitalization and require sophisticated care. In internal medicine facilities, where patients with greater degrees of reliance and need for continuous care are treated, the application of evidence-based practice (EBP) is essential. (Dalheim et al., 2012; Korhan et al., 2013). Nurses working in these units must be able to actively carry out practices to prevent the exacerbation, progression and/or complications of the disease and use EBP to increase the efficiency and quality of care provided to patients (Zhou et al., 2016).

Because they provide services to a very common patient group, nurses working in internal medicine units use EBP in the clinic; It may be at the desired level to increase the quality of care, minimize the risk of medical errors, standardize care, increase patient satisfaction, and provide cost efficiency (Aburuz et al., 2018; Güneş, 2017; Korkmaz, 2015). For this reason, it is important to determine the attitudes, knowledge and skills of nurses working in internal medicine units regarding EBP (Daştan and India, 2018; Menekli and Korkmaz, 2021).

According to a study looking into how intensive care nurses feel about evidence-based nursing, nurses who read professional journals, look over scientific research findings, are familiar with evidence-based practices, and get training in research methods after graduation have generally positive attitudes towards evidence-based nursing. (Dikmen et al.., 2018). In a study evaluating the attitudes of internal medicine nurses towards evidence-based nursing, it was determined that the nurses' attitudes towards evidence-based nursing

were at a moderate level (Menekli and Korkmaz, 2021). Consistent with the findings of this investigation, Daştan and India's (2018) research reported that internal medicine unit nurses' opinions regarding evidence-based nursing were moderate. Attitude is essential in guiding human behavior to achieve goals. For this reason, it is claimed that nurses' professional attitudes play a significant role in influencing the usage of EBP (Zhou et al., 2016). It is acknowledged that improving the application of EBP requires changing nurses' attitudes and expertise. (Mehrdad et al., 2012). Despite the existence of studies with relatively positive attitudes, it is stated that the gap between research and practice in nursing in the use of EBP and research continues (Özdemir and Akdemir, 2009; Pitsillidou et al., 2020).

Identifying factors that contribute to the research and nursing practice gap can provide a basis for developing strategies to reconcile it. According to a study investigating the barriers to the adoption of evidence-based practice among nurses, the main obstacle hindering the integration of research evidence into practice and therefore the application of evidence-based practice to nursing is that nurses do not have time to conduct research and read research articles (Pitsillidou et al., 2020). However, healthcare professionals have been reported to have poor information search and access skills, and deficiencies in the use of updated information sources have been noted (Farokhzadian et al., 2015; Sadeghi-Bazargani et al., 2014; Shafiei, et al., 2014). In a systematic review examining barriers related to EBP among nurses in low- and middle-income countries, it was found that nurses were most likely to experience institutional barriers (such as insufficient resources, limited access to information, insufficient staff and lack of institutional support), and interdisciplinary barriers (academic and clinical practice barriers). They stated that they experienced obstacles to EBP due to reasons such as lack of communication between environments, inconsistency between education and practice in the nursing discipline, and lack of teamwork) and nurse-related obstacles (such as perceived limitations within the scope of nurses' practice, time, EBP knowledge and individual obstacles) (Shayan et al., 2019). Öztürk et al. (2010) found that nurses seek to conduct research and use research findings in their practices, but they encounter obstacles such as lack of opportunities to implement research findings, lack of a central department with nursing-specific information, and nurses not having time to do research. In Demir et al.'s (2012) study, nurses stated that lack of time, lack of cooperation and support, and lack of authority were the most important obstacles; He also expressed the provision of institutional, administrative, and educational support as facilitating factors. According to these results, nurses should be aware of where and how to obtain evidence.

Conclusion

Research and instruction must be continued throughout one's life to adopt an evidence-based practice. The research required for EBP must be conducted by nurses working in internal medicine units, the research required for practice by nurse researchers, and the findings must be applied by nurses. To achieve this, first, nurses working in internal medicine units need to be encouraged to be good researchers, have the competence to critically evaluate research, provide nursing practices with an evidence-based culture, and realize that they have an obligation to do this. To do this, EBP's barriers should be lowered, clinical and academic nurses ought to collaborate, EBP must have greater space in undergraduate and graduate education programs, and nurses should be exposed to this culture. (Copur et al., 2015; Fink et al.., 2005; Küçükkaya, 2010).

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References

1. Aburuz ME, Abu Hayeah H, Al-Dweik G, Al-Akash HY. Knowledge, attitudes, and practice about evidence-based practice: a Jordanian study. Health Science Journal 2017;11(2):1–8.
2. AbuRuz ME, Hayeah HA, Al-Dweik G, Al-Akash HY. Knowledge, attitudes, and practice about evidence-based practice: a Jordanian study. Health Sci J. 2017;11(2):1.
3. Baicker, K., & Chandra, A. Evidence-based health policy. N Engl J Med, 2017; 377(25), 2413-5.
4. Bianchi M, Bagnasco A, Bressan V, et al. A review of the role of nurse leadership in promoting and sustaining evidence-based practice. Journal of Nursing Management. 2018;1–15.
5. Black, A. T., Balneaves, L. G., Garossino, C., Puyat, J. H., & Qian, H. Promoting evidence-based practice through a research training program for point-of-care clinicians. The Journal of nursing administration, 2015; 45(1), 14.
6. Brady N, Lewin L. Evidence-based practice in nursing: bridging the gap between research and practice. J Pediatr Health Care 2007;21:53-6.
7. Burns HK, Foley SM. Building a foundation for an evidence-based approach to practice: teaching basic concepts to undergraduate freshman students. J Prof Nurs. 2005;21(6):351–7..
8. Chalkidou, K., Tunis, S., Lopert, R., Rochaix, L., Sawicki, P. T., Nasser, M., & Xerri, B. Comparative effectiveness research and evidence-based health policy: experience from four countries. The Milbank Quarterly, 2009;87(2), 339-367.
9. Considine J, McGillivray B. An evidence-based practice approach to improving nursing care of acute stroke in an Australian emergency department. J Clin Nurs. 2010;19(1-2):138-144.
10. Copur, E. O., Kuru, N., & Seyman, C. C. Hemşirelikte kanıta dayalı uygulamalara genel bakış. Sağlık ve Hemşirelik Yönetimi Dergisi, 2015;1(2), 51-55.
11. Cosme S, Milner KA, Wonder A. Benchmarking of prelicensure nursing students'evidence-based practice knowledge. Nurse Educator 2018;43(1):50–53.
12. Curtis K, Fry M, Shaban RZ, Considine J. Translating research findings to clinical nursing practice. Journal of Clinical Nursing. 2017;26(5-6):862–872.
13. Dalheim A, Harthug S, Nilsen RM, Nortvedt MW. Factors influencing the development of evidence- based practice among nurses: a self-report survey. BMC Health Serv Res 2012;12:367.
14. Daştan, B., & Hintistan, S. Dahiliye kliniklerinde çalışan hemşirelerin kanıta dayalı hemşireliğe yönelik tutumlarının belirlenmesi: kırsal bölge örneği. Ordu Üniversitesi Hemşirelik Çalışmaları Dergisi, 2018;1(1), 1-9.
15. Dawes M, Summerskill W, Glasziou P, Cartabellotta A, Martin J, Hopayian K, et al. Sicily statement on evidence-based practice. BMC Med Educ. 2005;5(1):1. 4.
16. de Pedro-Gomez J, Morales-Asencio JM, Bennasar-Veny M, et al. Determining factors in evidence-based clinical practice among hospital and primary care nursing staff. J Adv Nurs. 2012;68(2):452-459
17. Demir, Y., Ak, B., Bilgin, N., Efe, H. ve ark. Hemşirelik Uygulamalarında Araştırma Sonuçlarının Kullanımındaki Engeller ve Kolaylaştırıcı Faktörler. Çağdaş Tıp Dergisi, 2012; 2(2), 94-101.
18. Dikmen, Y., Filiz, N. Y., Tanrıkulu, F., Yılmaz, D., & Kuzgun, H. Attitudes of intensive care nurses towards evidence-based nursing. International Journal of Health Sciences and Research, 2018; 8(1), 138-143.
19. Duncombe DC. A multi-institutional study of the perceived barriers and facilitators to implementing evidence-based practice. Journal of Clinical Nursing. 2018;27(5-6):1216–1226.
20. Farokhzadian, J., Khajouei, R., & Ahmadian, L. Information seeking and retrieval skills of nurses: Nurses readiness for evidence based practice in hospitals of a medical university in Iran. International Journal of Medical Informatics, 2015; 84,:570 –577.
21. Fineout-Overholt E, Melnyk B, Schultz A. Transforming health care from the inside out: advancing evidence-based practice in the 21st century. J Prof Nurs. 2005;21:335-344.
22. Fineout-Overholt, E., & Melnyk, B. M. ARCC evidence-based practice mentors: The key to sustaining evidence-basedpractice. In B. M. Melnyk & E. Fineout-Overholt (Eds.) Evidence-based practice in nursing & healthcare. A guide to best practice (3rded., pp. 376–385). Philadelphia, PA: Wolters Kluwer; 2015.
23. Fink, R.,Thompson, C.J., Bonnes, D. Overcoming barriers and promoting theuse of research in practice. Journal of Nursing Administration, 2005;35(3), 121-129.
24. Gennaro S, Hodnet E, Kearney M. Making Evidence-Based Practice a Reality in Your Institution. MCN 2001;26(5):236-244.
25. Gifford W, Zhang Q, Chen S, et al. When east meets west: a qualitative study of barriers and facilitators to evidence-based practice in Hunan China. BMC Nursing. 2018;17(1) doi: 10.1186/s12912-018-0295-x.
26. Greenhalgh, T., Howick, J., & Maskrey, N. Evidence based medicine: A movement in crisis? British Medical Journal, 2014; 348, g3725.
27. Güneş Ü. Hemşirelikte kanıta dayalı uygulama sürecinin adımları. Uluslararası Hakemli Hemşirelik Araştırmaları Dergisi, 2017; 9,171-87.
28. Hu, Y., Xing, W.J. Concepts and procedures of evidence-

based nursing. Shanghaiv Nurs. 2015; 15 (1), 89–93.
29. Institute of Medicine (US) (2011). Committee on the Robert Wood Johnson Foundation Initiative on the Future of Nursing. In: The Future of Nursing: Leading Change, Advancing Health. National Academies Press, Washington, DC.
30. Institute of Medicine. The future of nursing: Focus on education. 2010. http://iom.nationalacademies.org/Reports/2010/The-Future-of-Nursing-Leading-Change. Accessed 21 Feb 2024.
31. Intas G, Kostagiolas P, Zavras D, Chalari E, Stergiannis P, Toylia G. Information-seeking behavior of Greek nursing students: a questionnaire study. Comput Inform Nurs 2017;35(2):109-114.
32. Jun, J., Kovner, C. T., & Stimpfel, A. W. Barriers andfacilitators of nurses' use of clinical practice guidelines: Anintegrative review.International Journal of Nursing Studies, 2016; 60,54–68
33. Kim, S.C., Ecoff, L., Brown, C. E., Gallo, A. M., Stichler, J. F., &Davidson, J. E. Benefits of a regional evidence-based prac-tice fellowship program: A test of the ARCC Model.Worldviewson Evidence-Based Nursing, 2017;14(2), 90–9
34. Kocaman, G. Hemşirelikte kanıta dayalı uygulama. İçinde: Onkoloji Hemşireliğinde Kanıta Dayalı Semptom Yönetimi Kitabı (Ed. Gülbeyaz Can), 3P-Pharma Publication Planning, Mavi İletişim Danışmanlık AŞ Medikal Yayıncılık; 2007. s. 3-11
35. Korhan EA, Yönt GH, Tokem Y, Karadağ Ö, Sarıoğlu E, Yıldız K. Dahiliye ve cerrahi kliniklerde yatanhastaların bakım bağımlılığı düzeylerinin belirlenmesi. Anadolu Hemşirelik ve Sağlık Bilimleri Dergisi, 2013; 16 (4), 199-204.
36. Korkmaz M. Kronik Hastalıklarda kanıta dayalı uygulamalar. İçinde Ovayolu N, Ovayolu Ö, Temel İç Hastalıkları Hemşireliği ve Farklı Boyutlarıyla Kronik Hastalıklar. Adana: Nobel Yayın Dağıtım; 2015;782-791
37. Küçükkaya, P. G. Psikiyatri hemşireliğinde kanıta dayalı uygulama. Psikiyatri Hemşireliği Dergisi, 2010; 1(3), 128-132.
38. Mehrdad N, Joolaee S, Joulaee A, Bahrani N. Nursing faculties' knowledge andattitude on evidence-based practice. Iranian Journal of Nursing Midwifery Research, 2012; 17(7), 506-511
39. Melnyk, B. M. The evidence-based practice mentor: Apromising strategy for implementing and sustaining EBP inhealthcare systems.Worldviews on Evidence-Based Nursing, 2007;4(3),123–125.
40. Melnyk, B. M., Fineout-Overholt, E., Fischbeck Feinstein, N., Li, H., Small, L., Wilcox, L., & Kraus, R. Nurses' perceived knowledge, beliefs, skills, and needs regarding evidence-based practice: Implications for accelerating the paradigm shift. Worldviews on Evidence-Based Nursing, 2004; 1(3), 185-193.
41. Melnyk, B. M., Fineout-Overholt, E., Giggleman, M., & Cruz, R. Correlates among cognitive beliefs, EBP implementa-tion, organizational culture, cohesion and job satisfaction inevidence-based practice mentors from a community hospitalsystem.Nursing Outlook, 2010; 58(6), 301–308.
42. Melnyk, B. M., Gallagher-Ford, L., & Fineout-Overholt, E. Implementing the evidence-based practice competencies in healthcare.A practical guide for improving quality, safety and patient outcomes.Indianapolis, IN: Sigma Theta Tau International;2016.
43. Melnyk, B. M., Gallagher-Ford, L., Zellefrow, C., Tucker, S., Thomas, B., Sinnott, L. T., & Tan, A. The first US study on nurses' evidence-based practice competencies indicates major deficits that threaten healthcare quality, safety, and patient outcomes. Worldviews on Evidence-Based Nursing, 2018;15(1), 16-25.
44. Melnyk, BM. Achieving a high-reliability organizationthrough implementation of the ARCC model for system widesustainability of evidence-based practice.Nursing AdministrationQuarterly, 2012;36(2), 127–135.
45. Menekli, T., & Korkmaz, M. Dâhiliye Hemşirelerinin Kanıta Dayalı Hemşireliğe Yönelik Tutumları. Dokuz Eylül Üniversitesi Hemşirelik Fakültesi Elektronik Dergisi, 2021; 14(1), 38-47.
46. Özdemir L, Akdemir N. Turkish nurses' utilization of research evidence in clinical practice and influencing factors. International Nursing Review, 2009; 56: 319-325.
47. Öztürk, A., Kaya, N., Ayık, S., ve ark. Hemşirelik uygulamalarında araştırma sonuçlarının kullanımında engeller. İstanbul Üniversitesi FlorenceNightingale Hemşirelik Yüksekokulu Dergisi, 2010;18(3), 1304-4869.
48. Phillips, A.C., Lewis, L.K., McEvoy, M.P., Galipeau, J., Glasziou, P., Hammick, M., ...Williams, M.T. A systematic review of how studies describe educational in-terventions for evidence-based practice: stage 1 of the development of a reportingguideline. BMC Med. Educ. 2014; 14, 152.
49. Pitsillidou, M., Roupa, Z., Farmakas, A., & Noula, M. Barriers to the adoption of evidence-based practice among nurses;2020.
50. Sadeghi-Bazargani, H., Tabrizi, J. S., & Azami-Aghdash, S. Barriers to evidence-based medicine: A systematic review. Journal of Evaluation in Clinical Practice, 2014;20(6), 793–802.
51. Saunder H, Stevens KR, Vehviläinen-Julkunen K. Nurses' readiness for evidence-based practice at Finnish

university hospitals: a national survey. Journal of Advanced Nursing. 2016;72(8):1863–1874.
52. Scott K, McSherry R. Evidence-based nursing: clarifying the concepts for nurses in practice. J Clin Nurs 2009;18:1085-95.
53. Sedlar, G., Bruns, E. J., Walker, S. C., Kerns, S. E., & Negrete, A. Developing a quality assurance system for mul-tiple evidence based practices in a statewide service im-provement initiative. Administration and Policy in Mental Health and Mental Health Services Research, 2017;44(1), 29–41.
54. Shafiei, E., Baratimarnani, A., Goharinezhad, S., Kalhor, R., & Azmal, M. Nurses' perceptions of evidence-based practice: A quantitative study at a teaching hospital in Iran. Medical Journal of the Islamic Republic of Iran, 2014;28, 135
55. Shayan, S. J., Kiwanuka, F., & Nakaye, Z. Barriers associated with evidence-based practice among nurses in low-and middle-income countries: A systematic review. Worldviews on Evidence-Based Nursing, 2019;16(1), 12-20.
56. Sin, M. K., & Bliquez, R. Teaching evidence based practice to undergraduate nursing students. Journal of Professional Nursing, 2017; 33: 447– 451.
57. Stokke K, Olsen NR, Espehaug B, Nortvedt MW. Evidence based practice beliefs and implementation among nurses: a cross-sectional study. BMC Nursing. 2014;13(1):8.
58. Straus SE, Glasziou P, Richardson WS, Haynes RB. Evidence-based medicine: how to practice and teach it. Edinburgh: Churchill Livingstone Elsevier; 2011.
59. Tanenbaum S. Evidence-based practice in mental health: practical weaknesses meet political strengths. J Eval Clin Pract 2003;9:287-301.
60. Verloo H, Desmedt M, Morin D. Beliefs and implementation of evidence-based practice among nurses and allied healthcare providers in the Valais hospital. Switzerland J Eval Clin Pract. 2017;23(1):139–48.
61. Wallace R, Vanhook P. The importance of evidence-based practice. The Tennessee Nurse, 2016;78(4):11.
62. Wu, Y., Brettle, A., Zhou, C., Ou, J., Wang, Y., & Wang, S. Do educational interventions aimed at nurses to support the implementation of evidence-based practice improve patient outcomes? A systematic review. Nurse education today, 2018;70, 109-114.
63. Yost, J., Ciliska, D., Dobbins, M. Evaluating the impact of an intensive educationworkshop on evidence-informed decision making knowledge, skills, and behaviours:a mixed methods study. BMC Med. Educ. 2014;14 (1), 13.
64. Young, T., Rohwer, A., Volmink, J., Clarke, M.. What are the effects of teachingevidence-based health care (EBHC)? Overview of systematic reviews. PLoS One, 2014;Jan 28;9(1):e86706
65. Zhou F, Hao Y, Guo H, Liu H. Attitude, knowledge, and practice on evidence-based nursing among registered nurses in traditional chinese medicine hospitals: a multiple center cross-sectional survey in China. Evidence Based Complementary and Alternative Medicine, 2016;5478086.
66. Zhou, F., Hao, Y., Guo, H., & Liu, H. Attitude, knowl-edge, and practice on evidence-based nursing among reg-istered nurses in traditional Chinese medicine hospitals: A multiple center cross-sectional survey in China. Evidence-Based Complementary and Alternative Medicine, 2016.

ATATÜRK ÜNİVERSİTESİ YAYINLARI
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Examination of the possible effects of ozone application in Duchenne muscular dystrophy

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ABSTRACT

Duchenne muscular dystrophy (DMD), an X-linked disorder, has an incidence of one in 5000 boys and presents in early childhood with proximal muscle weakness. The disease is caused by mutations in DMD (encoding dystrophin) that abolish the production of dystrophin in muscle. In this study, we aimed to investigate the effect of ozone therapy (OT) on muscle oxygenation in DMD patients. For this purpose, DMD was developed in the primary skeletal muscle cell line. The changes that occurred by administering OT to the cell lines were observed. OT reduced mitochondrial ROS caused by DMD, partially improved the shape changes in myoblasts, but had no effect on dystrophin. OT to DMD patients may have a positive effect on muscle cells.

Keywords: Duchenne muscular dystrophy, mitochondrial ROS, ozone therapy

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Introduction

Duchenne muscular dystrophy (DMD), considered a debilitating and fatal skeletal muscle disease, is characterized by muscle weakness, exercise intolerance, and progressive deterioration of skeletal muscle (Blau et al., 1983). DMD is caused by large deletions and other minor forms of mutations (deletions, duplications, and inversions) in the dystrophin gene located on the short arm of the X chromosome. Lack of functional dystrophin disrupts the structure and function of muscle fibers necessary for the physiological growth of muscle tissue (Muntoni et al., 2003). The dystrophin (dp427) protein, which connects the actin cytoskeleton of muscle fibers to the extracellular matrix and is therefore an integral part of the contractile structure of muscle, is encoded by the dystrophin gene (DMD) on the X chromosome. Therefore, while DMD predominantly affects boys, girls are likely to be asymptomatic "healthy carriers". DMD is also characterized by a progressive degeneration of skeletal muscles, with symptoms appearing early in life, around 3 years, leading to loss of ambulation from the 13th year onwards, followed by cardiac complications and respiratory disorders such as chronic respiratory failure (Hoffman et al., 1987). Untreated, most DMD patients become wheelchair-bound by age 11-12. Muscle histology in DMD patients is nearly normal before the onset of clinical symptoms at 3–5 years of age. The initial stage of the disease is characterized by the presence of focal groups of necrotic myofibrils, muscle hypertrophy, and abnormally high levels of muscle creatine kinase. In the second (pathological) phase, repeated cycles of degeneration exhaust the regenerative capacity of muscle-specific stem cells (satellite cells) and fibrotic mechanisms cause the replacement of muscle tissue by collagenous connective tissue (Anthony et al., 2011).

Deficiencies or changes in dystrophin protein structure disrupt the stability of the cell membrane, induce oxidative stress, and also lead to increased turnover of calcium ions in the cytosol, all of which can lead to cell death. The resulting cell membrane lesions allow calcium ions to enter through the gaps, which trigger protease enzymes that promote premature cell death (Liew and Kang, 2013). Following cell membrane disruption, creatine kinase effluxes, leading to loss of stored energy for contraction. Although the underlying pathomechanisms still require further investigation, some studies have reported that a systemic metabolic disorder is central to the etiology of the disease. According to these studies, DMD; involved in glycolysis, nucleotide synthesis, tricarboxylic acid (TCA) cycle and electron transport chain (ETC). It causes structural changes in enzymes (Aslesh et al., 2021). This results in dysfunction of the contractile apparatus leading to decreased muscle strength, dysregulation of intracellular Ca2+ buffering, loss of homeostasis, and Ca2+-induced degeneration. It is assumed that the dysregulation of intracellular Ca2+ homeostasis caused by DMD is associated with mitochondria dysfunction (Falzarano et al., 2015). Mitochondria are important regulators of Ca 2+ ions in skeletal muscle, working synchronously with the sarcoplasmic reticulum (SR) to maintain a Ca 2+ ion potential of approximately 50 nM at rest and handling 100-fold functional oscillations up to 5 µM during stimulation. It is thought that increased Ca2+ ion during activity provides functional benefits to the muscle and thus oxidative ATP production can be matched with the demand at the cross-bridge level (Salmaninejad et al., 2021).

Ozone has been used medically for over 150 years, and over these years it has been applied either as a method of disinfection or as a treatment option for a variety of diseases (Bocci, 1999). It is an unstable molecule consisting of three oxygen atoms that can quickly convert to oxygen and a single oxygen atom that acts as a strong oxidant to kill microorganisms. At appropriate concentrations it also serves as an ideal medicine. It has been reported that ozone shows its protective effect by stimulating the endogenous antioxidant system and reducing glycogen consumption and lactate production. Although ozone has been applied for therapy since the end of the 18th century, the cellular mechanisms that explain the positive effects of ozone therapy, especially at low concentrations, are still largely unexplored. Three basic forms of topical ozone application have been identified: ozonated water, ozonated oil, and oxygen/ozone gas. Additionally, ozone activates the protein synthesis mechanism. Increase the amount of ribosomes and mitochondria in cells (Clavo et al., 2003). These changes at the cellular level; Stimulates the regeneration potential in tissues and organs by increasing functional activities. In this study, we aimed to investigate the effect of ozone therapy (OT) on muscle oxygenation in DMD patients. Despite recent clinical studies on OT, further biological and biochemical studies are needed to understand the limitations and possible side effects of its use in humans.

Within the scope of this study, we aimed to determine whether ozone can increase the amount of mitochondria in the dystrophic skeletal muscle cell line and to determine the cellular mechanisms responsible for regeneration abilities, considering its possible therapeutic properties based on dystrophin synthesis modulation by dystrophic skeletal muscle cells. In this study, the effects of low ozone concentrations on structural and functional cell properties

were investigated using morphological, morphometric, cytochemical and immunocytochemical techniques in brightfield and fluorescence.

Material and methods

Cell culture

Primary skeletal muscle cell line (SkMC)-Primary Skeletal Muscle Cells (PCS-950-010)) was obtained from ATCC. PCS were maintained in skeletal muscle growth medium (ATCC PCS-950-040) at 37°C, 5% CO2, and 95% humidity before transfection.

Transfection

Short interfering, Cas9 nuclease and sgRNA 2 were transfected into primary skeletal muscle cell line. Cells were plated at 60% density in six-well culture dishes the day before transfection.

Immediately before transfection, cells were washed with phosphate-buffered saline and 1 ml of serum-free SkMC growth medium was added. Transfection was performed according to the manufacturer's protocol using Genesilencer (PeqLab, Erlangen). It was carried out using Germany. Briefly, 5 µl of Genesilencer reagent was mixed with 25 µl of serum-free medium.

1000 ng of siRNA was diluted in a mixture of 25 µl of siRNA diluent and 15 µl of serum-free medium and incubated for 5 min at room temperature. The siRNA solution was added to the diluted Genesilencer and incubated at room temperature for 5 min before adding to the cells.

Serum was removed from the medium for the first 4 hours after transfection. Next, 1 volume of medium with a serum concentration of 10% was added to a final concentration of 5%. Twenty-four hours after transfection, the medium was transferred to SkMC differentiation medium containing 2.5% fetal bovine serum. (Promocell) has been changed.

Cell viability and proliferation

Cell Counting Kit-8 (CCK-8) was used to determine cell viability. The assay was performed in a 96-well plate according to the manufacturer's protocol. 10 µl of Cell Counting Kit-8 solution was added to each well containing 100 µl of fresh medium. After 2 h of incubation in humidified atmosphere, absorbance was measured at 450 nm using a microplate reader (Anthos HTII, Anthos Labtec, Wals, Austria). Results given as proportion of vital cells were calculated as follows: After transfection then OD 450 nm 5x103 SkMC was divided into OD 450nm 5x103 SkMC before transfection. Cell proliferation was measured using a colorimetric BrdU cell proliferation enzyme-linked immunosorbent assay kit (Roche, Mannheim, Germany). OD, maximum adjustable microplate reader

Measured at 450 nm using (Molecular Devices, Ismaning/Munich, Germany). Estimating cell viability and proliferation between five and nine samples was measured at 18 and 48 h or 72 h after transfection. Metabolic effects of ASO and siRNA on proliferation Time points were chosen based on their maximum effect, which differed across pathways and was determined in separate experiments.

Application of ozone therapy (OT)

Ozone gas was dissolved in PBS solution to maintain a final concentration of 0.3 mg/L. Ozonated phosphate buffer was added to the medium and the cells were incubated for another 30 minutes.

cultured and the medium was changed. This procedure was performed once a day for 3 days (Yiu & Kornberg, 2008).

Assessment of mitochondrial function

Cells or intact mitochondria were incubated with 5 µmol/L MitoSOX Red, 2 µmol/L 5,5',6,6'-tetrachloro-1,1',3,3'-tetraethylbenzimidazolylcarbocyanineiodide (JC-1), or 20-fold diluted fluorescein isothiocyanate (FITC)–conjugated Annexin V to determine changes in mitochondrial ROS. ROS levels in cytoplasmic fractions of cells were determined by using dichlorofluorescein diacetate (10 µmol/L) staining.

Dystrophin Staining

Cells were incubated with 4% paraformaldehyde in TBS (20 mM Tris-HCl, pH 7.5, 150 mM NaCl, 2mM EGTA, 2mM MgCl2) for 20 min at room temperature, three times with TBS and 0.5% Triton X-100/TBS. Following exposure to a blocking solution (containing TBS-0.5% bovine serum albumin; Sigma) for 10 min, fixed cells were incubated with monoclonal mouse anti-inflammatory for 1 h and 30 min. Dystrophin (NCL-DYS2, Novocastra, Newcastle Tyne, UK) and adhalin (NCL-50DAG, Novocastra) with Cy3-conjugated goat anti-mouse antibody (Jackson Immunoresearch, West Grove, PA, USA) diluted 1:200 for 1 h. was treated. Samples Vectashield mounting medium (Vector, Burlingame, CA, USA). Immunolabeled samples were examined by confocal

laser scanning microscopy.

Results

Cell viability and proliferation

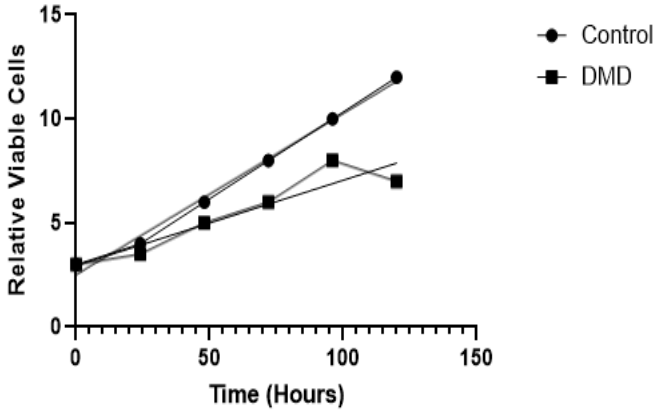

Figure 1. Growth curve analysis of iPSCs cells.

Cell culture and transfection

Generation of the disease-specific iPSC lines proceeded routinely, and characterization of iPSCs revealed no major differences compared with DMD generated from healthy cells. Efficient myogenic differentiation of the DMD-specific iPSCs proceeded only under optimized conditions.

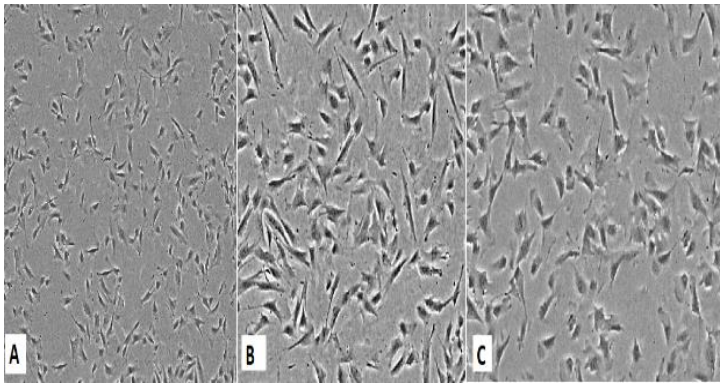

Figure 2. Generation of DMD specific iPSC lines. (A) control myoblasts; Myoblasts display typical compact morphology, (B) DMD myoblasts; malformed myoblasts and (C) DMD miyoblast+OT; skeletal muscle cells recovered after TO therapy.

Effect of OT on mitochondrial dysfunction

Mitochondrial ROS levels were measured in control cells and compared with DMD cell culture. DMD increased the levels of mitochondrial ROS in cell culture in a concentration-dependent manner (Fig 3), an effect partially prevented by OT (Fig 3).

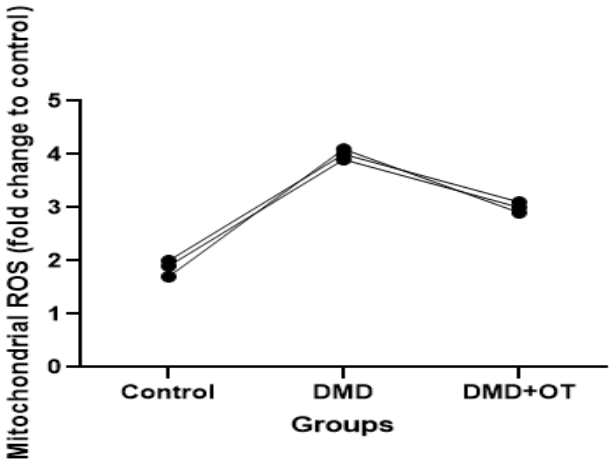

Figure 3. Mitochondrial ROS levels

Dystrophin

Dystrophin quantification in cell models is a valuable tool to characterize diseased versus non-diseased cells and measure dystrophin restoration in DMD cells, as potential therapeutic approach. Dystrophin was stained positive in the control group (Fig. 4A). DMD tissues, as expected, completely lacked dystrophin (Fig.4B). Similarly, dystrophin negative staining was observed in the DMD+OT group (Fig. 4C).

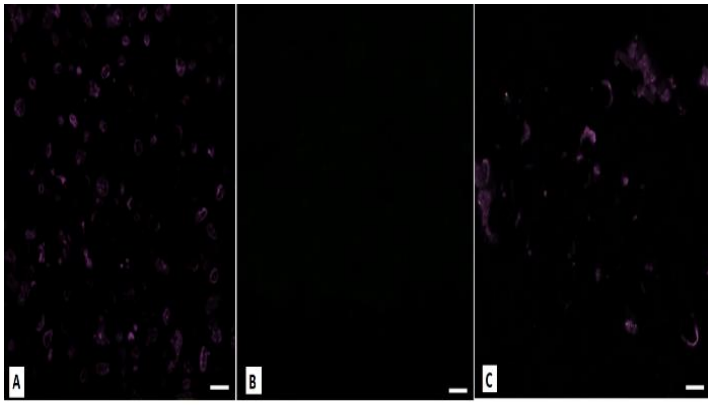

Figure 4. Representative images of dystrophin in control (A), DMD (B) and DMD+OT (C) Scale bar, 100 µm.

Discussion

Much research on the pathogenesis of Duchenne muscular dystrophy (DMD) is based on the hypothesis that there may be a defect in the sarcolemma of the dystrophic muscle fibre and that this in turn may allow an influx of calcium ions that cause hypercontraction and overload mitochondria (Rus, 2006).

There are several promising monotherapies for DMD, but there is no treatment yet that can reverse or completely halt the progression of all pathophysiological consequences of dystrophin deficiency in patients. Therefore, studies on DMD continue.

In this study, we aimed to identify suitable, fast-responsive and accessible molecular biomarkers of DMD to help determine the best route, frequency and

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References

1. Üsküdar Health Services Vocational School - "About Electroneurophysiology, Access: September 6, 2023. https://uskudar.edu.tr/shmyo/elektronorofizyoloji
2. Turkey Clinics "Neurology Journal," Access: September 6, 2023. https://www.turkiyeklinikleri.com/journal/noroloji-dergisi/1304-0537/tr-index.html
3. Ummuhan Işoğlu Alkaç, Clinical Development "A Stroll in the History of Brain Research: Electroneurophysiology," Access: September 7, 2023. https://www.klinikgelisim.org.tr/kg22_3/3.pdf
4. Betül Baykan, Istanbul Faculty of Medicine, "Electroencephalography," Access: September 7, 2023. http://www.itfnoroloji.org/semi2/eeg.htm
5. Medicana, "What is EEG?" Access: September 7, 2023. https://www.medicana.com.tr/saglik-rehberi-detay/17953/eeg-nedir
6. Acıbadem "What is EEG," Access: September 8, 2023. https://www.acibadem.com.tr/hayat/eeg-nedir/
7. About EEG, "Types of EEG" Access: September 8, 2023. https://eeguzerine.com/i_eeg-cesitleri.html
8. About EEG, "Routine EEG" Access: September 9, 2023. https://eeguzerine.com/i_rutin-eeg.html
9. About EEG, "EEG Electroencephalography" Access: September 9, 2023. https://eeguzerine.com/i_eeg_elektroensefalografi.html
10. Canan Kocaman "What is Electroencephalography (EEG)?" Access: September 9, 2023. https://www.canankocaman.com/elektroensefalografi-eeg-nedir
11. TR Presidency Legislation Information System "Regulation on Job Descriptions and Duties of Healthcare Professionals and Other Healthcare Workers," Access: September 9, 2023. https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=19696&MevzuatTur=7&MevzuatTertip=5
12. "Lifemed "What Are the Types of EEG" Access: September 10, 2023. https://www.lifemed.com.tr/blog/eegnin-cesitleri-nelerdir/
13. "Medipol University - Istanbul "Electroneurophysiology," Access: September 11, 2023. https://www.medipol.edu.tr/akademik/meslek-yuksekokullari/saglik-hizmetleri-meslek-yuksekokulu/bolumler/elektronorofizyoloji
14. "Biruni University "Electroneurophysiology," Access: September 12, 2023. https://myo.biruni.edu.tr/index.php/myo-elektronorofizyoloji/

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Use of Material Safety Data Sheet in Workplaces

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ABSTRACT

Employees in workplaces are exposed to physical, chemical, biological, ergonomic, and psychosocial hazards. These hazards affect employees in various ways. Having knowledge of the characteristics of chemicals to which employees are exposed can help minimize the risks of workplace accidents and occupational diseases. "Material Safety Data Sheets for Hazardous Substances and Mixtures" known as MSDS, should be provided in Turkish for chemicals used in workplaces, and employees should receive training. An MSDS for any chemical should contain 16 parameter information. Upon examination of the MSDS, the presence of risk statements (R) indicating the potential risks of the chemical and safety statements (S) outlining actions to be taken when exposed to the harmful effects of the chemical can be observed. Due to the length of MSDS in workplaces, posting them for warning purposes is generally challenging. Therefore, examining the MSDS for chemicals used in production and preparing short MSDS labels containing only necessary information would be more practical. These labels provide information to the staff in areas where chemicals are used in workplaces and assist in interventions during emergencies. This study provides users with concise information on the use of the mentioned MSDS labels, preventing hazards associated with chemicals in workplaces, and reducing risks. Easy access to this summary information could help laboratory users avoid workplace accidents and occupational diseases.

Keywords: Hazard, Risk, MSDS

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Introduction

Human beings, in order to meet their personal needs in the world where they live, become professionals through the education they receive in line with their abilities over time. The professions they engage in can be categorized into different sectors. During the execution of their professions, individuals may face various problems that could ultimately result in casualties (Ünal et al., 2021). In workplaces, situations that have the potential to cause harm to employees or workplaces, either existing or coming from external sources, are defined as hazards. The probability of loss, injury, or other harmful outcomes arising from exposure to hazards is defined as risk. Incidents that occur during the performance of work, resulting from occupational exposure, are referred to as occupational accidents. Diseases that occur as a result of occupational exposure during the performance of work are defined as occupational diseases (Work Health, 2013).

Employees in workplaces are exposed to ergonomic, psychosocial, biological, physical, and chemical risks. The risks categorized here affect employees in different ways. For chemical risks to affect humans, chemicals need to enter the body through specific routes. Chemical intake into the body occurs through respiration, digestion, and skin contact (Ünal et al., 2021; Ateş and Albayrak, 2022; Albayrak, 2019).

Chemical substances to which employees are exposed in different ways react with the chemicals present in their bodies. The chemicals synthesized as a result of these reactions cause changes in the employee's physiological structure. In addition, mutations in genetic material can occur during the renewal of body cells, leading to carcinogenic effects. Knowing the characteristics of the chemicals used by employees during their activities in the workplace can contribute to minimizing the risks of accidents and occupational diseases. This awareness activity can be achieved through the provision of Turkish Material Safety Data Sheets (MSDS), as required by the "Regulation on Safety Data Sheets for Hazardous Substances and Mixtures." Each MSDS for a chemical substance contains information under 16 headings (Harmful Substances, 2014). The 16 headings mentioned here are listed below:

- Identity of the substance/mixture and of the company/undertaking,
- Hazards identification,
- Composition/information on ingredients,
- First-aid measures,
- Firefighting measures,
- Accidental release measures,
- Handling and storage,
- Exposure controls/personal protection,
- Physical and chemical properties,
- Stability and reactivity,
- Toxicological information,
- Ecological information,
- Disposal considerations,
- Transport information,
- Regulatory information,
- Other information (Harmful Substances, 2014; Özdemir, 2021).

The information contained in the mentioned Material Safety Data Sheets (MSDS) can encompass pages of details depending on the types of properties the chemical possesses. Considering that workplaces may have numerous chemicals, having these extensive MSDSs in work environments makes it nearly impossible to review these documents in the event of an accident. This study aims to demonstrate an example application of how a usable MSDS can be created in work environments.

Upon examining Material Safety Data Sheets, one can observe the presence of hazard statements (H) to express the risks associated with the chemical and precautionary statements (P) indicating actions to be taken in case of exposure to the harmful effects of the chemical. Through these hazard statements, the potential dangers we may encounter while working with chemicals are defined, and precautionary statements outline the reactions we should take in the event of harm caused by chemical exposure (Ünal et al., 2021).

Due to the extensive nature of Material Safety Data Sheets (MSDS), which serve as guides for the safe use of chemicals in workplaces, posting them in the workplace for employee use as a warning poses general difficulties.

Therefore, it is more practical to prepare short MSDS labels containing only the necessary information in a format that can be easily understood by employees by examining the MSDS of the chemicals used in production. The MSDS labels prepared in workplaces can be hung on the wall with a file folder holder so that personnel working with the relevant chemical can easily see them. This not only provides information but also assists employees in emergency situations by facilitating intervention (Ünal et al., 2021; Ateş at al., 2022).

Material and methods

The abundance of chemicals used in both our workplaces and personal lives, in terms of both quantity and types, can lead to differences in the naming and classification of these chemicals worldwide. In order to identify the same chemical produced, exported, or imported globally, a standardization was needed. Therefore, the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) was established by the United Nations. The GHS system has contributed to the systematic classification of chemicals within the framework of international protocols. Thanks to this system, confusion that could arise from different classification systems that could be created in each country around the world has been prevented (SEA Labeling, 2020). With the GHS system, chemicals are classified into three groups based on their hazards: physical and chemical, health-related, and environmental hazards (Substances and Mixtures, 2013). In Figure 1, the warning sign to be included in the MSDS label for the use of sulfuric acid, as exemplified in our study, using the SEA Labeling Packaging Guide, can be seen (Substances and Mixtures, 2013).

Figure 1. Skin and metal corrosion (SEA Labeling, 2020).

When examining the contents of Material Safety Data Sheets (MSDS) for chemicals, hazard statements (H) and safety statements (P) are used to define the risks that employees may be exposed to during work with the respective chemical and the safety measures to be taken in case of exposure to the hazards of the chemical. Some examples of risk and safety statements can be seen in Table 1 and Table 2 (Hazardous Substances, 2008). By learning the risk statements before starting their activities, employees can be aware of the hazards they may face when working with chemicals. Similarly, by learning safety statements, they can be conscious of the measures to be taken in case of chemical-related harm.

Table 1. Hazard statements and their meanings (Hazardous Substances, 2008).

Hazard Statements	Meanings
H220	Explosive under to flame or in contact with sparks
H301	Toxic if swallowed
H317	May cause an allergic skin reaction upon prolonged exposure
H400	Very toxic to aquatic life long-lasting effect

Table 2. Safety statements and their meanings (Hazardous Substances, 2008).

Safety Statements	Meanings
P210	Keep away from heat, sparks, open flames, hot surfaces. No smoking
P280	Wear protective gloves/protective clothing/eye and face protection
P264	Wash thoroughly after handling
P403+P233	Store in a well-ventilation place. Keep container tightly closed

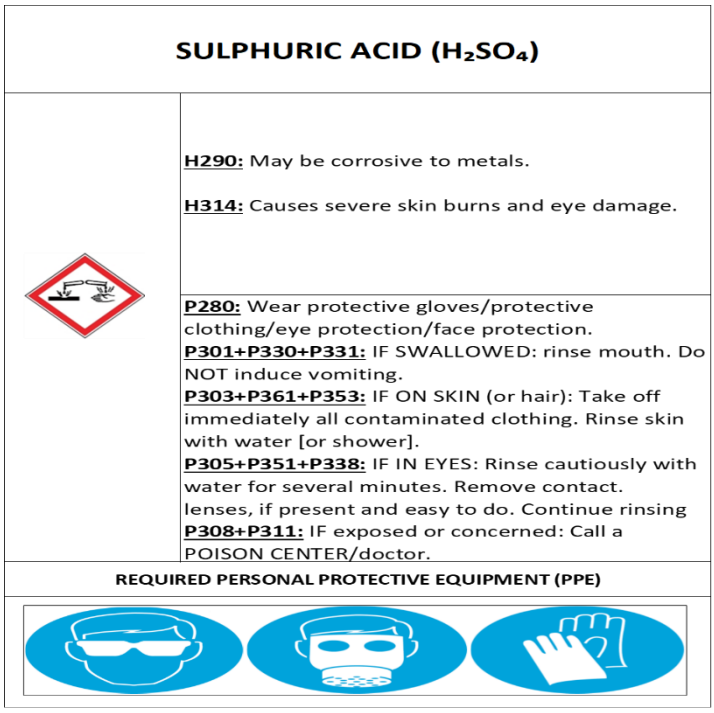

Figure 2. Sulphuric acid MSDS label (Substances and mixtures, 2013; Health and Safety, 2013).

Results and discussion

The types and levels of hazards that employees may be exposed to in workplaces vary depending on the nature of the activities. In other words, the hazardous chemicals to which employees may be exposed in a workplace classified as highly hazardous can generally pose a high level of danger. Various precautions can be taken to minimize the risks of exposure to different types of hazardous chemicals during industrial activities. Some of the measures that can be taken to eliminate potentially risky situations arising from the use of chemicals in workplaces are outlined below:

- Necessary arrangements and organizations should be implemented in the work area.

- Particularly when working with hazardous chemicals, activities should be conducted with the least number of employees possible.

- The exposure levels and durations to chemicals should be minimized.

- The quantity of chemicals used should be minimized.

- Workplace buildings and extensions should always be kept orderly and clean.

- Suitable and sufficient conditions for personal hygiene should be established.

- Disposal, transportation, and storage of chemical waste and residues should be carried out in the most appropriate manner.

- Preference should be given to chemicals that pose less risk to the health and safety of employees instead of hazardous chemicals.

- Sufficient control, inspection, and supervision should be planned and implemented.

- Regular measurements and analyses of the chemicals used should be carried out to keep the health and safety of employees at the highest level (With Chemical Substances, 2013).

In addition to the methods for mitigating the hazards of the mentioned chemicals, Material Safety Data Sheets (MSDS) for the chemicals used in workplaces should also be available. Through MSDS labels prepared in this study, awareness and knowledge levels regarding the chemicals to be used can significantly increase for those who will handle the chemicals. Similarly, with MSDS labels for all chemicals used in workplaces, employees can react quickly in case of exposure to an emergency. This way, chemical users can minimize the risks of workplace accidents and occupational diseases as much as possible.

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References

1. Ünal, E.S., Ateş, F.M., Karataş, G., Erdoğan, H., Aslan, H., Aslan, İ., Acar, M.N., Yağımlı, M., Öter, NS., Baykan, P., Başarlı, S., Saka, Y., Akşit, Z., Özmen, Z. (2021). Occupational health and safety sectoral management, Nobel academic publishing education consultancy com. pp:567 – 612, 2021.
2. Work health "6331 Occupational health and safety law", Access: October 11, (2023). https://www.mevzuat.gov.tr/MevzuatMetin/1.5.6331.pdf.
3. Ateş, F.M. And Albayrak, M. (2022). "Ataturk university vocational school of health services laboratories risk analysis application", International Journal of Innovative Research and Reviews, 6(2), 132-157, 2022.
4. Albayrak, M. (2019). “Risk Etmenleri,” in Çalışma Ortamındaki Risk Etmenleri. Ateş, F. M., Saka, Y., Şahin, Y., ed., Atatürk Üniversitesi Açıköğretim Fakültesi Yayınları, pp. 89-113, 2019.
5. Hazardous substances "Regulation on safety data sheets concerning hazardous substances and mixtures", Access: October 11, (2023). https://www.resmigazete.gov.tr/eskiler/2014/12/20141213-1.htm.
6. Özdemir, M., " Indoor sports hall risk analysis in terms of occupational health and safety (Bayburt example)", Anatolia Sport Research, 2(1), 30-45. 2021.
7. ATEŞ, F.M., Ömeroğlu, G., Albayrak, M. (2022). "Virtual applicability of material safety data sheet in laboratory environments", Proceedıngs Book, 24, 2022.
8. SEA labeling "SEA labeling packaging guide", Access: October 11, (2023). https://kimyasallar.csb.gov.tr/rehber-dokumanlar/18.
9. Substances and mixtures "Regulation on classification, labeling and packaging of substances and mixtures", Access: October 11, (2023). https://www.resmigazete.gov.tr/eskiler/2013/12/20131211M1-1.htm.
10. Hazardous Substances "Regulation on classification, packaging and labeling of dangerous substances and preparations", Access: October 11, (2023). https://www.resmigazete.gov.tr/eskiler/2008/12/20081226M1-4.htm.
11. Health and safety "Health and safety signs regulation", Access: October 11, 2023. https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=18829&MevzuatTur=7&MevzuatTertip=5.
12. With chemical substances "Regulation on health and safety measures in working with chemical