ISSN 2757-847X | e-ISSN 2718-0964

# EAMS

# Experimental and Applied Medical Science

Official Journal of Gaziantep Islam, Science and Technology University, Faculty of Medicine

June 2021, Volume 2, Issue 2

**GAZİANTEP İSLAM BİLİM VE TEKNOLOJİ ÜNİVERSİTESİ TIP FAKÜLTESİ**

**GAZİANTEP ISLAM SCIENCE AND TECHNOLOGY UNIVERSITY FACULTY OF MEDICINE**

# Experimental and Applied Medical Science

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**ISSN: 2757-847X**

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Dizinler/Indexing

Türkiye Atıf Dizini, Türk Medline, Google Scholar, Europub, Scilit, ASOS indeks, Advanced Science Index, Academic Resource Index, Eurasian Scientific Journal Index, Crossref, General Impact Factor

Publishing date: 29.06.2021
Yayın tarihi: 29.06.2021

## Owner/İmtiyaz Sahibi

On behalf of the Medical Faculty of Gaziantep Islam Science and Technology University
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# Aim

***Experimental and Applied Medical Science*** aims at being a current and easily accessible academic publication in which striking research results that will improve the quality of life and are unique from every field of medical sciences.

# Amaç

***Experimental and Applied Medical Science***, yaşam kalitesini arttıracak çarpıcı araştırma sonuçlarının sunulduğu, tıp bilimlerinin her alanında benzersiz, güncel ve kolay erişilebilir bir akademik yayın olmayı hedeflemektedir.

# Scope

***Experimental and Applied Medical Science*** is an open-access, internationally double-blind peer reviewed academic medical journal which is published in English four times a year, under the auspices of Medical Faculty of Gaziantep Islam Science and Technology University. The journal receives manuscripts for consideration to be publishing in the form of research articles, reviews, letter to editor, brief notification, summary notification etc. which could have been presented from within the country or abroad and including experimental animal studies related to the pathogenesis of diseases, pharmacological, clinical, epidemiological and deontological studies, also studies in the fields of improving public health, health services or health insurance.

During evaluation or publication no charge is demanded from authors. The journal is published every 3 months (March, July, September and December) with 4 issues per year. The literary language of the journal is English. Abstract part of the manuscript only should also be submitted in Turkish.

# Kapsam

***Experimental and Applied Medical Science***, Gaziantep İslam Bilim ve Teknoloji Üniversitesi Tıp Fakültesi himayesinde yılda dört kez İngilizce olarak yayınlanan açık erişimli, uluslararası çift kör hakemli bir akademik tıp dergisidir. Dergi, yurt içinden veya yurt dışından, hastalık patogenezleri ile ilişkili deneysel hayvan çalışmaları, klinik, farmakolojik, epidemiyolojik, deontolojik çalışmalar ile beraber halk sağlığının geliştirilmesi amacı taşıyan ve sağlık hizmetleri veya sağlık sigortaları konularında araştırma makaleleri, derlemeler, vaka sunumları, kısa bildirimleri, özet bildirimleri vs. yayınlamak için değerlendirmeye kabul etmektedir. Değerlendirme veya yayın sırasında yazarlardan herhangi bir ücret talep edilmez.

Dergi 3 ayda bir (Mart, Temmuz, Eylül ve Aralık) yılda 4 sayı olarak yayımlanır. Derginin yazı dili İngilizcedir. Makalenin sadece özet kısmı Türkçe olarak da gönderilmelidir.

# Ethical Principles and Publication Policy

Manuscripts are only considered for publication provided that they are original, not under consideration simultaneously by another journal, or have not been previously published. Direct quotations, tables, or illustrations that have extracted from any copyrighted material must be accompanied by written authority for their use from the copyright owners. All manuscripts are subject to review by the editors and referees. Deserving to be publishing is based on significance, and originality of the material. If any manuscript is considered to deserve publishing, it may be subject to editorial revisions to aid clarity and understanding without changing the data presented.

***Experimental and Applied Medical Science*** strictly adheres to the principles set forth by "Helsinki Declaration" whose web address is below.

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Editorial Board declares that all reported or submitted studies conducted with "human beings" should be in accordance with those principles.

Manuscripts presenting data obtained from a study design conducted with human participants must contain affirmation statements in the *Material and Methods* section indicating approval of the study by the institutional ethical review committee and "informed consent" was obtained from each participant. Also all manuscripts reporting experiments in which laboratory animals have been used should include an affirmation statement in the *Material and*

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Makaleler, orijinal/özgün olmaları, eş zamanlı olarak başka bir dergi tarafından incelenmemeleri veya daha önce yayınlanmamış olmaları koşuluyla yayına kabul edilir. Telif hakkıyla korunan herhangi bir materyalden alınan doğrudan alıntılar, tablolar veya resimler, kullanımları için telif hakkı sahiplerinden alınan yazılı izinle birlikte sunulmalıdır. Tüm yazılar editörler ve hakemler tarafından incelemeye tabidir. Yayınlanmaya hak kazanılması, materyalin önemine ve özgünlüğüne bağlıdır. Herhangi bir makalenin yayınlanmayı hak ettiği düşünülürse, sunulan veriler değiştirilmeden netlik ve anlayışa yardımcı olmak için editör revizyonlarına tabi tutulabilir.

***Experimental and Applied Medical Science***, internet adresi aşağıda yer alan "Helsinki Deklarasyonu" ile belirlenen ilkelere sıkı sıkıya bağlıdır.

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Editör Kurulu, "insan" ile yapılan tüm raporlanan veya sunulan çalışmaların bu ilkelere uygun olması gerektiğini beyan eder. İnsan katılımcılarla yürütülen bir çalışma tasarımından elde edilen verileri sunan makaleler, *Gereç ve Yöntemler* bölümünde çalışmanın kurumsal etik inceleme komitesi tarafından onaylandığını ve her katılımcıdan "bilgilendirilmiş onam" alındığını belirten onay ifadeleri kullanmalıdır. Ayrıca laboratuvar hayvanlarının kullanıldığı deneyleri bildiren tüm yazılar, *Gereç ve Yöntemler* bölümünde, internet adresi aşağıda

*Methods* section validating that all animals have received human care in compliance with the "Guide for the Care and Use of Laboratory Animals" whose web address is below and reveal approval by the institutional ethical review board. https://www.gibtu.edu.tr/Medya/Birim/Dosya/20210818130308_dca61056.pdf

If there is a commercial relation that contributes to the study process or there is an institution that provides financial support for the study; the authors must declare that they have no commercial relationship with the commercial product, drug, company used, or what kind of relationship (consultant or any other agreement) they have, if any.

Processing and publication are free of charge with the journal. No fees are requested from the authors at any point throughout the evaluation and publication process. All manuscripts must be submitted via the online submission system, which is available at https://dergipark.org.tr/tr/pub/eams. The journal guidelines, technical information, and the required forms are available on the journal's web page.

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belirtilmiş olan "Laboratuvar Hayvanlarının Bakımı ve Kullanımı Kılavuzu"na uygun olarak tüm hayvanların insanî bir bakım aldığını doğrulayan bir beyan ile kurumsal etik inceleme kurulunun onayını içermelidir. https://www.gibtu.edu.tr/Medya/Birim/Dosya/20210818130308_dca61056.pdf

Çalışma sürecine katkı sağlayan ticari bir ilişki veya çalışmaya maddi destek sağlayan bir kurum varsa; yazarlar ticari ürün, ilaç, aracılık eden şirket ile ticari bir ilişkilerinin olmadığını veya varsa ne tür bir ilişkisi (danışmanlık veya başka bir anlaşma) olduğunu beyan etmelidir.

Değerlendirme ve yayınlama süreçleri ücretsizdir. Değerlendirme ve yayın sürecinin hiçbir aşamasında yazarlardan ücret talep edilmez. Tüm yazılar https://dergipark.org.tr/tr/pub/eams adresinde bulunan çevrimiçi başvuru sistemi üzerinden gönderilmelidir. Dergi ile ilgili kullanım kılavuzları, teknik bilgiler ve gerekli formlar derginin internet sayfasında yer almaktadır.

Derginin tüm masrafları Gaziantep İslam Bilim ve Teknoloji Üniversitesi Tıp Fakültesi tarafından karşılanmaktadır. Reklam vermeyi düşüne kişi veya kurumlar yayın ofisi ile iletişime geçmelidir. Reklam görselleri sadece Baş Editör'ün onayı ile yayınlanabilir. Tüm araştırmacılar, makaleye doğrudan akademik veya bilimsel olarak katkıda bulunmuş olmalıdır. Yazarlar, makalenin planlanması, uygulanması, yazılması veya gözden geçirilmesi aşamalarından birine veya birkaçına katkıda bulunmuş olmalıdır. Tüm yazarlar nihai versiyonu onaylamalıdır. Bilimsel kriterlere uygun bir makale hazırlamak yazarların sorumluluğundadır.

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All manuscripts involving a research study must be evaluated in terms of biostatistics and it must be presented altogether with appropriate study design, analysis and results. ***p*** values must be given clearly in the manuscripts. Other than research articles, reviews, case reports, letters to the editor, etc. should also be original and up to date, and the references and, if any, their biostatistical parts should be clear, understandable and satisfactory.

The publication language of the journal is English. In addition, the abstract part of the article must be uploaded in both Turkish and English. Manuscripts should be evaluated by a linguist before being sent to the journal.

All manuscripts and editorial correspondence must be submitted online to the editorial office, https://dergipark.org.tr/tr/pub/eams .

According to the Law on Intellectual and Artistic Works, which was first published in the Official Gazette with the law number 5846 on 13/12/1951, whose web address is below, and on which subsequently various changes have been made or novel parts have been added in time, all kinds of publication rights of the articles accepted

Dergide yayınlanan yazılarda ifade edilenler veya görüşler, Gaziantep İslam Bilim ve Teknoloji Üniversitesi Tıp Fakültesi, editörler, yayın kurulu ve/veya yayıncının görüşlerini değil, yazar(lar)ın görüşlerini yansıtır; editörler, yayın kurulu ve yayıncı bu tür materyaller için herhangi bir sorumluluk veya yükümlülük kabul etmez.

Araştırma çalışması içeren tüm yazılar biyoistatistiksel açıdan değerlendirilmeli ve uygun çalışma düzeni, verilerin analizi ve sonuçları ile birlikte sunulmalıdır. ***p*** değerleri yazılarda açık olarak verilmelidir. Araştırma makaleleri dışında derlemeler, olgu sunumları, editöre mektuplar vb. de orijinal/özgün ve güncel olmalı, kaynaklar ve varsa biyoistatistiksel kısımlar açık, anlaşılır ve tatmin edici olmalıdır.

Derginin yayın dili İngilizce'dir. Ayrıca makalenin özet kısmı hem Türkçe hem de İngilizce olarak yüklenmelidir. Yazılar dergiye gönderilmeden önce bir dilbilimci/konunun uzmanı tarafından değerlendirilmelidir.

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İnternet adresi aşağıda belirtilmiş olan, ilk olarak 13/12/1951 tarih ve 5846 sayılı Kanun ile Resmi Gazete'de yayımlanan, sonraları üzerinde değişiklikler yapılmış veya yeni kısımlar eklenmiş olan Fikir ve Sanat Eserleri Kanunu'na göre; yayına kabul edilen makalelerin her türlü yayın hakkı dergiyi yayınlayan kuruma aittir. Ancak makalelerdeki düşünce ve öneriler tamamen yazarların sorumluluğundadır. https://www.gibtu.edu.tr/Medya/Birim/Dosya/20210818145630_406d24df.pdf

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# Author Guidelines

Submission of a paper will be taken to imply that it has not previously been published and that it is not being considered for publication elsewhere. Decision as to publication of papers submitted to the Experimental and Applied Medical Science will be based on the opinion of the Editorial Board as to the significance and originality of the work.

Manuscripts should be prepared electronically using an appropriate “office word” compatible text-processing package, formatted for A4 size, double-spaced throughout, and using a “Times New Roman” 12 point font. Articles must be written in English. Abstracts must be written in both Turkish and English. Text should flush left, and not be justified. Words should not be hyphenated. Pages should be numbered sequentially.

There should be a separate title page with:

a) The title

b) The authors' names

c) The laboratory of origin, with complete address of each author

d) A running title

e) Corresponding author and e-mail

f) Conflict of interest

g) Acknowledgements

The main body of full-length paper should be divided into:

1. Abstract

2. Introduction

3. Material and Methods

4. Results

5. Discussion

# Yazım Kuralları

Bir çalışmanın dergimize gönderilmesi için bu çalışmanın daha önce yayınlanmamış veya başka bir akademik dergide şu anda yayınlanmak üzere değerlendirilmiyor olması koşulu ile mümkündür. Experimental and Applied Medical Science’a gönderilen her türlü çalışmanın yayınlanmasına ilişkin karar, Yayın Kurulu'nun çalışmanın önemi ve özgünlüğü konusundaki görüşüne dayanacaktır.

Çalışmalar, ya “office word” programı ile ya da bu program ile uyumlu uygun bir metin işleme programı kullanılarak, A4 boyutunda hazırlanmalı, baştan sona çift aralıklı ve “Times New Roman” tarzında 12 punto yazı tipi kullanılarak elektronik ortamda yazılmalıdır. Makaleler İngilizce yazılmalıdır. Özetler hem Türkçe hem de İngilizce olarak yazılmalıdır. Metin iki yana yaslandırılmamalı, sadece sola yaslanmamalıdır. Kelimeler kısa çizgi ile hecelenmemelidir. Sayfalar sırayla numaralandırılmalıdır.

Aşağıdakileri içeren ayrı bir başlık sayfası olmalıdır:

a) Başlık

b) Yazarların isimleri

c) Her yazarın tam adresi ile birlikte çalıştıkları laboratuarlar

d) Kısa başlık

e) İletişimdeki yazar ve iletişim bilgileri

f) Çıkar çatışması beyanı

g) Teşekkür, bilgilendirme

Tam uzunluktaki kağıdın ana gövdesi şu bölümlere ayrılmalıdır:

1. Özet

2. Giriş

6. Conclusion
7. Conflict of interest
8. Acknowledgement
9. References

In general, there are no specific word lengths for any manuscript. The general principle is that a manuscript can be as long as necessary to communicate clearly and most effectively the scientific message, but should be as short as possible to achieve a complete presentation of the information without undue repetition or redundancy.

In the *Materials and Methods* section, the source of all compounds, equipment or software should be identified by the full name of the supplier, city, state/country. The chemical names of any drug should precede the trade name.

Papers describing animal experiments must define species, strain, sex, age, supplier and number of animals used. An ethical statement concerning the use of animals, or the details of ethical approvals, consent and recruitment of human subjects should be clearly stated. *Results* and *Discussion* can be broken down into subsections for improving the comprehensibility. The Results should not repeat methodological details and should avoid the discussion of the data.

The results of statistical tests should be incorporated in the body of the text, typically in the *Results* section, rather than in figure legends. Adequate description of statistical analysis should be provided. Statistical measures of variation in the text, illustrations and tables, should be identified. All dimensions and measurements must be

3. Gereç ve Yöntemler
4. Sonuçlar
5. Tartışma
6. Bağlam
7. Çıkar çatışması
8. Teşekkür, bilgilendirme
9. Kaynaklar

Genel olarak, herhangi çalışma için şart koşulan belirli bir kelime sayısı/metin uzunluğu yoktur. Genel ilke; bir makalenin bilimsel mesajı açık ve etkili bir şekilde iletmek için gerektiği kadar uzun olabileceği, ancak gereksiz tekrar veya fazlalık olmadan bilgilerin eksiksiz bir sunumunu elde etmek için mümkün olduğunca kısa olması gerektiğidir.

*Gereçler ve Yöntemler* bölümünde, tüm bileşiklerin, malzemelerin veya yazılımların kaynağı, tedarikçinin tam adı, şehir, eyalet/ülke ile tanımlanmalıdır. Herhangi bir ilacın kimyasal isimleri ticari isminden önce gelmelidir.

Hayvan deneylerini açıklayan makaleler, tür, soy, cinsiyet, yaş, tedarikçi ve kullanılan hayvan sayısını açıkça tanımlamalıdır. Hayvanların kullanımına ilişkin bir etik beyan veya insan deneklerin etik kurul onayları, bilgilendirilmiş onamları ve çalışmaya dâhil edilmelerine ilişkin ayrıntılar açıkça belirtilmelidir. *Sonuçlar ve Tartışma* bölümleri, anlaşılırlığı artırmak için alt bölümlere ayrılabilir. Sonuçlar, metodolojik ayrıntıları tekrarlamamalı ve verilerin tartışılmasından kaçınmalıdır.

İstatistiksel testlerin sonuçları, şekillerin altındaki açıklama kısımlarından ziyade metnin gövdesine, tipik olarak Sonuçlar bölümüne dâhil edilmelidir. İstatistiksel analizin yeterli bir şekilde açıklaması sağlanmalıdır. Metinde, resimlerde ve

specified in the metric system.

All subscripts, superscripts, Greek letters and unusual characters must be clearly identified.

In the text, abbreviations should be used consistently. Abbreviations should be defined on first use.

References should be designed in “Vancouver” style. While writing references, “Times New Roman” 10 point font should be used. Multiple authors should be separated by a comma. If there are more than three authors, after the 3rd author, "et al." should be inserted without a comma for both article and book references. If reference is made from a chapter in a book and there are many authors belonging only to this chapter, the title and chapter of the book are indicated, the first three of the chapter authors are written, and "et al." statement is added for subsequent authors.

Example:

1. Perell KL, Nelson A, Goldman RL, et al. Fall risk assessment measures: an analytic review. The journals of gerontology Series A, Biological sciences and medical sciences. 2001;56(12):M761-6.

2. Ha H, Han C, Kim B. Can Obesity Cause Depression? A Pseudo-panel Analysis. Journal of preventive medicine and public health = Yebang Uihakhoe chi. 2017;50(4):262-7.

3. Çekmen MB, Turgut M, Türköz Y, et al. Nitrik Oksit (NO) ve Nitrik Oksit Sentaz (NOS)'ınFizyolojik ve Patolojik Özellikleri. Türkiye Klinikleri Journal of Pediatrics. 2001;10(4):226-35.

4. Parlakpınar H, Örüm MH, Acet A. Kafeik asit fenetil ester (KAFE) ve miyokardiyal

tablolarda istatistiksel varyasyon ölçütleri tanımlanmalıdır.

Tüm boyutlar ve ölçüler metrik sistemde belirtilmelidir.

Tüm alt simgeler, üst simgeler, Yunan harfleri ve olağandışı karakterler açıkça tanımlanmalıdır.

Metinde kısaltmalar tutarlı bir şekilde kullanılmalıdır. Kısaltmalar ilk kullanımda tanımlanmalıdır.

Kaynaklar “Vancouver” tarzında yazılmalıdır. Kaynaklar yazılırken, “Times New Roman” 10 punto kullanılmalıdır. Birden çok yazar virgülle ayrılmalıdır. Hem makale hem de kitap referanslarında, eğer üçten çok yazar varsa, 3. Yazardan sonra virgül ve “et al.” ifadesi kullanılmalıdır. Kitapta bir bölümden referans yapılıyorsa ve sadece bu bölüme ait çok sayıda yazar varsa, kitabın başlığı ve bölümü belirtilip, bölüm yazarlarının ilk üçü yazılıp ve ardından sonraki yazarlar için “et al.” ifadesi eklenmelidir.

Örnek:

1. Perell KL, Nelson A, Goldman RL, et al. Fall risk assessment measures: an analytic review. The journals of gerontology Series A, Biological sciences and medical sciences. 2001;56(12):M761-6.

2. Ha H, Han C, Kim B. Can Obesity Cause Depression? A Pseudo-panel Analysis. Journal of preventive medicine and public health = Yebang Uihakhoe chi. 2017;50(4):262-7.

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5. Yıldırım AB. The effects of maternal hypothyroidism on the immunoreactivity of cytochrome p450 aromatase in the postnatal rat testes. 2015; Doctoral thesis.
6. https://hsgm.saglik.gov.tr/depo/birimler/kanserdb/istatistik/Trkiye_Kanser_statistikleri_2016.pdf (Last access date: 21.09.2020).
7. Kuran O, İstanbul, Filiz Kitabevi. Sistematik Anatomi. 1983 p. 76-9.
8. Abbas AK, Andrew H Lichtman, Shiv Pillai. Cellular and Molecular Immunology. 6th ed. Philadelphia: Saunders Elsevier; 2007 p. 121-56.

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Tables of numerical data should each be typed with double spacing on separate pages numbered in sequence in numerals, provided with a heading, and referred to in the text, as Table 1, Table 2, etc. Each table should have a brief but descriptive heading. Explanatory matter should be included in footnotes to the table.

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4. Parlakpınar H, Örüm MH, Acet A. Kafeik asit fenetil ester (KAFE) ve miyokardiyal iskemi reperfüzyon (Mİ/R) hasarı. İnönü Üniversitesi Sağlık Bilimleri Dergisi 2012; 1: 10-5.
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6. https://hsgm.saglik.gov.tr/depo/birimler/kanserdb/istatistik/Trkiye_Kanser_statistikleri_2016.pdf (Last access date: 21.09.2020).
7. Kuran O, İstanbul, Filiz Kitabevi. Sistematik Anatomi. 1983 p. 76-9.
8. Abbas AK, Andrew H Lichtman, Shiv Pillai. Cellular and Molecular Immunology. 6th ed. Philadelphia: Saunders Elsevier; 2007 p. 121-56.

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Sayısal veri tablolarının her biri, sayılarla sırayla numaralandırılmış bir başlık ile birlikte ve metinde Tablo 1, Tablo 2, vb. olarak atıfta bulunulmuş halde, ayrı sayfalarda çift aralıkla hazırlanmalıdır. Her tablonun kısa ama açıklayıcı bir başlığı olmalıdır. Tablo dipnotlarında açıklayıcı hususlara yer verilmelidir.

Bilimsel araştırmalarınızı desteklemek ve geliştirmek için elektronik ek materyaller kabul edilmektedir. Ek dosyalar, yazara, destekleyici uygulamaları, filmleri, animasyon dizilerini, yüksek çözünürlüklü

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görüntüleri, arka plan veri kümelerini, ses kayıtlarını ve daha fazlasını yayınlamak için ek olanaklar sunmaktadır.

Başvuru sırasında çıkar çatışmasının ve mali destek konularının açıklanması elzemdir. Yazarlar, makalelerinin yayımlanma tarihinden önce ortaya çıkabilecek ek çıkar çatışmalarını veya bulunan mali destekleri dergiye bildirmekle yükümlüdür. Tüm yazarlar, makalelerinin konusuyla doğrudan ilgili olsun ya da olmasın, tüm olası çıkar çatışmalarını ve mali desteği bireysel olarak açıklamalıdır.

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**The Chancellor's Message**

Dear Students and Academicians,

Islam has placed a huge emphasis on medicine, since the beginning. According to the Islamic opinion, obeying certain medicinal recommendations is indispensable for a Muslim for both his and all society's good. Recently, the world has lived through unfortunate memories because of the pandemic. That is the neither the first nor the last threat for humanity. Hadiths narrated by Islamic scholars were even able to shed light on how to be at war with contagious diseases, epidemics or pandemics, for many centuries. Our beloved prophet, beloved servant of Allah (C.C), Hz. Muhammed said that "If you hear of a plague somewhere,do not enter into there. If the plague occurs in your place, do not leave there", narrated by famous Islamic scholar Buhârî. This most fundamental principle for the fight against epidemics still remains valid today.

All advices regarding the medicine internalised from verses of the Quran, hadiths and the life of Hz. Muhammed are actually a set of principles, named as "Tıbb-ı Nebevî". Tıbb-ı Nebevî means medicinal principles and remarks of our prophet, Hz. Muhammed. It acts as a guideline for Muslims in certain major medical entities, such as general medicine, preventivemedicine and treatment approaches. Hadith mentioned above obviously points out certain principles of preventive medicine. Besides, there are others, for instance, in a verse of the Quran, Allah (C.C) Almighty orders that mothers should breastfeed their babies for two years. Today, scientists announce a number of research studies revealing the benefits of breast milk and they suggest that a baby should be breastfed for two years provided that thebaby should take only breast milk, not any other food supplement, during the first six months of the life.

We can find out lots of medicinal principles mentioned in the Quran or hadiths narrated by Islamic scholars. Also, Islamic world has managed to train honoured medical scientists during ages. One of famous medical scholars of his period was Ibn Sînâ who is well known with its original perspective into the medicine and adapting to orders of the Quran and medicinal principles of "Tıbb-ı Nebevî", really worth mentioning here. He wrote more 100 books in the fields of medicine and philosophy and these were utilised in Europe as reference books until 18th century.

I believe in that Gaziantep Islam, Science and Technology University Medical Faculty will be inspired by this great medicinal and cultural richness and will take its place in the modern medical world. I wish great success to the Medical Faculty Journal "Experimental and Applied Medical Science".

Wish you all the best

Prof. Dr. Mehmet Nihat Hatipoğlu
Chancellor of Gaziantep Islam Science and Technology University

**Chief Editor's Message**

Dear Readership,

While struggles continue at full speed to start education and training in our Faculty of Medicine which was brought to our country within the newly formed Gaziantep Islamic Science and Technology University, it has been one year since the "Experimental and AppliedMedical Science" sprouted, which is the academic publication of our Faculty of Medicine andin which we wholeheartedly believe will make a significant contribution to our academic community. We are very happy to deliver the fifth issue of our academic magazine to our readership in print, as well as in electronic form.

Nowadays, academic studies are accelerating, multiplying and diversifying. The need for channels where scientific studies, opinions and ideas can be freely expressed and easily shared with experts, researchers or postgraduate students who are still in the learning phaseis increasing day by day. "Experimental and Applied Medical Science" has adopted it as a principle from the first day to bring together original and up-to-date studies, stimulating scientific views and ideas from every field of medicine that will potentially increase the quality of life with its readers both from home and abroad. With this fifth issue of our journal, we will continue to publish in English 4 (four) times a year, more than thirty manuscripts , in different types, research articles, case reports, reviews, etc. will have already been published and met with our readers. Recently, researchers have begun to understand the importance of having their studies published in international double-blind peer-reviewed journals. Since the first day of its publication, "Experimental and Applied Medical Science" has subjected the manuscripts which have been received, to an international double-blind peer reviewed evaluation process. For this reason, we aim not only to evaluate the manuscripts submitted with an aspect in which we decide whether the manuscript deserves to be publishing or not, but also to help researchers improve their educational or academic lives by providing on-the-spot feedback.

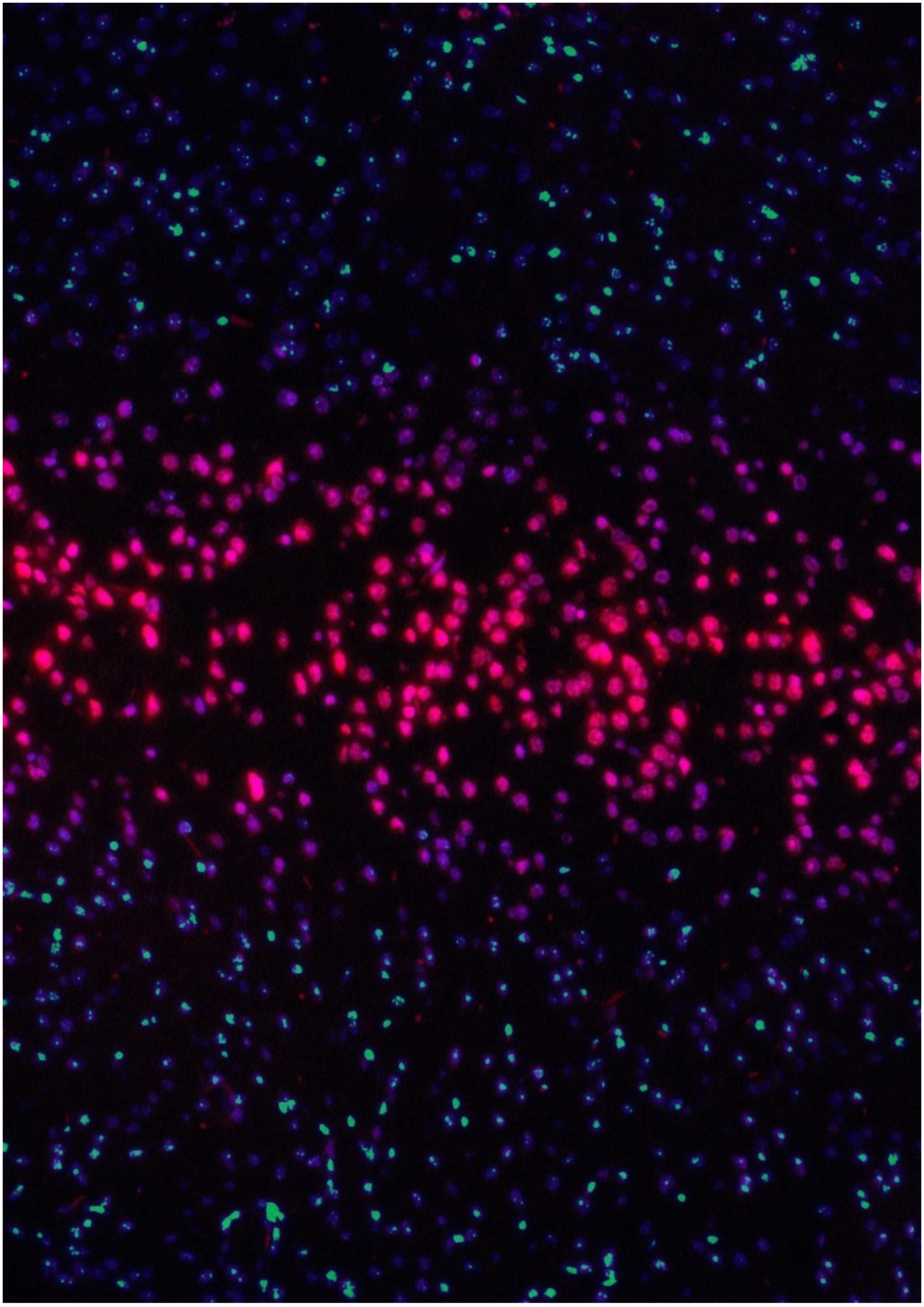
We are also happy that "Experimental and Applied Medical Science" which is only at the beginning of the road, has come a long way in a short time. In its 1 (one) year academic publication life, it has already started to be followed in nearly ten national or international indexes.

I would like to express my gratitude to our editorial and publishing boards, the esteemed academics who chose "Experimental and Applied Medical Science" for their manuscripts to have been submitted, all our readers, and our Rectorate for their unwavering support. I wish "Experimental and Applied Medical Science" the best success in its publication life.

Best Regards…

Chief Editor
Hamit Yıldız, Assoc. Prof.
Gaziantep University, Faculty of Medicine, Department of Internal Medicine

## Contents/İçindekiler



Experimental and Applied Medical Science, 2, 2: 146-153, 2021. DOI 10.46871/eams.2021.18

# Systemic Inflammatory Index and Platelet-to-Lymphocyte Ratio Predict Mortality in Patients with Acute Myocardial Infarction

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**Abstract**

*In this study, we aimed to evaluate the relationship between the laboratory parameters of platelet volume / lymphocyte ratio (PLR) and systemic inflammatory index (SII) with prognosis and mortality in patients with hospitalized GFR (Glomerular filtration rate) <60 ml / min and a diagnosis of acute myocardial infarction (AMI). This study was designed as a retrospective cohort study. 235 myocardial infarction (MI) patients over the age of 18 and with GFR <60 ml / min, hospitalized in our hospital between January 01, 2016 and January 01, 2019, were included in the study. The patients were divided into 2 groups as survival and mortality group. The two groups were compared in terms of demographic characteristics, clinical laboratory data (symptoms, comorbidities, laboratory findings, GFR, coronary angiography, medications and complications). Platelet - lymphocyte ratio (PLR) was obtained by dividing platelet count to lymphocyte count. Systemic inflammatory index (SII) was found by multiplying neutrophil count and PLR value. The mean age of the survival group was 67.1±12,8 years. In the mortality group, the mean age was 69.55±11,1 years. PLR and SII levels were significantly higher in the mortality group compared to the survival group (p=0.002, p=0.029, respectively). According to the results of ROC analysis in mortality group patients, it was found that sensitivity 59.1% and specificity 70.4% for PLR (p=0.002); sensitivity 54.5% and specificity 60.9% for SII (p=0.029). The risk factors were found to be significantly associated with mortality in the regression analysis included PLR (β: 0.007, OR (95% CI): 1.007 (1.001-1.012), p=0.001) and SII (β: 0.001, OR (95% CI): 1.000 (0.999-1.001), p=0.041). PLR and SII were able to predict the mortality from myocardial infarction.*

***Key words:*** *Acute myocardial infarction, Mortality, Platelet - lymphocyte ratio, Systemic inflammatory index.*

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## Introduction

It is estimated that approximately 17.3 million people worldwide die of coronary heart disease (CHD) and stroke each year, and this figure will be reached to 23.3 million by 2030. CHD is one of the major causes of mortality and morbidity in developing countries (1). The results of the Heart Disease and Risk Factors in Turkish Adults (TEKHARF) study conducted by the Turkish Society of Cardiology between 1990 and 2008 reveal that approximately 2.8 million people in Turkey have CHD and 170 thousand people die from this cause every year (2). Acute coronary syndrome (ACS) is a term used to describe symptoms consistent with acute myocardial ischemia, including myocardial infarction (MI) and unstable angina. One- fourth of all ACSs are ST elevation myocardial infarction (STEMI), the remainder is unstable angina pectoris (USAP) or non-ST elevation myocardial infarction (NSTEMI) (3). In addition to clinical and electrocardiogram (ECG) findings, biochemical markers are important both in the diagnosis of ACS and in evaluating the prognosis (4).

While the peripheral neutrophil count increases in acute myocardial infarction, the lymphocyte count decreases. Considering some other hematological parameters, it has been shown that neutrophil-lymphocyte ratio (NLR) predicts cardiac events in stable coronary syndromes, mortality in ACS, and prosthetic valve thrombosis as an indicator of systemic inflammation. In recent years, it has been shown that the ratio of platelet counts to lymphocyte count (thrombocyte to lymphocyte ratio, TLO) and systemic inflammatory index (SII) can be an indicator of systemic inflammation and are closely related to prognosis in chronic inflammatory diseases and cardiovascular diseases (5-8).

In this study, we aimed to evaluate the relationship between the laboratory parameters of platelet volume / lymphocyte ratio (PLR) and systemic inflammatory index (SII) with prognosis and mortality in patients with hospitalized GFR (Glomerular filtration rate) <60 ml / min and a diagnosis of acute myocardial infarction (AMI).

## Materials and methods

This study was designed as a retrospective cohort study. Before the study started, the study protocol was approved by local ethics committee of İstanbul Medipol University Clinical Research (Approval no: 05/04/2021, E-10840098-772.02-1598). This study was conducted in accordance with the ethical principles of the Declaration of Helsinki. 235 myocardial infarction (MI) patients over the age of 18 and with GFR <60 ml / min, hospitalized in our hospital between January 01, 2016 and January 01, 2019, were included in the study. The demographic characteristics of the patients, clinical data (symptoms, comorbidities, laboratory findings, GFR, coronary angiography, medications and complications that developed in the patients) were scanned.

The patients were divided into 2 groups as survival and mortality. The two groups were compared in terms of demographic characteristics, clinical data. Platelet - lymphocyte ratio (PLR) was found by dividing platelet count to lymphocyte count. Systemic inflammatory index (SII) was found by multiplying neutrophil count and PLR value.

## Statistical Analysis

The data obtained in this study were

analyzed using SPSS v.25 (SPSS, Chicago, USA) statistical program. Descriptive statistics such as frequency distribution, mean and standard deviation were used to evaluate the data. The difference between the means of two independent groups was compared with the student's t test, and the differences between more than two groups were compared with the analysis of variance with the parametric test. Mann-Whitney U and Kruskal-Wallis tests, which are nonparametric alternatives of these tests, were used in cases where parametric test assumptions were not met. Categorical data were analyzed using the Chi-square or Fisher's Exact test. Values of $p < 0.05$ were considered statistically significant at 95% confidence interval.

**Results**

Comparison of laboratory and socio-demographic findings between the groups of patient and control was shown in table 1. The mean age of the survival group was 67.1±12,8 years. In the mortality group, the mean age was 69.55 ± 11.1 years. PLR and SII levels were significantly higher in the mortality group compared to the survival group (p=0.002, p=0.029, respectively). There wasn't any statistical significance between the groups in terms of gender, hospitalization duration, coronary artery disease, heart failure, STEMI, Non-STEMI, hypertension, hyperlipidemia, diabetes mellitus, smoking, nephropathy, medications (acetyl salicylic acid, beta blocker, statins, ACE inhibitors, clopidogrel, ticagrelor, GFR (ml / min), hemoglobin (g/dL), creatinine (mg/dL), neutrophils (109/L), lymphocytes (109/L), and platelet count (109/L) (Table 1).

ROC analysis results in patients with mortality are shown in Table 2. According to the results of ROC analysis in patients with mortality, sensitivity and specificity have been found 59.1% 70.4% respectively for PLR (p=0.002); sensitivity and specificity have been found 54.5% 60.9% respectively for SII (p=0.029) (Table 2, Fig. 1).

Multiple logistic regression analysis of factors associated with mortality is shown in table 3. The risk factors found to be significantly associated with mortality in the regression analysis included PLR (β: 0.007, OR (95% CI): 1.007 (1.001-1.012), p=0.001) and SII (β: 0.001, OR (95% CI): 1.000 (0.999-1.001), p=0.041) (Table 3).

**Table 1:** Socio-demographic features and clinical and laboratory parameters of the patients.

| **Parameters** | **Survival (N=169, 71.9%)** Mean ± SD (min-max), n (%) | **Mortality (N=66, 28.1%)** Mean ± SD (min-max), n (%) | **p** |
|---|---|---|---|
| **Age (year)** | 67.1 ± 12.8 (32-101) | 69.55 ± 11.1 (46-100) | 0.187 |
| **Gender** | | | |
| **Male** | 99 (58.6%) | 40 (40.4%) | 0.778 |
| **Female** | 70 (41.4%) | 26 (59.6) | |
| **Number of Days of Hospitalization** | 3.14 ± 1.8 (1.0-15.0) | 3.11 ± 2.2 (1.0-13.0) | 0.918 |
| **Coronary artery disease** | 57 (33.7%) | 23 (34.8%) | 0.872 |
| **Heart failure** | 24 (14.4%) | 10 (15.2%) | 0.880 |
| **STEMI** | 99 (58.6%) | 33 (50.0%) | 0.235 |
| **Non-STEMI** | 70 (41.4%) | 33 (50.0%) | 0.235 |
| **Hypertension** | 132 (78.1%) | 47 (71.2%) | 0.267 |
| **Hyperlipidemia** | 29 (17.2%) | 11 (17.2%) | 0.996* |
| **Diabetes mellitus** | 63 (37.3%) | 27 (40.9%) | 0.609 |
| **Cigarette** | 32 (18.9%) | 11 (16.7%) | 0.682 |
| **Nephropathy** | 50 (29.6%) | 16 (30.8%) | 0.075* |
| **Acetyl salicylic acid** | 167 (98.8%) | 66 (100.0%)) | 0.377 |
| **Beta blocker** | 121 (71.6%) | 47 (71.2%) | 0.953* |
| **Statins** | 137 (81.1%) | 59 (89.4%) | 0.124* |
| **ACE inhibitors** | 81 (47.9%) | 24 (36.4%) | 0.110* |
| **Clopidogrel** | 115 (68.0%) | 46 (69.7%) | 0.808 |
| **Ticagrelor** | 48 (28.4%) | 20 (30.3%) | 0.774 |
| **GFR (ml / min)** | 47.81 ± 14.3 (5.0-60.0) | 46.47 ± 15.9 (5.0-60.0) | 0.531 |
| **Hemoglobin (g/dL)** | 12.00 ± 2.4 (1.6-18.4) | 11.63 ± 2.0 (6.9-16.7) | 0.255 |
| **Creatinine (mg/dL)** | 1.55 ± 1.1 (0.8-10.0) | 1.68 ± 1.3 (0.8-9.7) | 0.434 |
| **Neutrophils ($10^9$/L)** | 7.89 ± 4.2 (0.2-24.0) | 7.58 ± 3.0 (2.6-18.0) | 0.600 |
| **Lymphocytes ($10^9$/L)** | 2.55 ± 2.8 (0.2-31.8) | 2.00 ± 4.8 (0.3-12.3) | 0.146 |
| **Platelet ($10^9$/L)** | 253.13 ± 76.7 (72.0-658.0) | 267.83 ± 74.5 (133.0-490.0) | 0.181* |
| **PLR** | 144.33 ± 112.6 (9.7 ± 979.4) | 216.61 ± 213.3 (25.0 ± 1531.0) | 0.002***** |
| **Systemic inflammatory index (SII)** | 1243.3 ± 1659.9 (4.20-17218.0) | 1919.3 ± 2966.0 (200.20-22111.2) | 0.029***** |

*: Mann Whitney-U test used. STEMI: ST elevation myocardial infarction, ACE: Angiotensin converting enzyme, GFR: Glomerular filtration Rate, PLR: Platelet - lymphocyte ratio.

**Table 2:** ROC analysis results in patients with mortality

| | **Cut-off** | **Sensitivity** | **Specifity** | **AUC (95% CI)** | **p** |
|---|---|---|---|---|---|
| PLR | >141.2 | 59.1% | 70.4% | 0.632 (0.549-0.716) | 0.002 |
| SII | >943.8 | 54.5% | 60.9% | 0.592 (0.508-0.676) | 0.029 |

AUC: Area under the curve; PLR: Platelet- lymphocyte ratio; SII: Systemic inflammatory index.

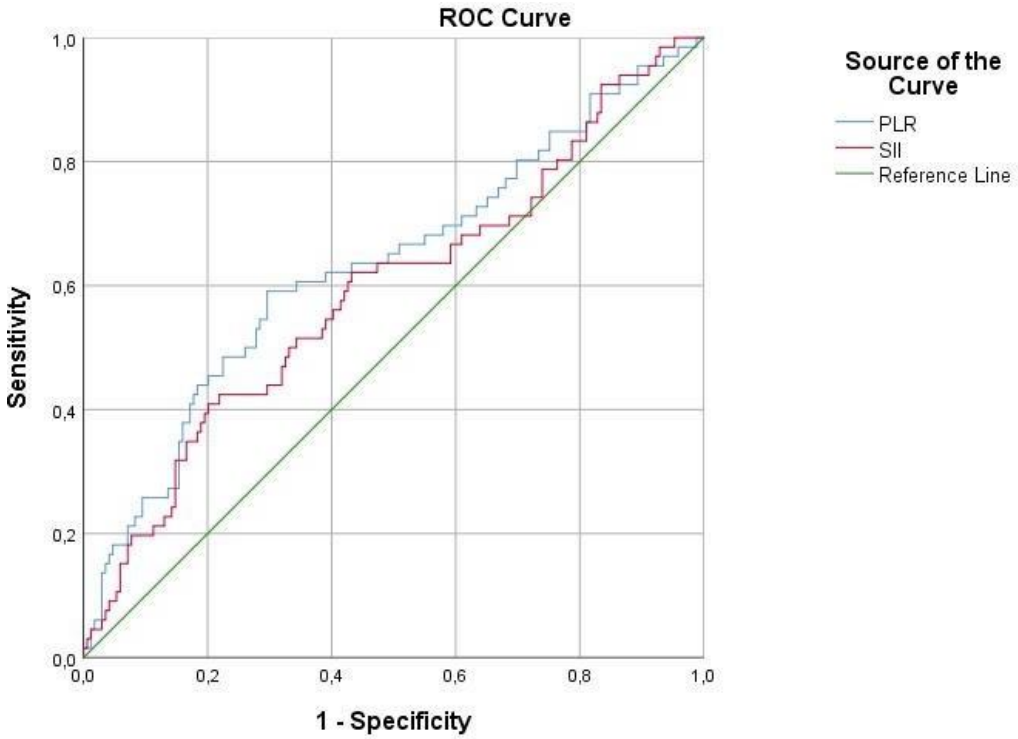


**Figure 1:** ROC analysis of PLR and SII.

**Table 3:** Multiple logistic regression analysis of factors used for mortality

| | *β* | OR (95% CI) | p |
|---|---|---|---|
| **PLR** | 0.007 | 1.007 (1.001-1.012) | **0.001** |
| **SII** | 0.001 | 1.000 (0.999-1.001) | **0.041** |

PLR: Platelet- lymphocyte ratio; SII: Systemic inflammatory index.

## Discussion

In this study, the effects of retrospective clinical and laboratory data on mortality were evaluated in 235 myocardial infarction (MI) patients over 18 years of age and with GFR <60 ml / min, hospitalized in coronary intensive care unit. There was a significant relationship between the laboratory markers obtained, especially PLR and SII, and those who died from myocardial infarction. Myocardial infarction is a disease with significant morbidity and mortality. While 169 (71.9%) patients survived in our study, 66 (28.1%) patients died in the hospital. PLR and SII levels were statistically significantly higher in the mortality group compared to the survive group. The risk factors found to be significantly associated with mortality in the regression analysis included PLR and SII.

Increased inflammatory marker levels in the blood are associated with poor outcome in heart failure as in many chronic diseases. An increased inflammatory stimulus causes the secretion of many inflammatory cytokines. These inflammatory cytokines show detrimental effects on the myocardium, leading to decreased left ventricular function and thus heart failure (1, 4, 5, 7, 9). White blood cells and their subgroups are important

inflammatory markers in cardiovascular disease. High neutrophil levels indicate increased inflammatory response, while low lymphocyte count indicates poor general health and high physiological stress. Both low lymphocyte count and high neutrophil count are important risk factors in predicting reduced survival in patients with heart failure (1, 4, 6). In a study by Oylumlu et al., they reported that PLR was significantly higher in patients admitted with a diagnosis of acute ST-elevation myocardial infarction when compared with those who did not develop stent thrombosis. However, they also stated that PLR is an important and independent predictor of stent thrombosis in patients with acute STEMI (6).

There is a relationship between low lymphocyte counts and adverse outcomes in patients with chest pain, stable CAD, unstable angina, and congestive heart failure (26-28). The histological basis of this relative lymphopenia is due to the release of cortisol in response to the stress of myocardial ischemia (4, 10, 11). Similarly, ST has been associated with low lymphocyte counts in our study as well. The advantage of PLR is that it reflects both activated coagulation and inflammatory pathways, and so it may be superior to platelet or lymphocyte counts alone in predicting adverse outcomes such as ST. In a study by Luke et al. in 191 patients with cute Coronary Syndrom (ACS) and SCAD (Stable Coronary Artery Disease), PLR values were significantly higher in ACS than SCAD (12). In a study by Azab et al. in 619 patients with NSTEMI, higher PLR values were associated with increased long-term mortality in patients with non-ST segment elevation myocardial infarctions (13).

The roles of PLR and other complex markers of systemic inflammatory response have been primarily described in relation to the prognosis of ACS. It has been shown that PLR correlates with a greater overall mortality in patients with NSTEMI (13). In a study by Sun et al. in 5886 patients with STEMI, Higher PLR was associated with recurrent myocardial infarction, heart failure, ischemic stroke, and all-cause mortality in patients with STEMI (14). In our study, PLR levels were statistically significantly higher in the mortality group compared to the survive group. According to the results of ROC analysis in patients with mortality, sensitivity and specificity have been found 59.1% 70.4% respectively for PLR. However, the risk factors found to be significantly associated with mortality in the regression analysis included PLR (β: 0.007, OR (95% CI): 1.007 (1.001-1.012), p=0.001).

Chronic inflammation has been considered to have major contributions to several important diseases, including cancer, cardiovascular disease, diabetes and metabolic syndrome (4, 15-17). Hu et al. first reported on the use of the SII in hepatocellular carcinoma, and the index had significant associations with prognostic clinical outcomes, including vascular invasion, tumor size and early recurrence (18). Seo et al. first reported the predictive value of SII in patients with chronic heart failure and further extended the importance of SII to cardiovascular disease (19). In a study by Yang et al, the addition of SII to the clinical model was improved the predictive power for major cardiovascular events including AMI, chronic heart failure and cardiovascular death in patients with coronary artery disease. However, high SII is an independent prognostic marker of future

adverse events and increases the predictive value for adverse events among patients with coronary artery Disease (7). In our study, SII levels were statistically significantly higher in the mortality group compared to the survive group. According to the results of ROC analysis, in patients with mortality, sensitivity 54.5% and specificity 60.9% for SII. However, the risk factors found to be significantly associated with mortality in the regression analysis included SII (β: 0.001, OR (95% CI): 1.000 (0.999-1.001), p=0.041).

**Limitations of Study**

The study has some limitations. Our study was designed as an observational, retrospective and single center study. In addition, periodic repetition of PLR and SII measurements will likely affect results. We did not compare PLR and SII with other markers used in myocardial infarction. Moreover, multi-center and prospective studies should be planned to support these preliminary results. Compared to other studies in the literature, the strengths of our study, our sample was larger and our results were supported by logistic regression analysis.

**Conclusion**

As inexpensive and easily available new inflammatory markers, PLR and SII were significantly higher in patients with GFR <60 ml / min and died from myocardial infarction (MI). In addition, PLR and SII were able to predict the mortality from myocardial infarction. However, PLR levels can predict hemodynamically severe coronary obstruction better than SII. The utility of this new marker warrants to be investigated in various cardiac situations. Large-scale, prospective, and multicenter studies will be necessary to clarify the relationship between PLR, SII and Myocardial infarction.

**Conflict of Interest**

The authors declare that they have no conflict of interest.

**Acknowledgment**

Authorship Contributions: Idea/Concept and design; SK, EO, control/supervision; SK, EO, data collection and/or processing; SK, EO, analysis and/or interpretation; SK, literature review; SK, EO, writing the article; SK, EO, critical reviewing; SK, EO. There are no funding sources.

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Experimental and Applied Medical Science, 2, 2: 154-163, 2021. DOI 10.46871/eams.2021.19

# Fear of Coronavirus, Emotional Eating Behaviours, and Physical Activity Levels during the Coronavirus Pandemic in Individuals Over 65 Years of Age

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**Abstract**

*The Covid-19 pandemic has led to dramatic changes in lifestyle across populations. This study aimed to investigate the relationship between fear of Coronavirus, emotional eating behaviour and physical activity levels in individuals aged >65 years, and to determine the differences between individuals who did and did not gain weight during the pandemic. The study included individuals aged>65 years who were not diagnosed with Coronavirus disease (Covid-19). Participants' demographic information, Fear of Covid-19 Scale scores, Emotional Eater Questionnaire (EEQ) scores, and physical activity levels according to the General Practice Physical Activity Questionnaire (GPPAQ) were recorded with an online questionnaire. The study included a total of 156 participants (72 females, 46.2%; 84 males, 53.8%). The average age was 71.86 ± 7.13 years. The average change in body mass index (BMI) between February 2020 and January 2021 was 0.80 ± 1.32 kg/m$^2$. Participants were divided into two according to change in body mass index during the pandemic as weight-gain (WG, n=104) and non-weight-gain (NWG, n=52) groups. The two groups were not different in terms of descriptive characteristics, the Fear of Covid-19 Scale scores, and physical activity levels (p>0.05). The WG group scored statistically higher in EEQ, and the EEQ type-of-food subscale (p=0.027, p=0.029, respectively). Current BMI, overall EEQ score, and EEQ disinhibition and type-of-food subscores were weakly positively correlated with the change in BMI (p<0.05). EEQ guilt subscores were weakly positively correlated with the age (p<0.05). The change in BMI during the Covid-19 quarantine was associated with the EEQ overall score and its subscales among elderly adults. Physical activity levels of groups were similar and participants who gained weight were more prone to emotional eating.*

***Key words:*** *Covid-19, Fear of Coronavirus, Emotional eating, Physical activity, Elderly.*

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## Introduction

An infectious disease emerged in Wuhan, China in December 2019 and was declared a pandemic by the World Health Organization in March 2020. The disease, caused by the novel Coronavirus (Sars-CoV-2) and named the Coronavirus disease 2019 (Covid-19), is still a major global health problem (1). As of February 2021, more than 107 million people were infected and more than 2.3 million died due to Covid-19 around the world. In Turkey, there have been more than 2.5 million cases of Covid-19 and more than 27 thousand related deaths (2,3).

There is ongoing concern about the psychological impact of the pandemic on the elderly (4). Previous studies established that infection outbreaks result in a wide range of effects on individual and public mental health (5). For instance, a study concerning the SARS epidemic associated the fear of infection with post-traumatic stress symptoms (6). Ahorsu et al. conducted a study to investigate the impact of the Covid-19 outbreak and found that fear of Covid-19 was correlated with depression, anxiety, and germ aversion behaviours (7). Another study found an association between drinking and smoking habits and Fear of Covid-19 scores (8). Numerous studies have confirmed the link between fear of Covid-19 and anxiety and depression (9). On the other hand, fear can impact social and physical activity participation, as well as causing a tendency to overeat as a coping mechanism to regulate and reduce negative emotions (10).

Staying at home for extended periods of time and the lockdown affect daytime routines, work schedules, and lifestyle habits (11). Decreased physical activity, along with prolonged inactivity, leads to poor quality eating behaviour, resulting in involuntary weight gain. Inactivity is associated with hypertension and impaired glucose tolerance and increases the risk of cardiovascular and metabolic diseases in individuals over the age of 65, who have become increasingly inactive during the Coronavirus pandemic (11). A Japanese study reported that physical activity participation of the elderly population was significantly reduced from January 2020 to April 2020 ($p<0.001$) and argued that this may result in severe health problems in the future (1).

Weight gain may be inevitable when physical inactivity is combined with emotional eating behaviours to escape or distract from emotional hardship (10). The negative emotional consequences of the global Covid-19 crisis associated with deaths, compulsory quarantine, and economic disruption, feelings of isolation, fear of infection, stress, and the interruption of daily life potentially increase emotional eating behaviour (10). A systematic review of 62 studies that included 162639 participants from 17 countries including China, Turkey, Iran, Spain, and Italy reported that the prevalence of Covid-19-related anxiety and depression were 33% and 28%, respectively (12). These results reflect the psychological impact of the Covid-19 pandemic on the Turkish population.

The literature on physical activity, obesity, and weight gain among the elderly during the pandemic is very limited. Recent studies have focused on the psychological effects of the lockdown (13), and it is clear that more data is needed on the fear of illness, eating behaviours, and physical activity levels of individuals over 65. This study aimed to investigate the fear of Coronavirus, emotional eating behaviour,

and physical activity levels among individuals aged >65 years and to compare these parameters between individuals who did and did not gain weight during the pandemic.

## Materials and Methods

This is a cross-sectional survey study. The study was granted approval by the local ethics committee (date 30.12.2020 and number 416) and the Republic of Turkey Ministry of Health Directorate General of Health Services.

The study included individuals aged >65 years who lived in Turkey and were literate in Turkish, and who did not have a diagnosis of Covid-19. Participants were selected using snowball sampling. Voluntary participants were asked to complete the online questionnaire (Google Forms) with help from digitally literate individuals.

Individuals diagnosed with Covid-19, individuals who inadequately completed the questionnaire, and those younger than 65 were excluded from the study.

Participants' demographic information, Fear of Covid-19 Scale scores (14), Emotional Eater Questionnaire (EEQ) scores (15), and physical activity levels according to the General Practice Physical Activity Questionnaire (GPPAQ) (16) were recorded.

*Fear of Covid-19 Scale:*

This scale was developed to measure individuals' fear of Covid-19. All items are positively worded. The total score indicates the level of fear of Covid-19. The minimum possible score is 7 and the maximum possible score is 35. A higher score indicates a higher fear of Covid-19 (14).

*Emotional Eater Questionnaire (EEQ):*

This 10-item 4-point Likert-type questionnaire consists of three subscales: disinhibition, type-of-food, and guilt. All items are positively worded. The minimum possible score is 0 and the maximum possible score is 30. A higher score indicates increased emotional eating (15).

Garaulet et al. (17) indicate that individuals that score 11 and higher on the EEQ are "emotional eaters".

General Practice Physical Activity Questionnaire (GPPAQ):

This 7-item three-part questionnaire was adapted to Turkish and validated by Noğay et al. The first part of the GPPAQ investigates physical activity involved in the person's work, the second part investigates physical activities performed within the previous week, and their durations, and the last part, the person's walking speed. The questionnaire evaluates physical activity in four categories, namely active, moderately active, moderately inactive, and inactive (16).

## Statistical Analysis

Data were analyzed using SPSS software package v.23. Participants' descriptive characteristics were presented as frequencies, percentages, and mean ± standard deviation. Conformity of the data to normal distribution was evaluated by the Shapiro-Wilk test. The difference between the mean BMI values of participants who did and did not gain weight during the pandemic was examined by the Mann-Whitney U and chi-square tests. We investigated the relationship between the change in body mass index (ΔBMI), age and other variables using Spearman's correlation analysis. A p value $<0.05$ was accepted as statistically significant.

**Results**

A total of 214 people responded to the online questionnaire in January 2021. 58 participants were excluded due to being aged <65 years (n=35), having a COVİD-19 diagnosis (n=15), and inadequate completion of the questionnaire, i.e., having a Z score outside the range of [-4,4] (n=8). Thus, the final analysis included 156 participants.

Among these, 46.2% (n=72) were female and 53.8% (n=84) were male. The mean age of the participants was 71.86 ± 7.13 years (Table 1). The mean pre-pandemic BMI (February 2020) was 26.60 ± 3.92 kg/m$^2$, the mean current BMI (January 2021) was 27.41 ± 4.23 kg/m$^2$, and the mean change in BMI (ΔBMI) was 0.80 ± 1.32 kg/m$^2$.

Participants were divided into two according to the change in body mass index during the pandemic as weight-gain (WG, n=104) and non-weight-gain (NWG, n=52) groups. For the WG group, the mean age was 71.85 ± 7.18 years, February 2020 BMI was 26.52 ± 3.97 kg/m$^2$, January 2021 BMI was 27.97 ± 4.34 kg/m$^2$, and mean ΔBMI was 1.45 ± 1.02 kg/m$^2$. For the NWG group, the mean age was 71.88 ± 7.10 years, February 2020 BMI was 26.77 ± 3.84 kg/m$^2$, January 2021 BMI 26.27 ± 3.78 kg/m$^2$, and mean ΔBMI was –0.50 ± 0.75 kg/m$^2$. The two groups were similar in terms of mean age (p=0.890) and February 2021 BMI (p=0.481) but significantly different in terms of current BMI (p=0.018) and ΔBMI (p=0.0001). The two groups were similar in terms of sex distribution, educational status, marital status, income level, known diseases, and drug use (p>0.05) (Table 1). The participants in the NWG group were more likely to have first-degree relatives diagnosed with Covid-19 (34.6% vs. 15.4%; p=0.011).

**Table 1:** Mean age and gender of the participants, socio-economic status, whether they have chronic diseases and drug use.

| | All, n=156 | WG, n=104 | NWG, n=52 | p value |
|---|---|---|---|---|
| | | mean ± SD | | |
| **Age (Years)** | 71.86 ± 7.13 | 71.85 ± 7.18 | 71.88 ± 7.10 | 0.890 |
| | | % (n) | | |
| **Gender (Male / Female)** | 53.8% (84) / 46.2% (72) | 53.8% (56) / 46.2% (48) | 53.8% (28) / 46.2% (24) | 1 |
| **Education status** | | | | 0.728 |
| **Primary education** | 53.8% (84) | 52.9% (55) | 55.7% (29) | |
| **Secondary education** | 15.4% (24) | 16.3% (17) | 13.5% (7) | |
| **Post-secondary education** | 21.8% (34) | 20.2% (21) | 25% (13) | |
| **Master's Degree/Doctorate** | 9% (14) | 10.6% (11) | 5.8% (3) | |
| **Marital status (Married / Single)** | 82.1% (128) / 17.9% (28) | 82.7% (86) / 17.3% (18) | 80.8% (42) / 19.2% (10) | 0.941 |
| **Income status** | | | | 0.217 |
| **Income<expenses** | 17.3% (27) | 15.4% (16) | 21.2% (11) | |
| **Income=expenses** | 40.4% (63) | 37.5% (39) | 46.1% (24) | |
| **Income>expenses** | 42.3% (66) | 47.1% (49) | 32.7% (17) | |
| **Chronic diseases (Yes / No)** | 70.5% (110) / 29.5% (46) | 75% (78) / 25% (26) | 61.5% (32) / 38.5% (20) | 0.121 |
| **Mental illness (Yes / No)** | 14.1% (22) / 85.9% (134) | 14.4% (15) / 85.6% (89) | 13.5% (7) / 86.5% (45) | 1 |
| **Chronic drug use (Yes / No)** | 60.9% (95) / 39.1% (61) | 65.4% (68) / 34.6% (36) | 51.9% (27) / 48.1% (25) | 0.147 |

%: percentage, n: number, SD: standard deviation, WG: Gain Weight, NWG: Not Gain Weight, * $p<0.05$ and significant. As determined by the chi-square test.

5.1% of all participants were physically inactive, 23.1% were moderately inactive, 30.1% were moderately active, and 41.7% were active. The two groups were not statistically different in terms of physical activity (Table 2).

**Table 2:** Physical activity levels

| | All, n=156 | WG, n=104 | NWG, n=52 | P value |
|---|---|---|---|---|
| **Inactive** | 5.1% (8) | 3.8% (4) | 7.7% (4) | 0.402 |
| **Moderately Inactive** | 23.1% (36) | 20.2% (21) | 28.8% (15) | |
| **Moderately Active** | 30.1% (47) | 31.7% (33) | 26.9% (14) | |
| **Active** | 41.7% (65) | 44.2% (46) | 36.6% (19) | |

%: percentage, n: number WG: Gain Weight, NWG: Not Gain Weight. As determined by the chi-square test.

For all participants, the mean total Fear of Covid-19 score was 22.67 ± 6.59, and not significantly different for the two groups (Table 3). On the other hand, the two groups were statistically different in terms of EEQ total score and type-of-food subscores. The number of participants evaluated as "emotional eaters" (EEQ score ≥11) was not significantly different for the two groups (Table 3). When the participants were divided according to age as 65-74 years old and over 75 years old, a statistically significant difference was found in the EEQ total score between the group that gained weight and the group that non-gained weight (Table 4).

**Table 3:** Scale Results.

| | All, n=156 | WG, n=104 | NWG, n=52 | P value |
|---|---|---|---|---|
| **Fear of Covid-19 score** | 22.67 ± 6.59 | 22.88 ± 6.59 | 22.25 ± 6.63 | 0.390 |
| **EEQ score** | 7.26 ± 5.16 | 7.76 ± 4.80 | 6.25 ± 5.72 | **0.027*** |
| **Disinhibition** | 4.04 ± 3.33 | 4.29 ± 3.14 | 3.54 ± 3.65 | 0.060 |
| **Type of food** | 2.06 ± 1.36 | 2.23 ± 1.31 | 1.73 ± 1.40 | **0.029*** |
| **Guilt** | 1.15 ± 1.31 | 1.24 ± 1.33 | 0.98 ± 1.26 | 0.155 |
| **Emotional eater (Yes / No) [a]** | 24.4% (38) / 75.6% (118) | 23.1% (24) / 76.9% (80) | 26.9% (14) / 73.1% (38) | 0.742 |

EEQ: Emotional Eater Questionnaire, WG: Gain Weight, NWG: Not Gain Weight, *p<0.05 and significant. As determined by the Mann-Whitney U test. [a] As determined by the chi-square test.

**Table 4:** Scale Results by Age.

| | 65-74 years | | | Over 75 years | | |
|---|---|---|---|---|---|---|
| | NWG, n=38 | WG, n=72 | p | NWG, n=14 | WG, n=32 | p |
| **Fear of Covid-19 score** | 21.55 ± 6.77 | 22.98 ± 5.99 | 0.286 | 24.14 ± 6.05 | 22.63 ± 7.87 | 0.886 |
| **EEQ score** | 6.42 ± 6.02 | 8.21 ± 4.74 | 0.048* | 5.79 ± 4.98 | 6.75 ± 4.87 | 0.303 |
| **Disinhibition** | 3.53 ± 3.67 | 4.57 ± 3.15 | 0.061 | 3.57 ± 3.74 | 3.66 ± 3.05 | 0.571 |
| **Type of food** | 1.82 ± 1.54 | 2.26 ± 1.28 | 0.090 | 1.5 ± 0.94 | 2.16 ± 1.39 | 0.171 |
| **Guilt** | 1.08 ± 1.38 | 1.38 ± 1.33 | 0.125 | 0.71 ± 0.82 | 0.94 ± 1.29 | 0.866 |
| **Emotional eater (Yes / No) [a]** | 28.9%(11) / 71.1%(27) | 26.4%(19) / 73.6%(53) | 0.824 | 21.4%(3) / 78.6%(11) | 15.6%(5) / 84.4%(27) | 0.684 |

EEQ: Emotional Eater Questionnaire, WG: Gain Weight, NWG: Not Gain Weight, *p<0.05 and significant. As determined by the Mann-Whitney U test. [a] As determined by the chi-square test.

Current BMI, overall EEQ score, and EEQ disinhibition and type-of-food subscores were weakly positively correlated with change in ΔBMI (Table 5). Other variables were not associated with ΔBMI (p>0.05).

Guilt score was weakly positively correlated with age. Other variables were not associated with age (p>0.05), (Table 5).

**Table 5:** Variables associated with ΔBMI and age.

| | | Change in BMI (ΔBMI) | Age |
|---|---|---|---|
| **Change in BMI** | r value | 1 | 0.013 |
| | p value | - | 0.876 |
| **Age** | r value | 0.013 | 1 |
| | p value | 0.876 | - |
| **Pre-pandemic BMI** | r value | 0.028 | -0.058 |
| | p value | 0.727 | 0.469 |
| **Current BMI** | r value | **0.338**** | -0.076 |
| | p value | 0.0001 | 0.348 |
| **Fear of Covid-19 score** | r value | 0.155 | 0.082 |
| | p value | 0.054 | 0.308 |
| **Emotional Eater Questionnaire score** | r value | **0.209**** | -0.145 |
| | p value | 0.009 | 0.071 |
| **Disinhibition** | r value | **0.161*** | -0.106 |
| | p value | 0.044 | 0.190 |
| **Type-of-food** | r value | **0.245**** | -0.055 |
| | p value | 0.002 | 0.498 |
| **Guilt** | r value | 0.106 | **0.229**** |
| | p value | 0.188 | 0.004 |

BMI: Body Mass Index, *Correlation is significant at p<0.05 (2-tailed), **Correlation is significant at p<0.01 (2-tailed). As determined by Spearman's correlation analysis.

## Discussion

In this study, we investigated fear of Covid-19, emotional eating behaviour, and physical activity levels in elderly people aged >65 years, who had to stay at home for extended durations of time during the pandemic, and who were primarily at risk of infection. The study included data from 156 participants. Accordingly, participants who did and who did not gain weight were similar in terms of fear of Covid-19 pandemic and physical activity levels. Even though the number of participants classified as "emotional eaters" according to the Emotional Eater Questionnaire was similar for the two groups, participants who gained weight during the pandemic scored significantly higher in the EEQ type-of-food subscale (p=0.029). Current BMI, overall EEQ score, and EEQ disinhibition and type-of-food subscores were weakly positively correlated with change in BMI and guilt score was weakly positively correlated with age. Moreover, participants in the NWG group were more likely to have first-degree relatives diagnosed with Covid-19 (p=0.011).

Rodriguez et al. conducted a study of 400 elderly individuals aged 60 to 86, and demonstrated that the Fear of Covid-19 score was higher in women than men, and that higher Covid-19 knowledge was associated with a higher fear of Covid-19 (9). They did not find any correlation between having a relative diagnosed with Covid-19 and fear scores but reported that older participants had lower fear scores (9). Haktanır et al. found that fear of Coronavirus was not significantly associated with age, chronic disease status, or education status, and that individuals aged over 60 years (16.87 points) scored lower on the fear of Covid-19 scale than individuals aged 50-59 (18.00 points),

although this difference was not statistically significant (18). This finding was ascribed to the increased sense of safety associated with increased social isolation (19). Although the results reported in the literature regarding the relationship between age and fear of Coronavirus vary (9, 18, 20, 21), the general opinion is that the elderly are less informed about the disease, and therefore are less anxious and less likely to protect themselves (22).

Again, Haktanır et al. reported a higher fear of Covid-19 among female participants than males. This finding was attributed to the higher response to stress in women (18). A different study found a positive and significant correlation between fear of Coronavirus and anxiety and depression (23). Ahorsu et al. showed that fear of Coronavirus is not affected by sex or age (7). To the best of our knowledge, there are no studies in the literature that investigate the relationship between body mass index and the fear of Covid-19. In this study, we did not find an association between change in weight and fear of Coronavirus in individuals aged over 65 years. As described above, the literature presents various results for different variables in the context of fear of Covid-19. We believe that these differences may be partially due to the different pandemic management strategies adopted by different countries. For this reason, we believe that assessing each society individually can produce more reliable results.

A study by Renzo et al. evaluated emotional eating behaviour during the Covid-19 quarantine (4). Most of their participants had symptoms of depression (61.3%), anxiety (70.4%), hypochondriasis (61.2%), and insomnia (52.2%). Moreover, participants reported feeling anxious due to their changing eating habits (48.7%), that they consumed an increased amount of food as a response to anxiety (57.8%), and ate for comfort (55.1%). Younger age, a lower BMI, less anxiety and mood changes, and a smaller tendency to increase food intake for comfort were associated with better eating control (4). A study of 638 female subjects aged 18-39 by Al-Musharaf showed that 47.2% of women had low EEQ scores, 40.4% had moderate EEQ scores, and 12.4% had high EEQ scores (i.e., were emotional eaters) (10). Also, among these women, 42.8% reported depression, 27% anxiety, 71% moderate stress, and 12.5% severe stress. Emotional eating scores were positively correlated with fat intake, number of meals, sugary food consumption, body mass index, stress, energy intake, and fast-food consumption. Shen et al. reported moderate to high perceived stress in 73.6% of their subjects. In addition, they reported emotional eating behaviour and food choice motives were associated with mood, convenience, price, and familiarity ($p<0.05$), and perceived stress was statistically correlated with emotional eating behaviour ($r=0.2$) (24).

A study by Papandreou et al. examined the effect of different isolation protocols from two different countries on eating behaviour and mood changes in individuals aged 18 and over (25). In Spain, 13.6% and 12.3% of the participants showed symptoms of moderate and severe depression and anxiety, while in Greece, these numbers were 18.8% and 13.2%, respectively. Participants from Spain scored statistically lower on the Emotional Eater Questionnaire compared to participants from Greece ($p<0.001$). Similarly, participants from Spain reported fewer

restrictions ($p<0.001$). In addition, a higher weight gain was reported in the Greek population. In our study, EEQ overall and type-of-food subscale scores were significantly higher in participants who gained weight during the pandemic. The literature reports that the change in BMI and food choice and disinhibition are correlated (25). In our study, we found that the fear of Covid-19 was similar among individuals who did and did not gain weight during the pandemic. We did not find a correlation between emotional eating and fear of Covid-19. Accordingly, it can be said that the fear of Covid-19 does not trigger emotional eating behavior in the elderly.

Increased inactivity during the Covid-19 pandemic can potentially increase morbidity and mortality among the elderly, especially if the lockdown is further extended (26). Antunes et al. investigated physical activity levels of 1404 participants aged 18-89 during the Covid-19 pandemic and reported that 447 participants (31.8%) had low physical activity, 697 people (49.6%) moderate physical activity, and 260 participants (18.5%) had high physical activity (27). Lesser et al. used the Godin Leisure Questionnaire to assess individuals over the age of 19 and classified 63.4% (n=694) of their participants as inactive and 36.6% (n=404) as physically active (28). They demonstrated that 40.5% of sedentary individuals and 22.4% of active individuals became less active and 33% of sedentary individuals and 40.3% of physically active individuals became more active during the pandemic (28). In our study, 41.7% of the elderly were classified as active, 30.1% as moderately active, 23.1% as moderately inactive, and 5.1% as inactive. Participants who did and did not gain weight during the pandemic were not statistically different in terms of physical activity. Therefore, we believe weight gain during the pandemic was not associated with physical inactivity but emotional eating behaviours, such as comfort eating and disinhibition.

The limitations of our research are its cross-sectional design, the limited representativeness of the sample, and having based psychological assessment on self-reported data.

To conclude, participants who did and did not gain weight during the pandemic were not different in terms of the fear of Covid-19 scores and physical activity levels. Body mass index was statistically associated with Emotional Eater Questionnaire scores. Eating habits and preferences of the elderly changed during the Covid-19 quarantine. Elderly individuals need psychological support to reduce emotional eating behavior and should be directed to physical activity for weight control and to become more active.

## Conflict of Interest

The authors declare that they have no conflict of interest.

## Acknowledgment

No institution has given financial support to the study. All researchers contributed equally to the study.

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Experimental and Applied Medical Science, 2, 2: 164-175, 2021. DOI 10.46871/eams.2020.20

# Investigation of Dynamic Thiol Disulfide Homeostasis in Acute Respiratory Failure Patients in Intensive Care Unit

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**Abstract**

*Thiols are antioxidant agents which belong to mercaptan group consisting of sulfur and carbon containing sulfhydryl (-SH). Thiol levels, in the case of elevated oxidative stress, are lowered by their use in neutralization of reactive oxygen molecules. It was aimed to investigate thiol and disulfide blood levels or thiol/disulfide ratio as a marker of total oxidant status which plays a role in the pathogenesis of inflammatory diseases that may cause respiratory failure. The study included 98 patients (58 males, 40 females) who have partial oxygen pressure (PaO2)<60 mmHg or partial carbon dioxide pressure (PaCO2)>45 mmHg in arterial blood in intensive care unit and 98 healthy volunteers. Total thiol and native thiol levels were measured by spectrophotometric method. Total thiol (270 ± 99.81), native thiol (203.90 ± 103.41) and disulfide (33.10 ± 12.42) levels of the patient group were significantly lower (p <0.001) than total thiol (423.62 ± 70.3), native thiol (307.13 ± 57.73) and disulfide (58.24 ± 27.21) of the control group levels. There is no significant difference between native thiol / total thiol, disulfide / total thiol and disulfide / native thiol ratios. This study may be the first study in the literature in terms of providing the diagnosis and follow-up of dynamic thiol-disulfide balance in patients with acute respiratory failure requiring intensive care support treatment. Thiol and disulfide blood levels or thiol / disulfide ratio can guide us as a prognostic test in acute respiratory failure patients.*

***Key words:*** *Native thiol, Oxidative stress, Respiratory failure, Thiol/disulfide homeostasis, Total thiol.*

## Introduction

Acute respiratory failure is a syndrome characterized by a sudden deterioration in the ability of the respiratory system to maintain adequate gas exchange, thus not providing enough oxygen ($O_2$) to meet the needs of the tissues and /or not eliminating the metabolism product carbon dioxide ($CO_2$). It can occur in a healthy person for a cause such as pneumonia or as an acute

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exacerbation in patients with chronic respiratory failure. Since acute respiratory failure is a clinical condition that can develop within minutes or hours and cause vital changes in blood gases and acid-base balance, early diagnosis and treatment are important in terms of the survival of the patient. Diagnosis of acute respiratory failure is made if the partial arterial oxygen pressure ($PaO_2$) is below 60mmHg or the partial arterial carbon dioxide pressure ($PaCO_2$) is above 45mmHg, due to the disorder in the oxygenation and / or $CO_2$ elimination functions of the respiratory system (1). Although for different pathophysiological reasons, many diseases can cause acute respiratory failure and these patients mostly require treatment and follow-up in intensive care units (2, 3).

With the increase of reactive oxygen species (ROS) such as hydroxyl radical, superoxide radical, and hydrogen peroxide formed during cellular metabolism and by the insufficiency of antioxidants responsible for their detoxification, deterioration in oxidative balance occurs, and oxidative stress develops. Increase in ROS causes cell damage or cell death by affecting macromolecules such as intracellular lipids, proteins, DNA and participates in the pathophysiology of many diseases (4, 5).

There are studies in the literature showing the role of oxidative stress in the pathogenesis of all infectious or inflammatory diseases that can cause respiratory failure, especially pneumonia and acute respiratory distress syndrome (ARDS) (6, 7). In these diseases, ROS released from high numbers of leukocytes damage the capillary endothelium and alveolar epithelium. Alveolar edema develops with this change in the alveolar epithelium, and alveolar collapse develops with the deterioration of the surfactant structure (8, 9).

Thiols are antioxidant agents among the mercaptan group used in the neutralization of reactive oxygen molecules in oxidative stress. Thiol synthesis can be performed in all eukaryotic living cells, and blood levels decrease as thiol groups are used for antioxidant purposes in the cell. The disulfide bonds formed by the interaction of thiols with oxidant molecules are transformed into thiol groups by reacting again with the proteins in the plasma thiol pool, and thus dynamic thiol / disulfide homeostasis is achieved. Dynamic thiol / disulfide homeostasis is only one of the many oxidant-antioxidant systems found in the human body and does not reflect the total antioxidant level of the body (10). There are studies showing the relationship of dynamic thiol / disulfide homeostasis with the pathogenesis of various diseases such as diabetes mellitus, cardiovascular diseases, cancer, rheumatoid arthritis, Parkinson's, Alzheimer's, and liver diseases (11-17).

Intensive care units are units where unstable patients that require intensive treatment and follow-up are accepted. Pathologies due to infection and / or inflammation such as pneumonia and ARDS constitute the majority of patients followed-up in intensive care units with the diagnosis of acute respiratory failure (18, 19). It was shown with various studies that oxidative stress plays a role in the etiopathogenesis of these diseases (20-22). If acute respiratory failure is diagnosed early, adequate oxygenation can be achieved with non-invasive supportive treatments. Invasive methods are needed to ensure adequate oxygenation in patients with severe acute respiratory failure. As a result of the accompanying nosocomial

infections due to these invasive interventions, an increase in mortality may occur.

In this study, it was investigated that thiol / disulfide homeostasis is determined by an automatic, fast, cheap, and applicable method in patients who develop acute respiratory failure in the intensive care unit or who have been admitted to the intensive care unit due to acute respiratory failure, and that whether acute respiratory failure provides an advantage in early diagnosis. Hypothesis based on that lung damage due to oxidative stress can be detected earlier by deterioration of thiol / disulfide homeostasis was aroused. By this way it is aimed that the detection of oxidative stress biochemically can provide early diagnosis and rapid initiation of treatment.

## Materials and Methods

This study was carried out prospectively from August 2018 till August 2019 in Intensive Care Department. Approval, with the decision numbered 2018 / 45, dated 01.26.2018, Gaziantep University Clinical Research Ethics Committee. Informed consent was obtained from the conscious patients and from the first-degree relatives of the unconscious patients.

*Patients and Control Groups*

A total of 98 patients, 58 males and 40 females, diagnosed with pneumonia and ARDS who were admitted to the intensive care unit due to acute respiratory failure and developed acute respiratory failure diagnosed with pneumonia, chronic obstructive pulmonary disease, pneumonia and asthma while in the intensive care unit, were defined as the patient group of the study. The control group consists of healthy individuals, who are at similar ages, in similar gender and do not have any known disease (59 males and 39 females, 98 individuals in total). Patients with $PaO_2$<60 mmHg or $PaCO_2$> 45 mmHg were considered acute respiratory failure. Both the patient and control groups are older than 18 years of age and consent was obtained from the patient / patient relatives in order to participate in the study. Those with cardiovascular, cerebrovascular and rheumatic diseases, those with acute-chronic kidney damage, those with malignancy and immunosuppression, diabetes mellitus patients, those who use antioxidant, lipid-lowering medication, anti-inflammatory drugs, or vitamin drugs, those who smoke, and pregnant women and those fewer than 18 years of age were excluded.

*Blood samples and laboratory measurements*

From patients who have been treated in the intensive care unit for any reason (excluding the exclusion criteria from the study) and from patients who develop acute respiratory failure ($PaO_2$<60 mmHg or $PaCO_2$> 45 mmHg) while being treated in the service and from healthy volunteers, 6 ml of venous blood was taken to biochemistry tubes with ethylenediaminetetraacetic acid (EDTA). The collected blood was centrifuged for 10 minutes at 1,800 rpm, the serum portion was separated and stored at -80°C until analysis.

*Biochemical Evaluation*

For the thiol-disulfide balance (native thiol (-SH) - disulfide (-S-S-) change) in the patient and control groups, measurements were made using the spectrophotometric method (Rel Assay Diagnostics, Mega Tıp, Turkey), which is the automatic measurement method found by Erel and Neşelioğlu (23). From these measurements, native thiol / total thiol, disulfide / total thiol, and disulfide / native

thiol ratio were calculated. This measurement method is primarily based on the conversion of the disulfide bonds in the samples to functional thiol groups by sodium borohydride (NaBH4), then on the elimination by being consumed with formaldehyde to prevent the reduction of the unused reducing sodium borohydride, 5,5'- dithiobis- (2-nitrobenzoic) acid (DTNB). Thus, disulfide bonds that may be formed in the future are prevented. After reaction with DTNB, all thiol groups were identified, including the reduced and the "disulfide", "native thiol" and "total thiol" groups; sulfide amounts were calculated as native thiol/total thiol, disulfide/total thiol, disulfide/native thiol percentage ratios.

**Statistical Analyses**

For the statistical analysis of the data, SPSS (Statistical Package for Social Sciences) 22.0 version statistical program was used. The Shapiro-Wilk test was used to test whether the numerical variables were consistent with the normal distribution. The student's t-test was used to compare normally distributed variables in two groups, and the Mann-Whitney U test was used to compare not normally distributed variables in two groups. $p<0.05$ was considered significant.

**Results**

In this study, thiol and disulfide levels and thiol / disulfide ratios, which are a marker of total oxidant status, of intensive care patients with acute respiratory failure were compared with healthy volunteers. The method used in the study is new, applicable and valuable in terms of providing speed and convenience in patient management. In the study, 98 patients (58 males, 40 females), and 98 healthy volunteers (59 males and 39 females) were included. The mean ages of the patient and control groups were 63.15 ± 16.36 and 61.92 ± 16.99, respectively (Table 1). The mean white blood cell (WBC) level of the patient group was 15.8 ($10^3$/µ), d-dimer level was 4.6 (ug/mL) and CRP levels were 160.36 ± 16.81 (mean ± standard deviation). There was no significant change in other biochemical parameters.

**Table 1:** Demographic data of acute respiratory failure (patient) and control group.

| | Patient Group (n=98) | Control Group (n=98) | P |
|---|---|---|---|
| **Age** | 63.15±16.36 | 61.92±16.99 | > 0.05 |
| **Gender, n (%)** | | | > 0.05 |
| **Female** | 40 (40.8%) | 39 (39.8%) | |
| **Male** | 58 (59.2%) | 59 (60.2%) | |

There was no statistically significant difference between patient and control groups in terms of age and gender (p> 0.05).

Total thiol (270 ± 99.81), native thiol (203.90 ± 103.41), and disulfide (33.10 ± 12.42) levels in the patient group were found to be significantly lower than total thiol (423.62 ± 70.3), native thiol (307.13 ± 57.73) and disulfide (58.24 ± 27.21) levels in the control group (p = 0.001, Table 2).

There is no significant difference between the patient and control groups in terms of native thiol / total thiol, disulfide / total thiol, and disulfide/native thiol ratio (p>

0.05, Table 2).

Total thiol levels were found to be significantly lower in patients with acute respiratory failure than in healthy volunteers ($p$= 0.001) (Figure 1).

Native thiol levels were found to be significantly lower in patients with acute respiratory failure than in healthy volunteers ($p$= 0.001) (Figure 2).

Disulfide levels were found to be significantly lower in patients with acute respiratory failure than in healthy volunteers ($p$= 0.001) (Figure 3).

**Table 2:** Evaluation of thiol/disulfide parameters of patients with acute respiratory failure and control group.

| | **Patient Group (n=98)** | **Control Group (n=98)** | **P** |
|---|---|---|---|
| **Native thiol (µmol/L)** | 203.90±103.41 | 307.13±57.73 | 0.001 |
| **Total thiol (µmol/L)** | 270±99.81 | 423.62±70.3 | 0.001 |
| **Disulfide (µmol/L)** | 33.10±12.42 | 58.24±27.21 | 0.001 |
| **Disulfide/Native thiol (%)** | 674.20 | 545.05 | > 0.05 |
| **Disulfide/Total thiol (%)** | 11.40 | 13.45 | > 0.05 |
| **Native thiol/Total thiol (%)** | 70.78±18.06 | 72.88±11.28 | > 0.05 |

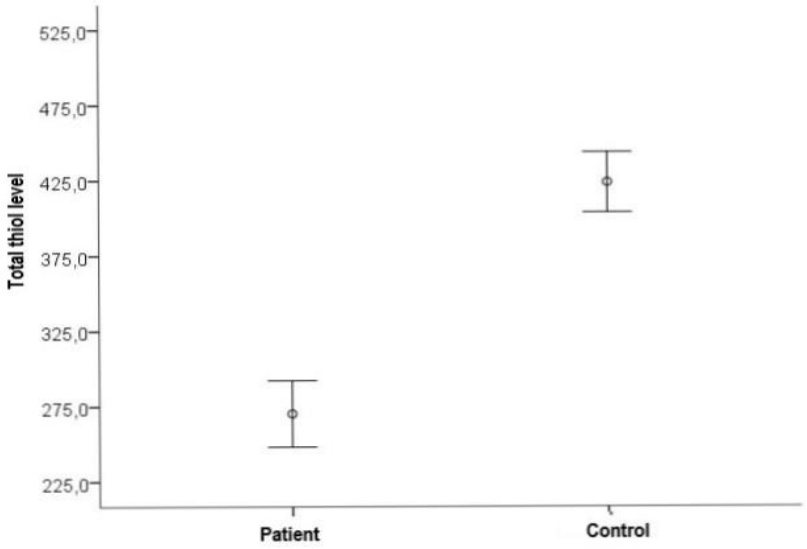


**Figure 1:** Total thiol levels of acute respiratory failure patients and control group.

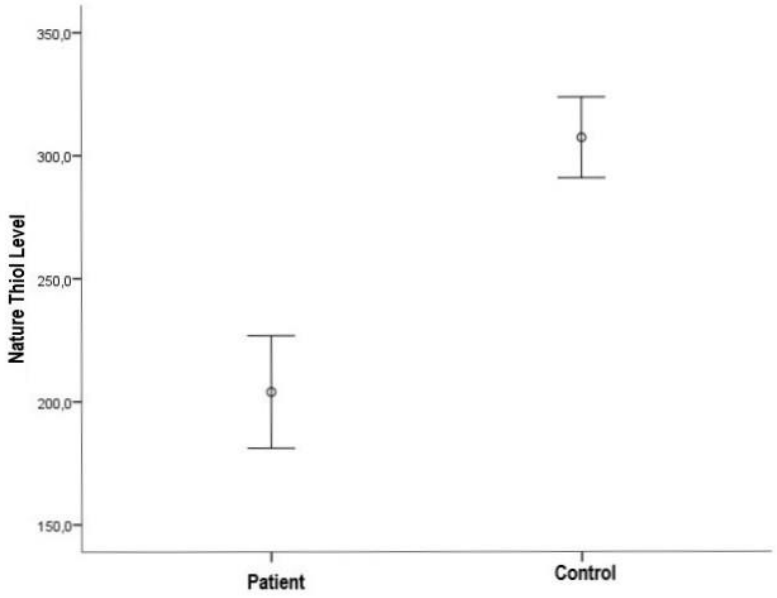


**Figure 2:** Native thiol levels of acute respiratory failure patients and control group.

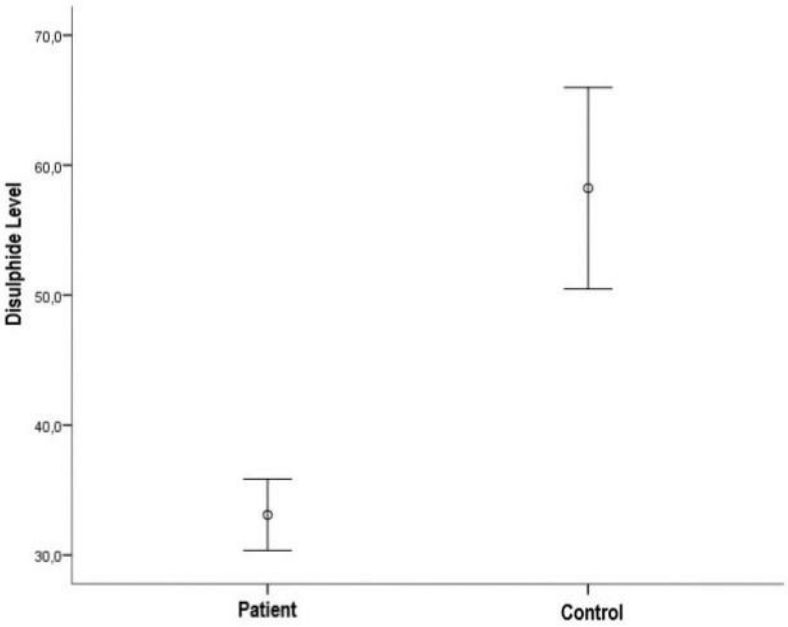


**Figure 3:** Disulfide levels of acute respiratory failure patients and control group.

There is no statistically significant difference between acute respiratory failure patients and healthy volunteers in terms of native thiol / total thiol ratio ($p$> 0.05) (Figure 4).

There is no statistically significant difference between acute respiratory failure patients and healthy volunteers in terms of disulfide / total thiol ratio ($p$> 0.05) (Figure 5).

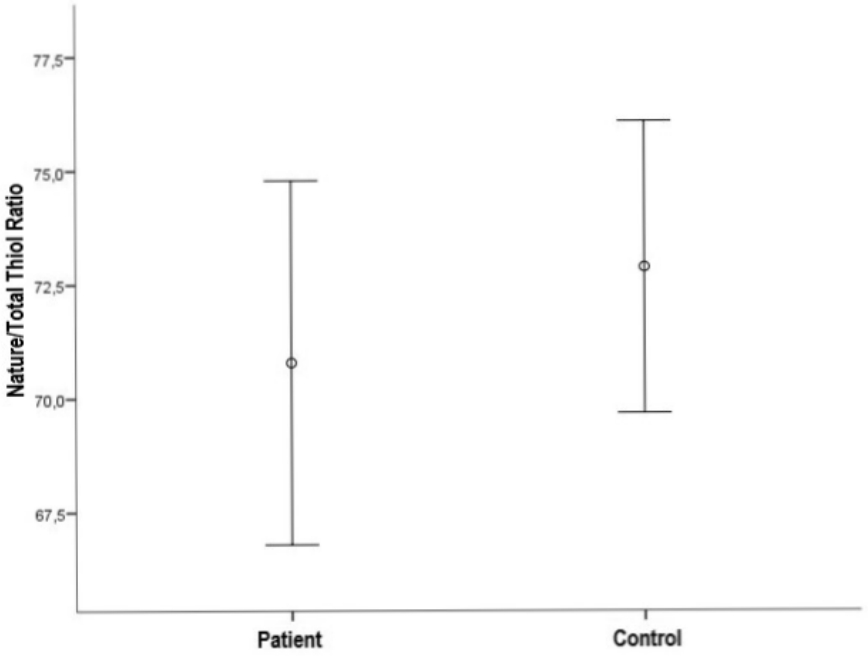


**Figure 4:** Native thiol/total thiol ratio of patients with acute respiratory failure and control group.

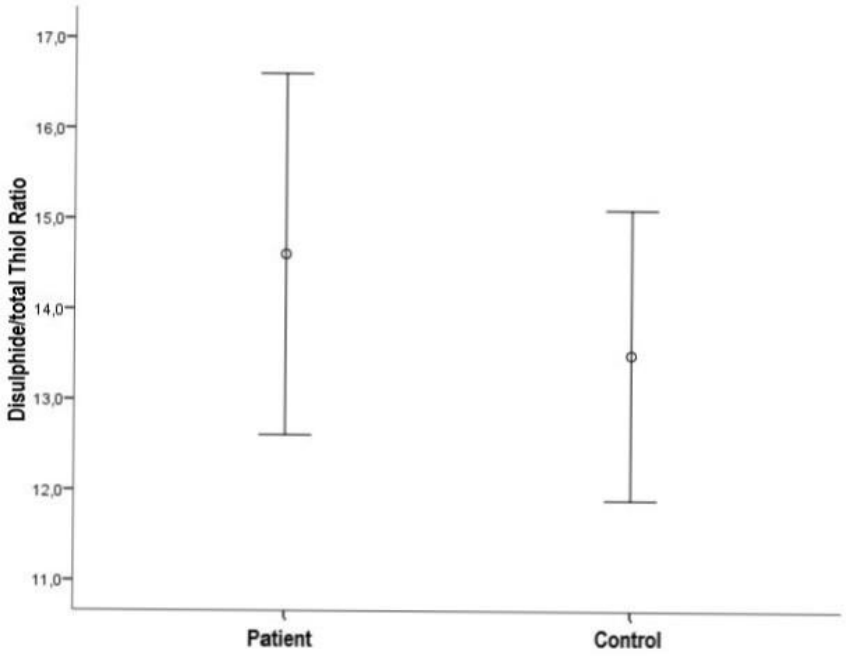


**Figure 5:** Disulfide/total thiol ratio of acute respiratory failure patients and control group.

There is no statistically significant difference between acute respiratory failure patients and healthy volunteers in terms of disulfide/native thiol ratio ($p > 0.05$) (Figure 6).

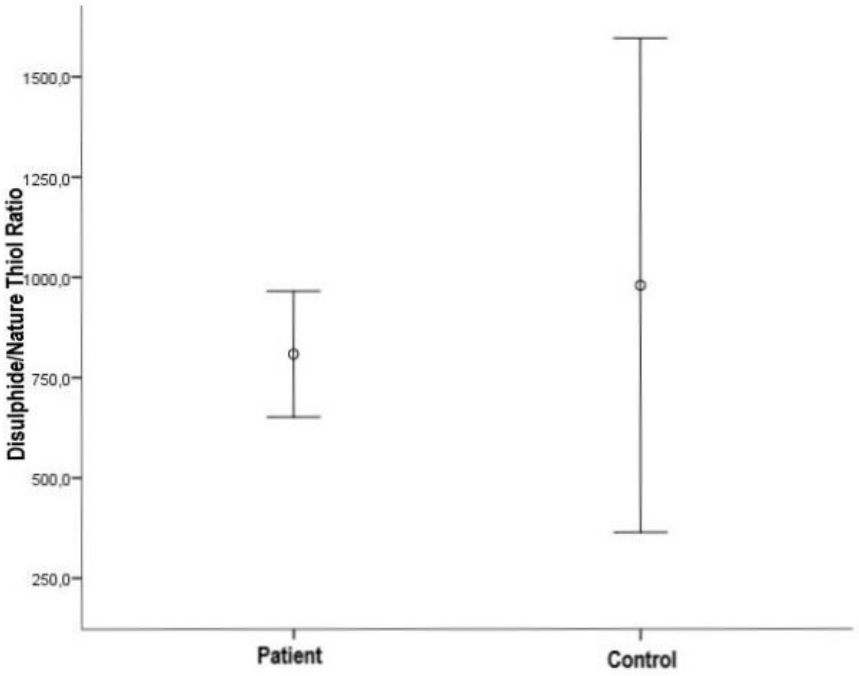


**Figure 6:** Disulfide/native thiol ratio of acute respiratory failure patients and control group.

## Discussion

In this study, thiol and disulfide blood levels and thiol / disulfide ratios, which are indicators of total oxidant status in intensive care patients with respiratory failure, were compared with healthy volunteers with a new, feasible method that will provide speed and convenience in patient management. Total thiol, native thiol, and disulfide levels were found to be statistically significantly lower in the patient group with respiratory failure compared to the control group. There was no significant difference in the ratio of native thiol / total thiol, disulfide / total thiol, and disulfide / native thiol. As far as we know, our study is the first study in the literature in terms of providing the diagnosis and follow-up of dynamic thiol-disulfide balance using an automatic, fast, and inexpensive method and initiating treatment in patients with acute respiratory failure requiring intensive care support treatment.

Oxidative stress is the deterioration of the prooxidant-antioxidant balance in the body and tissues. The formation of ROS known as prooxidants is a natural result of normal aerobic life. The existence and development of cells in oxygen-containing environments is not possible without powerful antioxidant enzymes and non-enzyme antioxidant systems. In aerobic life, constantly occurring prooxidants must be regularly absorbed by antioxidants and balanced by consumption. Otherwise, oxidative damage will occur and pathophysiological events may develop with its accumulation.

Thiols are antioxidant agents that consist of sulfur and carbon atoms and are used for the neutralization of ROS in oxidative stress situations. The disulfide bonds formed by the interaction of thiol groups with oxidant molecules interact with the proteins in the plasma thiol pool and are transformed back into the thiol group and dynamic thiol / disulfide homeostasis is

achieved (24-26). Dynamic thiol / disulfide homeostasis is associated with the pathogenesis of malignancies, cardiovascular, neurodegenerative, and inflammatory diseases (23).

In a healthy lung, the continuation of normal physiological functions is provided by the continuation of the balance between oxidants and antioxidants in the airway and extracellular areas. The lung is a tissue that can easily be damaged by ROS, which has high oxygen content. The increase of ROS stimulates mucus secretion, inactivates antiproteases and controls cell proliferation or apoptosis.

In respiratory tract infections, the entry and activation of phagocytes to the lower respiratory tract provides protection against ROS and lysosomal enzymes and microorganisms. Therefore, systemic ROS concentration may increase in respiratory tract infections (27). High ROS levels were seen to be associated with inflammatory reactions such as transcriptional modification, signal transduction, or gene expression of pro-inflammatory mediators (28). In respiratory tract infections, ROS released from polymorphonuclear leukocytes (PMNL) and macrophages cause tissue damage in the respiratory tract, and lung cells release inflammatory mediators and cytokines / chemokines to their environment in response to oxidative stress (27).

Smoking, acute exacerbations of chronic obstructive pulmonary disease (COPD), pneumonia, and asthma are clinical pictures in which oxidant / antioxidant balance deteriorated and oxidative stress is present (29, 30). Thiol levels, which are an indicator of oxidant / antioxidant imbalance in these diseases, have been shown to change with the severity of the disease and also with the treatment response.

Patients who develop acute respiratory failure and require intensive care are usually diagnosed with sepsis, pneumonia or acute exacerbation of COPD. The patients that included in this study were those who were being treated in the intensive care unit with a diagnosis of pneumonia or who were diagnosed with pneumonia that needed intensive care due to the development of acute respiratory failure.

In two different studies conducted in adult patients hospitalized with the diagnosis of community-acquired pneumonia and in the pediatric patient group, total thiol and native thiol levels have been found to be significantly lower in patients compared to the control group (27, 31). These findings are consistent with the findings we obtained in our study. However, in the study conducted by Parlak et al., they have shown that the disulfide/total thiol ratio was significantly higher in the patient group compared to the control group (27). They have interpreted this highness as the timely participation of some antioxidant mechanisms in the oxidative stress process and the ability to transform disulfide bonds back to thiol groups, thus keeping the thiol/disulfide homeostasis in balance. In our study, disulfide/total thiol ratios were not different in the patient and control groups. This can be interpreted as that antioxidant mechanisms could not participate in the oxidative stress process in time, as our study group consisted of patients with acute respiratory failure. In another study conducted by Temel et al., consistent with our findings, it has been found that native thiol, total thiol, and disulfide levels to be lower in children with community-acquired pneumonia than in the control group (31). However, unlike

this study, they have found the ratio of native thiol / total thiol to be lower, and the disulfide / native thiol and disulfide/total thiol ratio to be higher than the control group. In this study, the researchers have interpreted that a high amount of ROS was released from the increased leukocytes in the patient group and thus a high disulfide level was formed. Similarly, in a study conducted in patients with urinary stones, there has been a significant decrease in native thiol and total thiol levels compared to controls, while disulfide levels have been found to be significantly higher (32). In this approach, if considered, the results can be expected in infectious diseases with leukocytosis. The leukocyte levels of the patients participating in our study were found to be above normal limits. Therefore, the lower levels of total thiol, native thiol and disulfide compared to the controls can be explained by the fact that ROS released from a high number of leukocytes oxidize thiols and decrease their levels.

The results obtained from studies conducted in patients with COPD and asthma with inflammation in the etiopathogenesis as well as causes related to infection are also consistent with our results (28, 30, 33, 34). Babaoğlu et al. have emphasized the importance of oxidant / antioxidant balance in tissues and blood in obstructive pulmonary diseases and investigated the thiol / disulfide balance in patients (28). Thiol / disulfide homeostasis parameters have been found to be similar in all three patient groups (patients with asthma, COPD, and COPD overlap syndrome) who were taken as obstructive pulmonary disease. This result shows that all three diseases have similar pathophysiology but different clinic findings (28). Gündüzöz et al. have shown that firefighters exposed to chronic xenobiotics had abnormal respiratory function tests and chest radiographs, and significantly higher levels of disulfide and disulfide / native thiol. They have emphasized that oxidative stress may play an important role in the pathogenesis of lung injury in these individuals and that early detection of oxidative stress is important (35).

Effective use of intensive care beds is extremely important for the provision of hospital services and patient health. Patients who rank in priority and admitted to the intensive care units are unstable patients requiring intensive treatment and observation. Patients who developed acute respiratory failure constitute the priority patient group for intensive care units. The majority of patients with acute respiratory failure admitted to intensive care units consist of patients with sepsis, pneumonia, and ARDS. These patients, instead of the fact that they can regain their health with early diagnosis and treatment of respiratory distress, they have to fight with nosocomial infections rather than hospitalization reasons, due to the prolongation of stay in intensive care units due to delays in diagnosis and treatment, and the necessity of more invasive methods, and even die due to infection. Therefore, early diagnosis of respiratory failure and early intervention may eliminate the indication of hospitalization in the intensive care unit and shorten the stay in the intensive care unit of the patient who is already inpatient in the intensive care unit.

In this study, it was shown that native thiol, total thiol, and disulfide levels were significantly decreased in intensive care patients with acute respiratory failure. Determining the levels of thiol groups may be important in the prognosis, clinical

management, diagnosis and follow-up of diseases in which ROS are involved in the pathogenesis, increasing the survival of patients and shortening the duration of stay in intensive care. Our results are consistent with previous studies conducted in patients in whom oxidative stress plays a role in the pathogenesis of COPD, asthma and pneumonia.

The degree of respiratory failure and dynamic thiol-disulfide homeostasis could not be evaluated together in patients with acute respiratory failure. Since the patients we included in the study are patients who are being followed up in the intensive care unit and are unstable in terms of pulmonary functions, oxygen saturation and partial oxygen pressure values in the blood may vary until the general condition of the patient is stable. As a large number of blood samples can be taken during the day and this evaluation can be made, it is practically mandatory.

As a result, we predict that the fast, easy and accessible method we use to measure native thiol, total thiol, and disulfide levels in patients with acute respiratory failure may be a suitable biomarker in terms of diagnosing respiratory failure and providing ease of patient follow-up.

## Conflict of Interest

The authors declare that they have no conflict of interest.

## Acknowledgment

No institution has given financial support to the study. All researchers contributed equally to the study.

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Experimental and Applied Medical Science, 2, 2: 176-183, 2021. DOI 10.46871/eams.2021.21

# ABO Blood Groups and Hyperbaric Oxygen Therapy Effectiveness in Sudden Hearing Loss

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**Abstract**

*The efficiency of hyperbaric oxygen (HBO) treatment according to ABO blood group system was evaluated in patients with idiopathic sudden sensorineural hearing loss (ISSNHL). Serum lipid values and novel atherogenic risk calculations of 346 patients who came to the clinic for HBO treatment were performed. HBO treatment efficiency was evaluated on ABO blood groups. The effect of serum lipid levels and atherogenic risk levels on HBO treatment was measured according to the blood groups of ISSNHL patients. The most important finding is that ISSNHL patients with O blood group antigen benefit the least from HBO therapy. Moreover, patients with O blood group antigen had statistically lower serum lipid values and atrogenic risk index than patients with non-O blood group. In addition, the frequency of O blood group in ISSNHL patients was higher than in non-O blood groups. The effect of serum lipid values and atherogenic risk indices in ISSNHL patients receiving HBO therapy may vary according to ABO blood groups. The relationship between hyperbaric oxygen therapy and the ABO blood grouping system should be supported by further research.*

***Key words:*** *Hyperbaric oxygen therapy, Atherogenic index, Atherogenic plasma index, Lipoprotein combine index, Blood groups, Non–O blood group.*

## Introduction:

Human ABO blood type is determined by a gene on chromosome 9.Moreover, ABO blood group is the first genetic polymorphism recognized in humans (1). The ABO histocompatibility-expression of blood group antigens on the surface of erythrocytes and it is also expressed on the surface of platelets, endothelial and epithelial cells. Therefore, there is a large literature on the relationships between ABO blood group and different pathologies (1-3).

ISSNHL, in which HBO therapy is used in the treatment, is a common otological emergency with still uncertain cause

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(4).The ABO blood group, which has a role in the pathophysiology of a wide range of diseases in the literature, may also include ISSNHL (5).Because there are studies showing that there is a relationship between ABO blood groups and hearing loss. For example, according to studies, individuals with O blood group have the lowest amplitude in both ears (6-8). People with blood type O show a higher prevalence of hearing loss after exposure to industrial noise. However, it is not clear whether the blood group status affects the auditory brainstem responses reflecting cochlear hair cell and auditory nerve bioelectric activity (6-8).In addition, among the various factors reported to affect the susceptibility to hearing loss, race, geographical region, eating habits, dyslipidemia, cholesterol, etc. factors can be included (9). Therefore, the importance of blood lipids in the pathogenesis of ISSNHL has been widely reported in the literature (9-11). In fact, high levels of low-density lipoprotein cholesterol (LDL), total cholesterol (TC), and apolipoprotein B (Apo-B) have been suggested as risk factors for ISSNHL pathology (7-10). Consequently, the importance of blood lipids in the pathogenesis of ISSNHL has been widely discussed in the literature (9). But, the role of atherogenic risk factors in the pathogenesis of ISSNHL is still controversial (5, 9).

A clinical study showed that TC, LDL-C, and Apo-B levels were significantly higher in patients with ISSNHL compared to control subjects (11). Also it has been reported that ISSNHL is associated with many vascular and coagulation diseases (3-5)

Dyslipidemia is one of the most important cardiovascular risk factors, which is also defined as a cardiovascular risk factor in European societies and evidence has shown that there is a relationship between ISSNHL and dyslipidemia (6, 7). These findings led to the hypothesis that non-O blood group antigens may have higher levels of dyslipidemia and an inflammatory condition and oxidative stress may occur (3-5). Inflammation and oxidative stress may play a critical role in ISSNHL disease (11, 12). Because impaired cochlear perfusion appears to be an important etiopathogenetic event in ISSNHL. The cochlea is an end organ that is metabolically dependent on a supply of nutrients and oxygen to maintain its normal physiological function. It is very sensitive to changes in blood circulation. Early histopathological studies showed that sclerotic changes in the blood vessels of older ears contribute to inner ear degeneration and other cochlear changes (11-13). Therefore, the effect of the ABO blood system on atherosclerosis susceptibility is thought to be mediated in part by its changed on blood lipid levels. Today, it is well known that atherogenic risk calculation plays an important role in clinical practice. However, despite their obvious clinical significance, the computational risk of atherogenicity of ABO blood group antigens is poorly known (1, 9). However possible relationship of blood lipids levels to blood groups may be one of the causes of ISSNHL.

However, there is no study in the literature showing the distribution of atherogenic indices in ISSNHL according to blood groups. In addition, the contribution of ABO blood group distribution to the response efficiency of HBO therapy in ISSNHL patients is unknown. The aim of this preliminary study is to evaluate the possible effect of the distribution of new

atherogenic risk indices by blood groups in ISSNHL patients on HBO therapy.

## Materials and Methods

*Subjects*

Patients known according to ABO blood type laboratory records and ISSNHL patients who came to hyperbaric clinic for treatment were included in the study. Those selected for inclusion in this study are adults over the age of 18 who have been informed about the study and have voluntary consent. The age range of the working group formed is 18-58. A total of 346 patients affected by ISSNHL were included in the study. Exclusion criteria for patients with ISSNHL were: acute inflammation, infection, autoimmune disorders, cochlear-vestibular dysfunction, otologic surgery, neurological disorders, ototoxic drug use, neoplasm, or other chronic diseases. In addition, those who used drugs due to lipid metabolism disorder and those with features suggestive of diabetes and metabolic syndrome were also exclusion criteria. Body mass index, waist circumference, systolic blood pressure, and diastolic blood pressure measurements were performed by physicians in all patients at rest in the hyperbaric clinic. In addition, data on clinical and demographic characteristics such as age, chronic disease history, and smoking status were collected from medical records. Post-treatment improvement of hearing results were analyzed according to ISSNHL criteria. All subjects included gave their informed consent to participate in the study. The study was approved by the ethics committee of the relevant institute.

*HBO therapy*

HBO treatment was applied as follows in patients with ISSNHL. Each consecutive HBO treatment session was administered five days a week, each session was 120 minutes. Clinical follow-up of all patients in the hyperbaric clinic was performed and a multi-atmospheric hyperbaric chamber (Baroks, MUL35) was used. During HBO therapy, each patient breathes 100% oxygen at 2.5 at high atmospheric pressure. Also, all sessions of HBO had five-minute air break times every 30 minutes. In each HBO treatment session, patients were also given 15 minutes of compression and 10 minutes of opening time.

*Samples*

Venous blood samples were collected from patients and control subjects after at least 12 h of fasting for the evaluation of serum lipids. The samples were collected into no-additive vacutainer tubes. Blood samples were centrifuged, and serum was transferred to laboratory until further analysis**.**

*Lipid parameters*

Auto-analyzer Beckman AU5800® (Beckman Coulter Diagnostics, CA, USA) for the measurement of, TC, low density lipoprotein cholesterol (LDL-C), high density lipoprotein cholesterol (HDL-C) and triglyceride (TG) were used in the study and commercial diagnostic reagent kits of the same brand were used. Estimation of serum very low density lipoprotein (VLDL) and non-HDL-C concentrations were calculated using the formula as follows: [VLDL cholesterol] (mmol/L) = [Triglyceride]/2.2 and non-HDL-C = (TC) – (HDL).TC, LDL-C, and TG were measured by enzymatic methods and HDL-C by a direct method. TC, TG, HDL-C and LDL-C concentrations were double measured in all subjects.

*Non-traditional atherogenic indices*

Especially in this study, the atherogenic index (AI), atherogenic plasma index

(AIP), lipoprotein combine index (LPCI) were calculated from the values of routine lipid parameters (mmol/L). In fact, AI is defined as the ratio of non-HDL-C to HDL-C (non-HDL-C / HDL-C); LCI is defined as the ratio of TC x TG x LDL to HDL-C.

AIP was calculated as a logarithm of the ratio of the molar concentration (mmol/l) of TG to HDL-C (i.e., log [TG/HDL-C]) [29].

Simply atherogenic indices were calculated using the following formulas: AI; non-HDL-C / HDL-C, LCI; TC x TG x LDL / HDL-C. Unlike these new index calculations, logarithm values of base 10 were used in the calculation of AIP.AIP; log10 (TG / HDL-C). It was calculated according to the ratio of logarithmic TG concentration in the AIP to logarithmic HDL-C. AIP is an index that has been classified for atherosclerosis in the literature: Low risk of AIP<0.1, 0.1 to 0.24 for medium risk and more than 0.24 for high risk.

## Statistical Analyses

All continuous variables are presented as the median and interquartile range (25th and 75th percentiles) and compared using the Mann-Whitney test. Categorical data are shown as percentages and compared using the Chi square test. The statistical analysis was performed using MedCalc® software. A value of $p<0.05$ was considered statistically significant.

## Results

The mean age of ISSNHL patients and the number of female patients (n: 204) of 346 patients included in this study are given in table 1. Other demographic and clinical data of the patients are given in Table 1. In addition, the distributions of blood group antigens of all ISSNHL patients are given in Table 1.While the majority of patients had O (n: 154) blood type, ISSNHL patients with AB blood group had a statistically higher smoking percentage than other blood group patients. In addition, serum uric acid (UA) level was statistically higher in patients with blood type A, but UA and fasting blood glucose (FBG) levels were within normal limits in all blood groups (Table 1).

**Table 1:** Characteristics of the ISSNHL patients.

| Baseline characteristics | A (n:133) | B (n:32) | AB (n:27) | 0 (n:154) |
|---|---|---|---|---|
| | Mean ± SD | | | |
| **Age(years)** | 44.9 ± 11 | 43.9 ± 8.4 | 47.03 ± 8 | 44.05 ± 10 |
| **BMI((kg/ m$^2$)** | 26.3 ± 3 | 25.8 ± 2.9 | 26.8 ± 2.61 | 25.4 ± 2.77 |
| **Smoking(%)** | 45 | 38 | 47* | 21 |
| **HT(%)** | 7.2 | 7.8 | 8.2 | 7.9 |
| **FBG(mg/dl)** | 101 ± 11 | 98 ± 9 | 103 ± 12 | 100 ± 13 |
| **UA(mg/dl)** | 5.8 ± 1.3* | 5.5 ± 1.4 | 5.5 ± 1.46 | 5.36 ± 1.24 |

*p<0.05 BMI=Body mass index, HT=hypertension, FBG=Fasting blood glucose, UA=Uric acid, SD=Standard deviation.

The serum lipid values of the patients included in the study and the atherogenic risk indexes calculated from these lipid values are given in table 2. Also lipid values of ISSNHL patients are given in table 2.

The important finding is that the AIP and LPCI are statistically significantly lower in individuals with O blood group than other blood groups. Also, TG and TG / HDL-C ratio are lower in patients with O blood group. However, in patients with AB blood

group, TC and AI risk index were significantly higher than other blood groups (Table 2).

In addition, the response of ISSNHL patients to HBO therapy differed significantly compared to blood group antigens. Perhaps an important finding that draws attention is that patients with O blood group antigen had the lowest response to HBO therapy despite low atherogenic risk values. Unfortunately, only 16% of patients with blood type O antigen showed complete recovery with HBO therapy.

**Table 2:** Lipid parameters of ISSHL Patients.

| Overall lipid variables(n:345) | ABO Blood Groups | | | |
|---|---|---|---|---|
| | A (n:133) | B (n:32) | AB (n:27) | O (n:153) |
| **Traditional Lipid Parameters** | | | | |
| **TC(mmol/L)** | 5.6 | 5.1 | 5.8* | 5.18 |
| **TG(mmol/L)** | 1.76 | 2.27 | 1.79 | 1.44** |
| **LDL-C(mmol/L)** | 3.54 | 3.23 | 3.62 | 3.28 |
| **HDL-C(mmol/L)** | 1.47 | 1.57 | 1.24* | 1.45 |
| **VLDL(mmol/L)** | 0.35 | 0.59 | 0.36 | 0.11*** |
| **Novel Lipid Indices** | | | | |
| **API** | 0.18 | 0.17 | 0.20 | 0.15** |
| **AI** | 2.87 | 2.24 | 3.5* | 2.9 |
| **LPCI** | 24.1 | 23.8 | 24.8 | 20.4** |
| **TG/HDL-C** | 1.19 | 1.44 | 1.41 | 0.99** |

AB versus A, B and O (*p<0.05) O versus A,B and AB ( **p<0.01) , O versus A,B and AB ***p<0.001. TC; total cholesterol, AI; atherogenic index, API; atherogenic plasma index, LPCI; lipoprotein combine index.

On the contrary, the rate of those who did not respond to HBO treatment was 30%. Fortunately, 54% of patients improved after HBO therapy (Table 3).

However, the number of patients recovered the most was in ISSNHL patients with B blood group antigen (31%), followed by AB (27%) and A (18.3) blood groups, respectively. Also, AB blood group had the lowest rate of response to failed treatment with HBO therapy in ISSNHL patients (Table 3).

**Table 3:** Patients recovering with HBO.

| ABO Blood Groups | 0- | 0+ | A- | A+ | AB- | AB+ | B- | B+ | n |
|---|---|---|---|---|---|---|---|---|---|
| **As it is** | 2 | 48(30%) | 4 | 24(20%) | | 5(22%) | | 1(0.03%) | 84 |
| **Improvement** | 4 | 76(54%) | 9 | 74(69.7%) | 4 | 12(72%) | 3 | 19(75.8%) | 201 |
| **Healing** | | 24(16%) | 1 | 21(18.3%) | 1 | 5(27%) | | 9(31%) | 61 |
| **n:** | 6 | 148 | 14 | 119 | 5 | 22 | 3 | 29 | 346 |

## Discussion

Previous studies have reported several atherogenic risk factors for ISSNHL. Among these risk factors, the rates of diabetes mellitus and hypercholesteremia are higher in patients with ISSNHL compared to the control group (14, 15). In addition, studies have also shown that patients with ISSNHL have a higher risk of stroke (14, 15).Indeed according to the results of this study, atherogenic risk factors and blood group data may be cost effective in determining the efficacy of HBO therapy.

In this preliminary study, we first showed the lower efficacy of ISSNHL patients

with blood group antigen O in the treatment HBO. Also this study has showed that more patients of ISSNHL who applied for HBO treatment had O blood group antigen.

We also show that the distribution of atherogenic risk indexes is not associated with the risk of ISSNHL. Because the ISSNHL patients included in this study did not have a high atherogenic risk index.

Relationships between hearing and blood lipid levels have long been the focus of scientific research. Patients with ISSNHL often have hyperlipidemia. The cochlea is an end organ that is metabolically dependent on a supply of nutrients and oxygen to maintain its normal physiological function. It is very sensitive to changes in blood circulation. Cochlear ischemia is considered one of the most important causes of ISSNHL. Hyperlipidemia may contribute to cochlear ischemia due to increased blood viscosity. Increased blood viscosity can reduce inner ear blood flow and cause inner ear damage [17]. Moreover, lipid metabolic disorders can lead to lipid accumulation in cochlear hair cells and damage to cochlear nerve cells, followed by inhibition of neural transduction (17, 18). Moreover, hearing loss due to hyperlipidemia tends to improve with diet control and anti-lipidemic therapy (19).

However, the findings obtained in this study showed that the O blood group ISSNHL patients with normal TC and TG values gave the lowest response to HBO treatment. On the contrary, patients with AB and A blood groups gave a higher response to HBO treatment compared to O blood group, although they had TC and TG levels above normal values. In addition individuals with B blood group gave the best response to HBO treatment despite high borderline TG levels. Yet there is no study showing the relationship of blood group antigens with HBO treatment in ISSNHL patients. The findings of this preliminary study need to be supported by further studies. The finding that might be suggested from this study is that ISSNHL patients with O blood group antigen are less likely to be injured than HBO therapy. The negative might be effects of O blood antigens on microcirculation may lies in its affecting the rheological properties of blood, the composition of membrane lipids, protein-lipid interactions in membrane structures and the activities of membrane-bound enzymes. Recently, researchers reported that individuals with blood group O are relatively more susceptible to noise-induced hearing loss (20). To confirm ABO blood group hypothesis, measuring ultrahigh-frequency auditory sensitivity in individuals with different blood groups would be beneficial Also the reduction in amplitude of ultrahigh-frequency in blood group O indicates a possible reduction in outer hair cell function. However, HBO therapy is generally very effective on recovery from ISSNHL patients. In patients with ISSNHL blood group O, the lipid profile indicates a statistically lower atherogenicity. As a result, the novel atherogenic indexes AIP and AI index are lower in patients with blood group O than non-O blood groups. To date, atherogenic indices by blood grouping have not been studied in ISSNHL patients. The results of the present study are in consensus with reports by previous studies who also reported reduced HBO treatment response in individuals with blood group O (20, 21).

**Conclusion**

This study attempted to determine effects

of blood group type on ISSNHL using atherogenic indices and lipid measurements during HBO therapy. The results of the study showed a significant reduction in good response to HBO therapy in individuals with blood type O compared to individuals with other blood groups. However, there was no significant difference in response to HBO treatment between non-O blood groups. Therefore, it can be considered that ISSNHL patients with blood group O antigen may be genetically susceptible to ISSNHL and their lipid levels are not effective. Further studies on larger individual groups are required to generalize the results.

## Conflict of Interest

The authors declare that they have no conflict of interest.

## Acknowledgment

No institution has given financial support to the study. All researchers contributed equally to the study.

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Experimental and Applied Medical Science 2, 2: 184 - 188, 2021. DOI 10.46871/eams.2021.22

**Review Article**

# Preparation for Colonoscopy and Patient Requirements

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**Abstract**

*Colonoscopy is an important procedure in the diagnosis and treatment of colorectal diseases. The success of this procedure is directly related to the sufficient bowel preparation before colonoscopy. Insufficient preparation for colonoscopy may cause repetition of the procedure and loss of labor, time and cost for the patient and healthcare personnel. In this review based on the literature, preparation for colonoscopy and patient requirements are included.*

***Key words:*** *Colonoscopy, Preparation, Patient Requirements.*

## 1. Introduction

Colonoscopy is the most valid test method in terms of sensitivity and specificity in the diagnosis of lower gastrointestinal pathologies (1). With colonoscopy, precancerous polyps in the large intestine are removed, and the cellular structure of the removed polyps are examined by histopathological methods. The success of this screening method, which has an important place in diagnosis and treatment, is higher than other screening methods (2).

In preparation for the colonoscopy procedure, it is mostly recommended to follow a liquid-based diet, to use laxatives 3 days before the procedure, and to empty the intestines by drinking all of the large-volume mixtures containing Polyethylene Glycol (PEG) the day before the procedure (3, 4). The most commonly used drugs for bowel cleansing are PEGs, sodium phosphate, and sennosides. PEG is an isotonic oral solution, is not digested and absorbed. The most important disadvantages of PEG solutions, which are used safely in many patient groups in bowel cleansing, are that they are taken in a high volume and that they taste bad (5). Sodium phosphate-containing solutions are laxative drugs, which can be well tolerated by patients due to their low volumes, but should be used carefully against the risk of kidney failure due to their hyperosmolar nature (6, 7).

Bowels should be prepared well to perform good imaging with colonoscopy and to detect and remove existing polyps. In an ideal bowel preparation, colonic mucosa should be clearly visible in colonoscopy and there should be no solid or liquid residue (8-12).

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## 2. Preparation for colonoscopy

### *2.1. Diet*

A clear liquid diet before a colonoscopy is shown as strong evidence-level practice according to American Society for Gastrointestinal Endoscopy (ASGE) and European Society for Gastrointestinal Endoscopy (ESGE) guidelines (6). According to this diet, patients only consume clear liquids the day before the colonoscopy. They are asked to avoid granular and red-colored liquids, as their color will be similar to blood during colonoscopy. This diet contains no solid food, and it is recommended to consume energy-rich liquid and pulp-free liquids containing salt and mineral that aim to replace the deficiencies that may occur due to a one-day diet restriction. Purified water, coffee or light tea, flour-free soups and lemonade can be recommended as clear liquids. It is recommended to drink plenty of liquids and drink at least 2 liters of water before the procedure (13). Continuation of sufficient hydration during the bowel preparation process ensures that electrolyte imbalance and dehydration can be prevented (14). However, diet continues to be an important aspect of bowel preparation, especially if the preparation is made with more tolerable low-volume preparations such as oral sodium sulfate and sodium picosulphate or magnesium citrate (15).

### *2.2. Medications*

Many medications with a little water are allowed until the day of the colonoscopy, and even before the colonoscopy. Since oral intake will decrease before the procedure, the dosage of some drugs such as diabetes medications may need to be adjusted. Oral iron intake should be stopped at least one week before the colonoscopy because the residue is black, viscous, and difficult to clean. (16).

Bowel cleansing medications should be safe, easy to use, cheap, tolerable, should not cause patient discomfort and deterioration of the fluid-electrolyte balance. However, none of the current preparation medications have all of these features (13, 17).

*2.2.1. Polyethylene Glycol/Macrogol Solutions*

This solution, which has an isoosmotic composition, keeps the electrolytes in balance by minimizing the fluid exchange in the intestinal membrane. Polyethylene glycol has a high molecular weight and a polymer structure that is not absorbed in the intestinal mucosa. It manifests its effect in colon cleansing by diluting the stool. The advantages of PEG solutions are that they do not damage the colon mucosa and cause electrolyte imbalance. PEG solutions are prepared with 4 liters of water (18). To increase patient compliance, it is recommended that the solution be drunk in divided doses: half in the evening, and the other half in the morning of the colonoscopy (6).

*2.2.2. Hyperosmotic Solutions*

These solutions, which contain magnesium or phosphate, cleanse the intestines with osmotic force and cause intestinal distension by providing water passage to the intestinal system and creating an excretory effect. Its advantages are that it can be highly tolerated by the patient and that it is less in volume. The disadvantage is that it draws water into the intestine, causing electrolyte imbalance (18, 19).

*2.2.3. Magnesium Citrate*

In the preparation with magnesium citrate, a five-day low-residue diet, and a clear liquid diet, on the last day, are applied. (19).

*2.2.4. Stimulant Laxatives*

These are easy-to-use, low-cost herbal medicines with few side effects for bowel cleansing (7). These drugs, which perform bowel cleansing by increasing peristalsis and causing fluid secretion in the intestinal lumen (6).

**3. Patient requirements in preparation for a colonoscopy procedure**

The desired bowel cleansing is defined by ASGE as the rapid clearance of all macroscopic and microscopic fecal loads in the colon without disturbing the comfort and fluid-electrolyte balance of the patient (18). While evaluating the requirements of the patient preparing for a colonoscopy procedure, independent factors affecting bowel cleansing should be examined; and it is recommended to prepare individual preparation instructions with intensive training for patients with insufficient preparation determinants instead of the standard bowel preparation training (13, 20, 21).

Studies show that patients experience discomfort such as changes in eating and drinking habits during the diet restriction due to preparation for colonoscopy, and changes in taste, bloating, nausea, vomiting during the use of the preparation drug, pain, and diaper rash in the anus region due to frequent defecation on the day before the procedure, and insomnia during the night before the procedure (22, 23). It has also been shown that endoscopic interventions often cause anxiety and concerns in patients, and the reasons for these feelings may be due to lack of information about the operation, fears that they will feel discomfort or pain during the preparation and the procedure (23). Providing individual training for patients for colonoscopy preparation and keeping their compliance with the preparation instructions at the highest level are necessary approaches for a successful colonoscopy (6). It has been reported that the pre-colonoscopy patient education program given by healthcare professionals increases compliance with the procedure, provides sufficient bowel preparation, so the colonoscopy procedure will not be repeated, and therefore reduce costs (3). It has also been shown that with the increase in the level of knowledge of the patients, their anxiety and concerns towards the procedure decrease, and the psychosocial support given to the patient increases the satisfaction and motivation levels (24-26). It is recommended that patient education, which can increase patient compliance for bowel preparation, should include verbal and written instructions, be given in plain language and an easy-to-apply manner (3). Patients should be educated about all components of bowel preparation, and the importance of compliance with the preparation process on colonoscopy procedure results should be emphasized (3). The educational tools used should be applicable to all patients regardless of their education level and health literacy (13). Patients should be supported and the process should be managed to this end, patients should be reminded of their appointments by phone, it should be confirmed that the use of diet and preparation drugs is understood, and the importance of the use of the entire drug should be emphasized (8).

**4. Conclusion**

The success of the colonoscopy procedure is directly related to the sufficient bowel preparation being made a priority. Planning the patient for bowel preparation according to the patient's needs before colonoscopy, it in simple and

understandable language, and in an easy-to-apply manner, will increase the success of the procedure.

## 5. Conflict of interests

The author declares no conflict of interests.

## 6. Acknowledgement

No institution has given financial support to the study. All researchers contributed equally to the study.

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