GAZİANTEP İSLAM BİLİM VE TEKNOLOJİ ÜNİVERSİTESİ · GİBTÜ ·

GISTU

JOURNAL OF HEALTH AND BIOLOGICAL SCIENCES

GJOHBS

GİBTÜ

SAĞLIK VE BİYOLOJİK BİLİMLER DERGİSİ

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GAZİANTEP ISLAM SCIENCE AND TECHNOLOGY UNIVERSITY HEALTH SERVICES VOCATIONAL SCHOOL

GISTU JOURNAL OF HEALTH AND BIOLOGICAL SCIENCES

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Aim

GISTU Journal of Health and Biological Sciences aims to be a publication that supports scientific developments and contributes to the field by providing innovative and comprehensive academic content in the field of health and biological sciences.

Scope

GISTU Journal of Health and Biological Sciences is an open access, international double-blind peer-reviewed scientific journal published 3 times a year in English under the auspices of Gaziantep Islam Science and Technology University Health Services Vocational School.

The scope of the journal includes clinical and experimental original articles, reviews, case reports, letters to the editor in the fields of Molecular Biology, Genetics, Biotechnology, Biological Sciences, Physiotherapy and Rehabilitation, Nutrition and Dietetics, Midwifery and Nursing, Veterinary, Dentistry, Pharmacy, Medical Sciences.

No fee is charged to the authors during evaluation or publication. The journal is published every 4 months (January, May, November) as 3 issues per year. The written language of the journal is English. Abstract part of the manuscript only should also be submitted in Turkish.

Amaç

GİBTÜ Sağlık ve Biyolojik Bilimler Dergisi, sağlık ve biyoloji bilimleri alanında yenilikçi ve kapsamlı akademik içerikler sunarak, bilimsel gelişmeleri destekleyen ve alana katkı sağlayan bir yayın olmayı hedeflemektedir.

Kapsam

GİBTÜ Sağlık ve Biyolojik Bilimler Dergisi, Gaziantep İslam Bilim ve Teknoloji Üniversitesi Sağlık Hizmetleri Meslek Yüksek Okulu himayesinde yılda 3 kez İngilizce olarak yayınlanan açık erişimli, uluslararası çift kör hakemli bir bilimsel dergidir.

Derginin kapsamı, Moleküler Biyoloji, Genetik, Biyoteknoloji, Biyolojik Bilimler, Fizyoterapi ve Rehabilitasyon, Beslenme ve Diyetetik, Ebelik ve Hemşirelik, Veterinerlik, Diş Hekimliği, Eczacılık, Tıp Bilimleri alanları olmak üzere sağlık bilimleri alanlarında klinik ve deneysel özgün makale, derleme, olgu sunumu, editöre mektup türünde yazılara yer verilir.

Değerlendirme veya yayın sırasında yazarlardan herhangi bir ücret talep edilmez.

Dergi 4 ayda bir (Ocak, Mayıs, Kasım) yılda 3 sayı olarak yayımlanır. Derginin yazı dili İngilizcedir. Makalenin sadece özet kısmı Türkçe olarak da gönderilmelidir.

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GISTU Journal of Health and Biological Sciences strictly adheres to the principles set forth by "Helsinki Declaration" whose web address is below. https://www.gibtu.edu.tr/Medya/Birim/Dosya/20210525133548_b192cec0.pdf

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.

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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

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All researchers must have made a direct academic or scientific contribution to the paper. All researchers should have contributed to the article directly either academically or scientifically. Authors should have contributed either one or a few of planning, performing, writing or reviewing of manuscript. All authors should approve the final version.

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. Bütün çalışmalar ve editör kurulu ile yazışmalar sabib@gibtu.edu.tr adresi üzerinden yayın ofisine gönderilmelidir.

Derginin tüm masrafları Gaziantep İslam Bilim ve Teknoloji Üniversitesi Sağlık Hizmetleri Meslek Yüksekokulu tarafından karşılanmaktadır. Reklam vermeyi düşünen 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.

It is the authors' responsibility to prepare a manuscript that meets scientific criterias.
Statements or opinions expressed in the manuscripts published in the journal reflect the views of the author(s) and not the opinions of Gaziantep Islam Science and Technology University Health Services Vocational School, editors, editorial board, and/or publisher; the editors, editorial board, and publisher disclaim any responsibility or liability for such materials.
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.

According to the Law on Intellectual and Artistic Works, the internet address of which is given below, first published in the Official Gazette with the Law No. 5846 dated 13/12/1951 and published in the Official Gazette with the Law No. 5846 dated 13/12/1951, then amended or new sections were added; all kinds of publication rights of the articles accepted for publication belong to the institution publishing the journal. However, the thoughts and suggestions in the articles are entirely the responsibility of the authors.https://www.gibtu.edu.tr/Medya/Birim/Dosya/20210818145630_406d24df.pdf

Dergide yayınlanan yazılarda ifade edilenler veya görüşler, Gaziantep İslam Bilim ve Teknoloji Üniversitesi Sağlık Hizmetleri Meslek Yüksekokulu, 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.
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İnternet adresi aşağıda belirtilmiş olan, ilk olarak 13/12/1951 tarih ve 5846 sayılı Kanun ile Resmi Gazete'de yayımlanan, sonra 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

Author Guidelines

A study can be submitted to our journal only if it has not been previously published or is not currently under consideration for publication in another academic journal. The decision to publish any work submitted to GISTU Journal of Health and Biological Sciences will be based on the Editorial Board's opinion on the importance and originality of the work.

Manuscripts should be prepared in **A4 size** using **Office Word** or a compatible text processing programme. Line and paragraph spacing should be **1.0, font style should be 'Times New Roman' and font size should be 11.**

Articles should be written in **English** and abstracts should be prepared **in both Turkish and English.** The text should be **justified** and 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) Full address of each author and the institutions they work with

d) Abstract

e) Keywords

f) Author and contact details in contact

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

1. Introduction
2. Material and Methods
3. Results
4. Discussion
5. Conclusion
6. Declarations
7. Acknowledgement
8. References

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. GİBTÜ Sağlık ve Biyolojik Bilimler Dergisi'ne gönderilen her türlü çalışmanın yayınlanmasına ilişkin karar, Yayın Kurulu'nun çalışmanın önemi ve özgünlüğü konusundaki görüşüne dayanacaktır.

Çalışmalar, **Office Word** veya uyumlu bir metin işleme programı kullanılarak **A4 boyutunda** hazırlanmalıdır. **Satır ve paragraf aralığı 1,0**, **yazı stili "Times New Roman" ve punto büyüklüğü 11** olacak şekilde elektronik ortamda yazılmalıdır. Makaleler **İngilizce** yazılmalı, özetler ise **hem Türkçe hem de İngilizce** olarak hazırlanmalıdır. Metin **iki yana yaslanmış** olmalı ve **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 kurumlar

d) Özet

e) Anahtar Kelimeler

f) İletişimdeki yazar ve iletişim bilgileri

Tam uzunluktaki kağıdın ana gövdesi şu bölümlere ayrılmalıdır:

1. Giriş
2. Materyal ve Metot
3. Bulgular
4. Tartışma
5. Sonuç
6. Beyanlar
7. Teşekkür
8. Kaynaklar

In general, there is no specific word count/text length stipulated for any work. The general principle is that an article can be as long as necessary to convey the scientific message clearly and effectively, but should be as short as possible to achieve a complete presentation of information without unnecessary repetition or redundancy.

Introduction

The introduction should emphasise the importance of the study by placing it in a broader context. The purpose and value of the study should be clearly stated, the current status of the research area should be carefully reviewed and important studies should be referred to. A balanced framework should be presented, addressing different perspectives and controversial points where necessary. Finally, the main objective of the research should be summarised and the most important findings should be briefly stated. Care should be taken to ensure that this section is understandable not only for specialists in the field but also for scholars from different disciplines.

Materials and Method

In the Materials and Method section, explain your plan, your patients, your experimental animals, your materials and controls, the study methods you used and the statistical method you applied.

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.

Giriş

Giriş bölümü, çalışmayı daha geniş bir bağlama yerleştirerek önemini vurgulamalıdır. Çalışmanın amacı ve değeri açıkça belirtilmeli, araştırma alanının mevcut durumu dikkatlice gözden geçirilerek önemli çalışmalara atıfta bulunulmalıdır. Konuyla ilgili farklı bakış açıları ve tartışmalı noktalar gerektiğinde ele alınarak dengeli bir çerçeve sunulmalıdır. Son olarak, araştırmanın temel hedefi özetlenmeli ve ulaşılan en önemli bulgular kısaca belirtilmelidir. Bu bölümün, yalnızca alanın uzmanları için değil, farklı disiplinlerden gelen bilim insanları için de anlaşılır olmasına özen gösterilmelidir.

Materyal ve Metot

Materyal ve Metod bölümünde planınızı, hastalarınızı, deney hayvanlarınızı, materyal ve kontrollerinizi, kullandığınız çalışma yöntemlerinizi ve uyguladığınız istatistiksel yöntemi açıklayınız.

Results

Section, state in detail your findings supported by statistical methods. Emphasise only your most important findings; do not compare your findings with other studies in this section. Such comparisons should be reserved for the discussion section. Figures and tables should support the findings given in the text and should not repeat them. It is sufficient to show the data in only one of the presentations in the form of text, figures or tables.

Discussion

In this section, the conclusions drawn from the findings and the current literature should be discussed and interpreted together. Statistical results used in the findings should not be repeated in this section. At the end of the discussion section, the limitations of the study should be stated under the subheading 'Limitations'.

Conclusion

This section should include the results of the discussion and the contribution of the results obtained from the study to the field in one paragraph.

Declarations

Ethical Approval Certificate

The experimental procedures of this study were approved by the Local Animal Care and Ethics Committee of XXXXXXXXXXXXXXXXXXXXXXX University, XXXXXXXXXXXXXXX (Approval date and number: XXXXXX).

Author Contribution Statement

Please indicate how and at what stage each author contributed to this study.

For example:

Bulgular

Bulgularda istatistiksel metotlarla desteklenmiş bulgularınızı ayrıntılı olarak belirtiniz. Sadece en önemli bulgularınızı vurgulayınız; bu bölümde bulgularınızı diğer araştırmalarla karşılaştırmayınız. Bu tip karşılaştırmalar tartışma bölümüne saklanmalıdır. Şekil ve tablolar metin içinde verilen bulguları desteklemeli tekrar etmemelidir. Verinin metin, şekil veya tablo şeklindeki sunumların sadece bir tanesinde gösterilmesi yeterlidir.

Tartışma

Bu bölümde bulgulardan çıkarılan sonuçlar ve güncel literatür birlikte tartışılmalı ve yorumlanmalıdır. Bulgularda kullanılan istatistik sonuçları bu bölümde tekrar edilmemelidir. Tartışma bölümünün sonunda çalışmanın limitasyonları "Limitasyonlar" alt başlığı ile belirtilmelidir.

Sonuç

Bu bölüm tartışma sonucunda ve bir paragraf olacak şekilde çalışmadan elde edilen sonuçların alana katkısını içermelidir.

Beyanlar

Etik Onay Belgesi

Bu çalışmanın deneysel prosedürleri XXXXXXXXXXXXXXXXX Üniversitesi, XXXXXXXXXXXXXXXX Yerel Hayvan Bakım ve Etik Kurulu tarafından onaylanmıştır (Onay tarihi ve numarası: XXXXXX).

Yazar Katkı Beyanı (Author Contribution Statement)

Lütfen her bir yazarın bu çalışmaya nasıl ve hangi aşamada katkıda bulunduğunu belirtiniz.

Örneğin:

X.X: Data collection, research, formal analysis and writing of the original draft

Y.Y: Project management, supervision, conceptualisation, methodology, review and editing

Z.Z: Data collection and research.

Fund Statement

If the study was funded by an institution/organisation, it should be stated as 'This study was funded by XXXXXXXXXXX'.

Publication Rights Agreement and Conflict of Interest Form

Please declare any conflicts of interest or state 'The authors declare no conflicts of interest.' Authors should identify and declare any personal circumstances or interests that may be considered to improperly influence the representation or interpretation of the reported research results. The Publication Rights Agreement and Conflict of Interest Form (to be e-mailed by the Editorial Board after manuscript submission) should be signed by the authors and sent to sabib@gibtu.edu.tr as a jpeg file.

Acknowledgement

In this section, you can indicate any administrative and technical support or in-kind donations (e.g. materials used for experiments).

References

References should be designed in Vancouver style and numbered in the order they appear in the text. If multiple and consecutively numbered sources are given; they should be written as 15-18. Unpublished observations and personal interviews should be avoided as references. Multiple authors should be separated by a comma.

X.X: Veri toplama, araştırma, resmi analiz ve orijinal taslağın yazılması

Y.Y: Proje yönetimi, gözetim, kavramsallaştırma, metodoloji, inceleme ve düzenleme

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Teşekkür (Acknowledgment)

Bu bölümde, her türlü idari ve teknik desteği veya ayni bağışları (örneğin, deneyler için kullanılan malzemeler) belirtebilirsiniz.

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If there are more than three authors, after the third author, "et al." should be added without a comma for both article and book references. If a chapter in a book is cited and there are many authors belonging to only this chapter, the name of the book and the chapter are stated, the first three authors of the chapter are written, and "et al." is added as an explanation for the subsequent authors. Journal names to be shown in the reference should be abbreviated as per the original.

Tables-Graphics-Figures-Pictures

All tables, graphs, figures and pictures should be placed on separate pages after the references. Tables should be set vertically in the text. Tables should be added in Word, each with double spacing, using the "Insert Table" section. Mean and Standard Deviation values (X±SD) given in tables should be in the same column. Percentage values (n(%)) given in tables should be in the same column. Decimal numbers should be given as 2 digits after the comma in the text and tables. All graphs-figures-pictures used in the text should be called "Figure" and tables should be called "Table". All figures and tables used should be indicated in the text. Each should be numbered according to the order of occurrence in the text and a short title should be written. Table titles should be written clearly above the table, and figure titles should be written below the figure. Abbreviations and statistical methods used in tables should definitely be explained below. If quoting from another publication, written reprint permission should be sent together.

Figures should be prepared using the ‘jpeg’ compression technique and each figure should be saved in a separate file.

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Figures must be at least 9×13 cm in size and have a resolution of 600 dpi. Send images as separate files only as TIFF or EPS files with a minimum resolution of 300 dpi. In images where the patient's identity can be determined, the signed consent of the patient or their legal representative must be attached to the submitted text, otherwise the names of the person(s) in question or their eyes must be covered with "tape".

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We accept electronic supplementary materials to support and enhance your scientific research. Supplementary files provide the author with additional possibilities to publish supporting applications, movies, animated sequences, high-resolution images, background datasets, audio clips, and more.

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Research Article

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Reflection of Nursing Students' Climate Crisis Awareness on Climate Change Anxiety

Hemşirelik Öğrencilerinin İklim Krizi Farkındalığının İklim Değişikliği Anksiyetesine Yansıması

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ABSTRACT

Purpose: This study was conducted to evaluate the reflection of nursing students' climate crisis awareness on climate change anxiety.

Methods: The universe of the descriptive and correlational type study was composed of students studying in the nursing department of a university (400 students). The sample of the research consisted of 106 students. Data were collected using the Descriptive Characteristics Form, Global Climate Change Awareness Scale (GCCAS) and Climate Change Anxiety Scale (CCAS). The data obtained from the study were evaluated with the SPSS 23 package program.

Results: Students participating in the study 94.3% knew the concept of climate change, 92.5% were concerned about the future regarding climate change, 63.2% wanted to participate in social responsibility activities aimed at preventing the climate crisis, and 95.3% wanted to increase the efforts to prevent the climate crisis. The total score of the GCCAS was statistically significantly higher in those who wanted to increase the measures to prevent the climate crisis (73.36±16.78), and the total score of the CCAS was statistically significantly higher in those who thought that our country could find a solution when the climate crisis intensified (30.36±12.13) ($p<0.05$).

Conclusion: As a result, almost all of the nursing students knew the concept of climate change, were concerned about the future regarding climate change, and wanted to increase the efforts to prevent the climate crisis. In addition, it was determined that the students' awareness of the climate crisis was high and their anxiety was at a moderate level.

Keywords: Nursing, Student, Climate crisis, Awareness, Anxiety

ÖZET

Amaç: Bu çalışma, hemşirelik öğrencilerinin iklim krizi farkındalığının iklim değişikliği anksiyetesine yansımasını değerlendirmek amacıyla yapıldı.

Yöntem: Tanımlayıcı ve ilişki arayıcı tipte yürütülen araştırmanın evrenini, bir üniversitenin hemşirelik bölümünde eğitim gören öğrenciler (400 öğrenci) oluşturdu. Araştırmanın örneklemi ise, 106 öğrenci oluşturmuştur. Veriler; Tanıtıcı Özellikler Formu, Küresel İklim Değişikliği Farkındalık Ölçeği (KİDFÖ) ve İklim Değişikliği Anksiyetesi Ölçeği (İDAÖ) kullanılarak toplandı. Araştırmadan elde edilen veriler SPSS 23 paket programıyla değerlendirildi.

Bulgular: Çalışmaya katılan öğrencilerin %94.3'ü iklim değişikliği kavramını bilmekte, %92.5'i iklim değişikliği konusunda geleceğe dair endişe taşımakta, %63.2'si iklim krizini önlemeye yönelik sosyal sorumluluk çalışmalarına katılmak istemekte, %95.3'ü iklim krizini önlemeye yönelik çalışmaların arttırılmasını istemektedir. KİDFÖ toplam puanı iklim krizini önlemeye yönelik önlemlerin arttırılmasını isteyenlerde (73.36±16.78), İDAÖ toplam puanı ile iklim krizi şiddetlendiği zaman ülkemizin buna çözüm bulabileceğini düşünenlerde (30.36±12.13) istatistiksel olarak anlamlı derecede daha yüksektir ($p<0.05$).

Sonuç: Sonuç olarak hemşirelik öğrencilerinin tamamına yakını iklim değişikliği kavramını bilmekte, iklim değişikliği konusunda geleceğe dair endişe taşımakta ve iklim krizinin önlenmesine yönelik çalışmaların artırılmasını istemektedir. Ayrıca öğrencilerin iklim krizi farkındalıklarının yüksek, anksiyetelerinin ise orta düzeyde olduğu saptanmıştır.

Anahtar Kelimeler: Hemşirelik, Öğrenci, İklim krizi, Farkındalık, Anksiyete

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Introduction

Climate change is the changes in the climate that occur as a result of activities that directly or indirectly disrupt the composition of the global atmosphere (1). Climate change, which is one of the most important environmental problems in the world, is an alarming situation and the most important public health problem faced by humanity in the 21st century (2, 3).

The problem of climate change, which occurred within the framework of nature's own dynamics in the past and was regulated in the natural flow; Today, it is formed as a result of human activities. Urbanization, industrialization and excessive use of fossil fuels, which have increased rapidly since the industrial revolution, cause the order of the climates to deteriorate (1, 4). As a result; problems such as temperature changes, melting of glaciers, rise in sea level, drought, decrease in agricultural lands, disruption in seasonal cycles, floods, storms, forest fires, loss of livability in some regions, water and food insecurity, higher prevalence of disease, mass migrations and ultimately the emergence of a global security problem are expected (1-6). On the other hand, the uncertainty and stress brought about by change can also cause people to experience psychological problems such as trauma, fear, substance abuse, depression and anxiety (5, 7-9). It is possible to define climate change anxiety as not being sure about the future of the world and all living things in it and worrying about ecological disasters that may occur due to the climate crisis (10). These problems caused by the climate crisis, and especially the state of anxiety, can be prevented from becoming a crisis by increasing the consciousness and awareness levels of individuals. As a matter of fact, the increase in the level of consciousness and awareness about climate change points to the most promising point in reaching a solution (11). If consciousness and awareness cannot be achieved, people's sensitivity to climate change will decrease and the destructive effects of the climate crisis will increase (12). In addition, when people who act consciously develop sensitivity to climate change, this awareness will be combined with hope and optimism to reduce the level of anxiety (10).

If awareness is supported and nurtured by knowledge, change can be created. Therefore, it is necessary for all people living in the world to be aware of the dangers, consequences and solutions of the issue. In order to achieve the necessary transformation, it should be ensured that individuals understand this process well and have the necessary equipment. Nurses, who have important responsibilities in protecting and maintaining the natural environment from depletion, pollution, deterioration and destruction, are people who have scientific equipment and communication skills in providing health education (13). For this reason, nurses have important duties in raising public awareness about climate change, raising awareness, creating behavior change and initiating climate action, protecting and maintaining physical and mental health. It is important to evaluate the awareness of climate change in future nurses studying in nursing schools and to be able to instill this awareness. However, there is only one study (2) examining climate awareness in nursing students in our country, and there is no study determining the anxiety levels of nursing students. This study, which we think will make important contributions to the literature, was conducted to examine the reflection of nursing students' awareness of climate crisis on climate change anxiety.

Research questions; Nursing students,

1.Is there a difference between sociodemographic characteristics and climate change awareness and anxiety?
2. What is the level of climate change awareness?
3. What is the level of climate change anxiety?
4. What is the relationship between climate change awareness and anxiety?.

Materyal ve Metot (Materials and Method)

Type of Research

This research was conducted in a descriptive and relationship-seeking type.

Place and Date of the Study

The research was conducted between June 2023 and February 2024 at Gaziantep Islam Science and Technology University (GISTU) Faculty of Health Sciences, Department of Nursing.

Universe and Sample of the Study

The population of the study consists of 1st, 2nd and 3rd year students studying in the Department of Nursing, Faculty of Health Sciences, GISTU (400 students in total). The sample of the study was calculated with the G*Power 3.1.9.program (Franz Faul, Universitat Kiel, Germany) with reference to the study titled "Evaluation of teachers' awareness of global climate change (2023) (14)" and the sample size was determined as 106 people (α=0.05, 1-β= 0.80, effect size d= 0.48). Students who volunteer in the study, study in the nursing department, have a smartphone and internet, and speak Turkish will be included. Students who do not want to participate in the study will be excluded from the research.

Data Collection Tools

1. Introductory Features Form

The introductory characteristics form prepared by the researchers contains a total of 15 questions, 9 questions questioning the sociodemographic characteristics of the students and 6 questions questioning their knowledge about the climate crisis.

2. Global Climate Change Awareness Scale (GCCAS)

The scale developed by Deniz et al. (2021) determines the awareness levels of university students regarding global climate change. The scale is a 5-point Likert-type scale consisting of 21 items (I am not aware at all: 1 - I am fully aware: 5). The scale, which consists of 4 sub-dimensions (Awareness of the Effects of Global Climate Change on Natural and Human Environments (items 1-9), Awareness of Global Organizations and Agreements (items 10-15), Awareness of the Causes of Global Climate Change (items 16-18) and Awareness of the Energy Consumption of Global Climate Change (items 19-21)), does not contain reverse items. All dimensions of the scale can be added. In total, the scale scores between 21-105. The Cronbach alpha coefficient of the scale is 0.82. The Cronbach alpha coefficient of the scale sub-dimensions varies between 0.72-0.87 (15). In this study, the Cronbach alpha coefficient of the scale is 0.94.

3. Climate Change Anxiety Scale (CCAS)

The Turkish validity and reliability of the scale developed by Clayton and Karazsia (2020) (8) was conducted by Cebeci et al. (2022). The scale is a 5-point Likert type (1: Never – 5: Almost always) consisting of 13 items and 2 sub-dimensions. Items 1-8 constitute the “Cognitive Impairment” sub-scale; items 9-13 constitute the “Functional Impairment” sub-dimension. In total, the scale scores between 13-65. The Cronbach Alpha value of the scale was determined as 0.94 (3). In this study, the Cronbach alpha coefficient of the scale was 0.96.

Data Collection

The data for the study were collected by the researchers in a separate room via face-to-face interviews using questionnaires and scales in 15-20 minutes. The purpose of the study was explained to the participants in detail, and it was stated that the study was conducted with the approval of the hospital administration and ethics committee. In addition, the data were collected after obtaining the informed consent form and verbal approval from the participants.

Evaluation of Data

The data obtained from the study were analyzed using the Statistical Package for the Social Sciences (SPSS) version 23.0 (IBM Corp., Armonk, NY, USA) program. Descriptive statistical methods used were mean, standard deviation, number and percentage calculations. T-test was used to compare two independent groups that were found to be normally distributed with Skewness (-0.770 - 1.125) and Kurtosis (0.232-0.750) values, variance analysis (ANOVA) was used to compare more than two groups, and Pearson correlation analysis was used to test the relationship between variables. $p<0.05$ was accepted for significance.

Ethical Aspects of the Research

Approval was obtained from the ethics committee of a state university to conduct the research (Decision Date: 16.06.2023, Decision No: 248.26.04, Protocol No: 2023/248). During the research process, the necessary research and publication ethics principles were followed in accordance with the Declaration of Helsinki.

Before starting the study, written and verbal permissions were obtained from the institution where the data would be collected. In addition, participants were informed about the purpose, duration and scope of the research and their informed consent form and verbal approvals were obtained.

Results

The average age of the participants participating in the study is 20.96±2.54, the average number of siblings is 4.50±2.28. In addition, 87.7% of the participants are female, 36.8% of their mothers and 37.7% of their fathers have primary school education, 72.6% of their income is equal to their expenses, 94.3% of them know the concept of climate change, 92.5% of them have concerns about climate change in the future, 81.1% of them think that our country is taking precautions against the climate crisis, 48.1% of them think that our country can find a solution when the climate crisis intensifies, 63.2% of them want to participate in social responsibility activities to prevent the climate crisis, and 95.3% of them want to increase the precautions to prevent the climate crisis (Table 1).

The total score of the GCCAS is statistically significantly higher in those who want to increase the measures to prevent the climate crisis (73.36±16.78), in those who do not think that our country will be able to find a solution when the climate crisis intensifies with the cognitive impairment sub-dimension score (19.45±7.67), in those with high expenditures with the functional impairment sub-dimension score (12.60±4.13), and in those who do not think that our country will be able to find a solution when the climate crisis intensifies with the CCAS total score ($p<0.05$) (Table 1). The total score of the GCCAS was 72.64±16.99, the mean of the Cognitive Impairment sub-dimension was 16.05±7.10, the mean of the functional impairment sub-dimension was 9.31±4.936 and the total score of the CCAS was 25.21±11.55 (Table 1).

Table 1: Comparison of the descriptive characteristics of nursing students and the total scores and sub-dimension means of GCCAS, Cognitive Impairment Sub-Dimension, Functional Impairment Sub-Dimension and CCAS

Introductory Features (n=106)		**n (%)**	**GCCAS (21-105 point)**	**CCAS**		
				Cognitive Impairment (8-40 point)	**Functional Disorder (5-25 point)**	**Total (13-65 point)**
Age X±SD (Min-Max)	20.96±2.54 (Min:18-Max:42)					
Number of siblings X±SD (Min-Max)	4.50±2.28 (Min:0-Max:12)					
Gender	Woman	93 (87.7)	72.36±17.33	16.06±6.89	9.21±4.79	25.05±11.22
	Man	13 (12.3)	74.61±14.86	16.00±8.80	10.00±6.01	26.38±14.18
Statistical Analysis (t/p)			-0.445/0.65	0.031/0.976	-0.535/0.594	-0.387/0.699
Mother's education status	Not literate	22 (20.8)	68.31±15.80	15.95±7.63	9.54±4.62	25.72±11.86
	Literate	20 (18.9)	73.15±13.41	14.50±4.53	7.95±2.85	22.25±6.82
	Primary school	39 (36.8)	73.84±18.23	16.82±8.11	9.92±5.88	26.30±13.44
	Middle school	11 (10.4)	70.36±21.81	16.90±8.19	9.81±6.06	26.72±13.62
	High school and above	14 (13.2)	77.14±16.33	15.64±5.79	8.78±4.00	24.42±9.58
Statistical Analysis (F/p)			0.696/0.597	0.396/0.811	0.602/0.662	0.481/0.750
Father's education status	Not literate	5 (4.7)	74.80±4.49	11.60±3.36	6.00±1.22	17.60±4.09

	Literate	10 (9.4)	65.80±13.39	16.10±5.91	9.10±4.45	25.20±10.25
	Primary school	40 (37.7)	71.10±17.30	16.55±7.29	9.82±5.27	25.95±11.91
	Middle school	17 (16.0)	73.23±21.24	19.00±9.05	10.64±5.74	29.94±14.00
	High school and above	34 (32.1)	75.85±16.32	14.64±6.10	8.58±4.41	23.11±10.29
Statistical Analysis (F/p)			0.810/0.522	1.642/0.169	1.178/0.325	1.610/0.177
Income status	Income ↑	14 (13.2)	72.28±18.10	16.28±6.99	8.85±5.62	25.14±12.48
	Income= Expense	77 (72.6)	72.77±16.11	15.64±7.18	8.75±4.75	24.35±11.51
	Expense ↑	15 (14.2)	72.26±21.27	17.93±6.93	12.60±4.13	29.73±10.53
Statistical Analysis (F/p)			0.009/0.991	0.652/0.523	**4.113/0.019**	1.371/0.258
Knowing the concept of climate change	Yes	100 (94.3)	73.32±16.39	16.13±7.12	9.31±4.96	25.28±11.58
	No	6 (5.7)	61.33±24.16	14.83±7.38	9.33±4.76	24.16±12.12
Statistical Analysis (t/p)			1.199/0.282	0.432/0.666	-0.011/0.991	0.228/0.820
Concern about future climate change	Yes	98 (92.5)	73.63±15.93	16.42±7.11	9.45±4.97	25.72±11.60
	No	8 (7.5)	60.50±25.16	11.50±5.50	7.50±4.34	19.00±9.50
Statistical Analysis (t/p)			1.453/0.187	1.910/0.059	1.081/0.282	1.594/0.114
I think our country is taking precautions against the climate crisis problem.	Yes	20 (18.9)	69.10±16.62	17.95±6.51	10.15±4.38	28.10±10.24
	No	86 (81.1)	73.46±17.07	15.61±7.20	9.11±5.05	24.54±11.79
Statistical Analysis (t/p)			-1.035/0.303	1.328/0.187	0.843/0.401	1.242/0.217
When the climate crisis intensifies, do not think that our country can find a solution to it	Yes	11 (10.4)	68.90±16.29	16.92±8.27	10.90±5.26	26.88±13.50
	No	51 (48.1)	71.01±17.89	19.45±7.67	10.03±5.52	30.36±12.13
	Indecisive	44 (41.5)	75.45±16.02	14.20±4.76	8.06±3.83	22.00±7.69
Statistical Analysis (F/p)			1.102/0.336	**3.264/0.042**	2.605/0.079	**3.482/0.034**
Wanting to participate in social responsibility activities to prevent the climate crisis	Yes	67 (63.2)	74.34±14.70	15.77±7.03	8.77±4.76	24.56±11.36
	No	39 (36.8)	69.71±20.22	16.53±7.29	10.23±5.15	26.33±11.95
Statistical Analysis (t/p)			1.356/0.178	-0.531/0.597	-1.472/0.144	-0.757/0.451
Requesting increased efforts to prevent the climate crisis	Yes	101 (95.3)	73.36±16.78	16.19±7.11	9.34±4.96	25.38±11.58
	No/Indecisive	5 (4.7)	58.00±16.17	13.20±7.12	8.60±4.61	21.80±11.71
Statistical Analysis (t/p)			**2.001/0.048**	0.920/0.360	0.329/0.743	0.675/0.501
X±SD (Min-Max)			72.64±16.99 (21-105)	16.05±7.10 (8-38)	9.31±4.93 (5-25)	25.21±11.55 (13-63)

A positive and high magnitude relationship was found between the CCAS and the Cognitive (r=0.973) and Functional (r=0.903) Disorder Sub-dimensions (p<0.005) (Table 2).

Table 2: Examination of the relationship between GCCAS, CCAS and sub-dimensions

Correlations									
Scale and Sub-Dimensions		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1. Impacts on Natural and Human Environment	r	1							
2. Awareness of Global Organizations and Agreements		,337**	1						
3. Causes That Cause It		,349**	,504**	1					
4. Energy Consumption Relationship		,699**	,237*	,236*	1				
5. GCCAS		,848**	,677**	,601**	,670**	1			
6. Cognitive Impairment		-,102	,249*	,120	-,166	,052	1		
7. Functional Disorder		-,168	,295**	,216*	-,214*	,052	,820**	1	
8. CCAS		-,136	,254**	,158	-,205*	,043	**,973****	**,903****	1

p<0.005

Discussion

The climate crisis, as one of the greatest threats of our time, deeply affects not only environmental balances but also the psychological health of individuals. Young people, in particular, are more vulnerable to the negative effects of climate change than adults due to their immature physiological systems, dependence on adults, and repeated exposure to climate events (16, 17). In this context, our study aims to examine the effects of climate crisis awareness levels on climate change anxiety in a young group of nursing students.

The research findings reveal that the vast majority of students (95.3%) have a high level of awareness about climate change and the climate crisis and have serious concerns about the future. The fact that participants demand increased measures against the climate crisis clearly demonstrates young people's sensitivity to environmental problems and their desire to produce solutions. In addition, this finding indicates that nursing students have the potential to lead in environmental health and sustainability issues in the future. In fact, in a survey conducted by the Australian Institute for Disaster Resilience (AIDR) with the participation of 1477 Australian youth (10-24 years old), the vast majority of participants stated that they were aware of climate change and were concerned about this situation, which supports this sensitivity (18).

On the other hand, despite the high awareness levels of students, a certain segment of society has been observed to have serious levels of climate change anxiety. Higher levels of cognitive impairment and climate change anxiety were found in individuals who were concerned about climate change and did not believe that the country could solve this problem when the climate crisis intensified. This situation shows that concerns and hopelessness about the future have negative effects on individuals' mental health. Similarly, Chiw and Ling's (2019) study on Australian youth aged 7-24 revealed that 96% of participants viewed climate change as a serious problem and 89% were concerned about its effects (19). The finding that pessimistic expectations about environmental problems can increase individuals' anxiety levels and negatively affect their cognitive functions indicates that climate change awareness may not always produce positive results. These results clearly emphasize that environmental concerns have significant effects not only on physical health but also on mental health.

The research findings reveal that the socioeconomic status of individuals has a significant impact on environmental anxiety levels. It has been observed that anxiety levels are higher in individuals with higher income levels, especially because they feel the effects of environmental problems more closely or have more information on these issues. This finding is consistent with the existing literature emphasizing the determining role of socioeconomic status on environmental anxiety and anxiety. For example, Strife's (2012) study of over 15,000 Australian youth aged 14–23 (20) and ReachOut's (2019) findings revealed that participants were concerned about their

socioeconomic status deteriorating due to environmental disasters such as food shortages, droughts, fires, and floods, and that they planned to have fewer children or not have children in line with these concerns (21). This suggests that environmental concerns have a serious potential to affect not only individual quality of life, but also community health and demographic trends.

In our study, it was determined that the students' cognitive and functional impairment levels were generally at moderate levels. It is understood that students with high awareness of global climate change do not experience this awareness in an extremely negative way in their daily lives. However, the strong positive relationship between cognitive impairment and climate change anxiety indicates that an increase in awareness may cause these psychological effects to become more pronounced. This situation reveals that in addition to raising students' awareness of environmental problems, the possible psychological effects of this awareness should also be taken into consideration. With increasing awareness levels, the importance of developing strategies for managing environmental anxiety is emphasized once again. These findings obtained in our study are parallel to other studies in the literature (22, 23).

Limitations and Strengths of the Study

The study's limitations include the collection of research data from a single university. However, being the only study in the literature that evaluates the reflection of nursing students' climate crisis awareness on climate change anxiety stands out as a strength that makes this study valuable.

Conclusion

As a result, almost all nursing students know the concept of climate change, are concerned about the future of climate change, and want to increase efforts to prevent the climate crisis. It was also determined that students' awareness of the climate crisis was high and their anxiety was at a moderate level.

According to these results; it has become clear that nurses need to be prepared to effectively combat not only health problems but also environmental threats. A more comprehensive education process on environmental health will enable nurses to be sensitive and prepared for environmental crises such as global climate change. In addition, the inclusion of anxiety and stress management strategies in this education process can help students cope with environmental concerns. In addition, nursing education should address environmental health and psychological health issues from a holistic perspective, which will enable health professionals to combat future global environmental crises more effectively.

Declarations

Ethical Approval Certificate

Ethics committee approval was received for this study from Gaziantep Islam Science and Technology University (Decision Date: 16.06.2023, Decision No: 248.26.04, Protocol No: 2023/248).

Author Contribution Statement

E.K and E.K: Concept, Design, Supervision, Sources, Data Collection and/or Processing, Analysis and/or Interpretation, Literature Review Writing, Critical Review.
Z.G: Sources, Critical Review.

Fund Statement

The authors declare that this study has received no financial support.

Conflict of Interest

The authors declare that they have no conflict of interest.

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Research Article

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Investigation of the Interaction of Phytochemical Compounds in *Vitis vinifera* L. with Human Hemoglobin Protein by Molecular Docking Method

Moleküler Docking Yöntemi ile *Vitis vinifera* L. İçeriğindeki Fitokimyasal Bileşiklerin İnsan Hemoglobin Proteini ile Etkileşiminin İncelenmesi

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ABSTRACT

Purpose: Hemoglobin is a protein found in red blood cells that carries oxygen to tissues and is an important marker, especially in the diagnosis of anemia. *Vitis vinifera* is a plant that is reported to be beneficial for anemia due to its rich content of phytochemical compounds. This study aimed to investigate the interactions between the active compounds in *Vitis vinifera* and hemoglobin protein using the molecular docking method.
Methods: The Maestro Schrödinger software package was utilized to calculate the binding affinity of the plant's active compounds to the hemoglobin protein. The molecular structures of the ligands were retrieved from the PubChem database, while the hemoglobin protein structure (PDB ID: 2D60) was obtained from the RCSB Protein Data Bank.
Results: In this study, the interactions between 16 active compounds of *V. vinifera* and hemoglobin protein were analyzed. The phytochemical components with the highest binding affinities to hemoglobin protein were identified as vitisin A (-9.144 kcal/mol), proanthocyanidin (-7.791 kcal/mol), and anthocyanin a2 (-7.356 kcal/mol).
Conclusion: This study demonstrated the interactions between human hemoglobin protein and phytochemical compounds in *Vitis vinifera* using molecular docking binding scores. The low binding energies of Vitisin A, proanthocyanidin, and anthocyanin a2 indicate the potential of these compounds to act as binders for the hemoglobin protein.

Key words: *Vitis vinifera*, Phytochemical, Ethnobotany, Hemoglobin, Molecular docking.

ÖZET

Amaç: Hemoglobin, dokulara oksijen taşıyan kırmızı kan hücrelerinde bulunan proteindir, özellikle anemi (kansızlık) teşhisinde dikkate alınan önemli bir belirteçtir. *Vitis vinifera*, içerdiği birçok fitokimyasal bileşikler sayesinde, anemiye iyi geldiği belirtilen bir bitkidir. Bu çalışmada *V. vinifera* içeriğinde bulunan etken maddeler ile hemoglobin proteini arasındaki etkileşimin moleküler docking yöntemi ile araştırılması amaçlanmıştır.
Yöntem: Bitki içeriğinde bulunan etken maddelerin hemoglobin proteinine bağlanma afinitelerini hesaplamak için Maestro Schödinger paket programı kullanıldı. Ligandların moleküler yapısını bulmak için Pubchem veri tabanı kullanıldı. Hemoglobine (PDB ID: 2D60) ait protein yapısı RCSB Protein Veri Bankasından elde edildi.
Bulgular: Bu çalışmada *V. vinifera* içeriğinde bulunan 16 etken madde ile hemoglobin proteini arasında etkileşim olduğu belirlendi. Hemoglobin proteini ile en iyi bağlanma afinitesine sahip fitokimyasal bileşenler vitisin A (-9.144 kcal/mol), proanthocyanidin (-7.791 kcal/mol) ve anthocyanin a2 (-7.356 kcal/mol) olarak belirlendi.
Sonuç: Bu çalışma ile insan hemoglobin proteini ile *V. vinifera* içeriğinde bulunan fitokimyasal bileşiklerin moleküler docking bağlanma skoru ile, gerçekleştirdiği etkileşimler gösterilmiştir. Vitisin A, proanthocyanidin ve anthocyanin a2'nin bağlanma enerjilerinin düşük olması bu bileşiklerin hemoglobin proteininin birer bağlayıcısı olma potansiyelini göstermektedir.
Anahtar Kelimeler: *Vitis vinifera*, Fitokimyasal, Etnobotanik, Hemoglobin, Moleküler kenetleme.

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Introduction

Anemia is characterized by a reduction in hemoglobin levels in red blood cells (erythrocytes) below normal thresholds, representing a significant health issue caused by various factors, including iron deficiency, and exerting multifaceted effects on the body's overall functionality (1-2). It is among the most prevalent blood disorders globally, posing a serious challenge to public health (3). Approximately 1.9 billion individuals worldwide are estimated to be affected by anemia (4). While anemia is observed across many regions, it remains a critical public health concern, particularly in underdeveloped countries (5). Severe anemia during pregnancy can result in complications such as developmental delays in the fetus, preterm delivery risks, and increased mortality rates in elderly individuals (6-8). Anemia can occur due to insufficient iron in the body, leading to the inability to produce adequate blood cells. The primary cause of anemia should be determined in detail.

Hemoglobin is an iron-containing metalloprotein crucial for oxygen transport to tissues (9). Its primary function in mammals is known to be the transport of O_2 from the lungs to the tissues, and it has also been reported to interact with gases such as carbon dioxide (CO_2), carbon monoxide (CO), and nitric oxide (NO) (10). In such cases, the irreversible binding of carbon monoxide gas to hemoglobin leads to poisoning. The hemoglobin molecule comprises globin, apoprotein, and iron-containing groups (11). Structurally, it is a protein complex consisting of four subunits: two alpha (α) chains of 141 amino acids and two beta (β) chains of 146 amino acids. Each subunit contains a globin chain and a heme group (12). The alpha chain includes the amino acid histidine, which facilitates oxygen binding through coordination bonds with the heme group's iron atom. Additionally, hydrophobic amino acids, such as valine and phenylalanine, in the beta chain stabilize the heme group's hydrophobic pockets (13). Understanding the conformation of hemoglobin is essential for comprehending its functional mechanisms, determining its physiological effects, and enhancing our knowledge of the pathophysiology, prevention, and treatment of diseases like anemia.

Vitis vinifera L., a grape species of the genus Vitis, is cultivated globally in both seeded and seedless varieties. This species holds immense agricultural and economic significance, accounting for 90% of the world's grape production (14). Grapes are rich in bioactive compounds such as phenolic compounds, flavonoids, and stilbenoids, providing potent pharmacological properties across all parts of the plant, from root to skin. Moreover, grapes contribute significantly to human health through nutrients such as minerals, vitamin C, and dietary fibers (15-20). In several countries, including Pakistan, Italy, and Türkiye, *V. vinifera* is utilized ethnopharmacologically for treating anemia, colds, wound care, and bronchitis (21-25). Research indicates that the bioactive compounds in grapes exhibit diverse pharmacological activities, including antioxidant, anticancer, and anti-inflammatory effects, thus establishing grapes as an essential agricultural crop for both nutritional and therapeutic applications worldwide (26). Additionally, its rich content of macro and micro nutrients, particularly high iron levels, has led to grapes being popularly regarded as a blood-building and anemia-relieving food.

Molecular docking, an in silico technique increasingly employed in drug design for various diseases, facilitates the analysis of molecular interactions by identifying optimal binding pairs between target proteins of interest and ligand conformations (27). Molecular docking is one of the approaches that helps understand the mechanism of action by which active compounds can function as protein inhibitors.

Erbay et al. highlighted *V. vinifera* as one of the effective plants traditionally used to manage anemia in Türkiye (28). Muhamad et al. conducted a comprehensive study on the phytochemical components and pharmacological activities of *V. vinifera* (26).

The objective of this study is to explore the interactions of 16 phytochemical compounds (Table 1) derived from the ethnopharmacologically significant *V. vinifera* plant with hemoglobin protein to evaluate their potential therapeutic applications against anemia.

Table 1. Phytochemical components of *V. vinifera* (26).

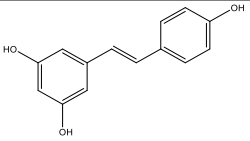
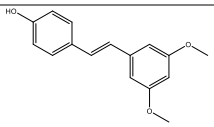
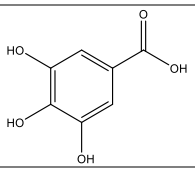
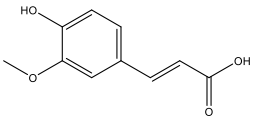
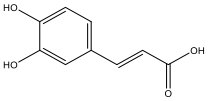
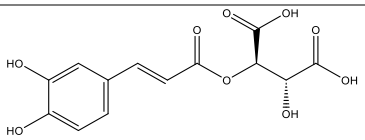
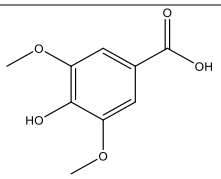
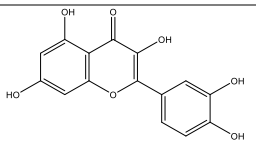
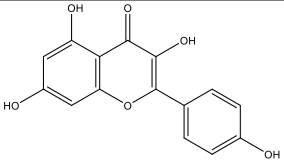
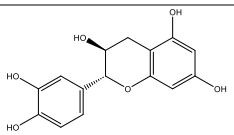
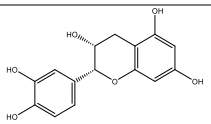
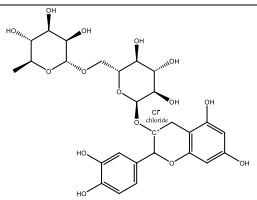
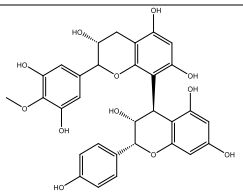
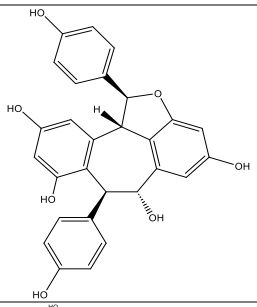
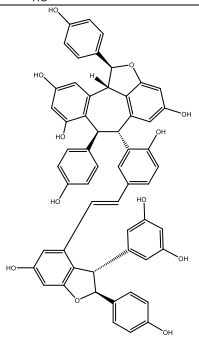
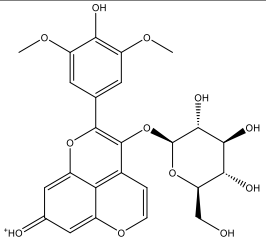
Molecule Name	IUPAC Name	2D Structure
Resveratrol	5-[(E)-2-(4-hydroxyphenyl)ethenyl]benzene-1,3-diol	
Pterostilbene	4-[(E)-2-(3,5-dimethoxyphenyl)ethenyl]phenol	
Gallic acid	3,4,5-trihydroxybenzoic acid	
Ferulic acid	(E)-3-(4-hydroxy-3-methoxyphenyl)prop-2-enoic acid	
Caffeic acid	(E)-3-(3,4-dihydroxyphenyl)prop-2-enoic acid	
Caftaric acid	(2R,3R)-2-[(E)-3-(3,4-dihydroxyphenyl)prop-2-enoyl]oxy-3-hydroxybutanedioic acid	
Syringic acid	4-hydroxy-3,5-dimethoxybenzoic acid	
Quercetin	2-(3,4-dihydroxyphenyl)-3,5,7-trihydroxychromen-4-one	
Kaempferol	3,5,7-trihydroxy-2-(4-hydroxyphenyl)chromen-4-one	

Table 1. Phytochemical components of *V. vinifera* (26) (continued).

Molecule Name	IUPAC Name	2D Structure
(+) -Catechin	(2R,3S)-2-(3,4-dihydroxyphenyl)-3,4-dihydro-2H-chromene-3,5,7-triol	
Epicatechin	(2R,3R)-2-(3,4-dihydroxyphenyl)-3,4-dihydro-2H-chromene-3,5,7-triol	
Anthocyanin a2	(2R,3R,4R,5R,6S)-2-[[(2R,3S,4S,5R,6S)-6-[2-(3,4-dihydroxyphenyl)-5,7-dihydroxychromenylium-3-yl]oxy-3,4,5-trihydroxyoxan-2-yl]methoxy]-6-methyloxane-3,4,5-triol;chloride	
Proanthocyanidin	(3R)-2-(3,5-dihydroxy-4-methoxyphenyl)-8-[(2R,3R,4R)-3,5,7-trihydroxy-2-(4-hydroxyphenyl)-3,4-dihydro-2H-chromen-4-yl]-3,4-dihydro-2H-chromene-3,5,7-triol	
Ampelopsin A	(1S,8S,9R,16S)-8,16-bis(4-hydroxyphenyl)-15-oxatetracyclo[8.6.1.02,7.014,17]heptadeca-2(7),3,5,10(17),11,13-hexaene-4,6,9,12-tetrol	
Vitisin A	(1S,8S,9R,16S)-9-[5-[(E)-2-[(2S,3S)-3-(3,5-dihydroxyphenyl)-6-hydroxy-2-(4-hydroxyphenyl)-2,3-dihydro-1-benzofuran-4-yl]ethenyl]-2-hydroxyphenyl]-8,16-bis(4-hydroxyphenyl)-15-oxatetracyclo[8.6.1.02,7.014,17]heptadeca-2(7),3,5,10(17),11,13-hexaene-4,6,12-triol	
Vitisin B	[3-(4-hydroxy-3,5-dimethoxyphenyl)-4-[(2S,3R,4S,5S,6R)-3,4,5-trihydroxy-6-(hydroxymethyl)oxan-2-yl]oxy-2,8-dioxatricyclo[7.3.1.05,13]trideca-1(12),3,5(13),6,9-pentaen-11-ylidene]oxidanium	

Materials and Methods

The molecular docking analysis of hemoglobin (PDB ID: 2D60) protein with 16 bioactive compounds from the *V. vinifera* plant was conducted using the Maestro Schrödinger software package. The 3D crystal structure of the receptor protein was retrieved from the Protein Data Bank (PDB) (https://www.rcsb.org/). As the study focuses on human hemoglobin, the structure selected corresponds to the organism Homo sapiens and was free of mutations (29). The structure, determined through X-Ray Diffraction, has a resolution of 1.70 Å.

Since the obtained structures cannot be directly utilized in docking calculations, they were optimized prior to analysis. During this process, hydrogen atoms were added to the receptor, partial charges were assigned, and missing loop regions and side chains were completed using the Protein Preprocess module within the Maestro Schrödinger software.

The ligand molecules were similarly prepared under the same pH conditions using the LigPrep module. To define the binding site of the receptor, a grid box was created using the Receptor Grid module, and the ligand coordinates were specified along the X, Y, and Z axes. These preparatory steps were essential to enhance the reliability of docking procedures and ensure accurate analysis of receptor-ligand interactions (30).

Results

The molecular docking results between hemoglobin protein and the 16 phytochemical components of the plant are presented in Table 2. The results indicated that the hemoglobin molecule can interact with vitisin A. Vitisin A established hydrogen bonds with ASP94, GLU101, LYS127, LYS99, and THR137, as well as a π-cation interaction with ARG141. The ligand demonstrated robust binding with multiple amino acids within the active site of the protein through both hydrogen bonding and π-cation (Pi-Cat) interactions. The docking score of the ligand-receptor interaction, -9.144 kcal/mol, suggests a strong interaction, reflecting high binding affinity and stability. However, it has been observed that the active component Vitisin A, does not interact with the histidine, valine, and phenylalanine amino acids located in the alpha and beta chains of the hemoglobin molecule, which facilitate oxygen binding and contribute to structural stabilization (Figure 1).

Table 2. Molecular docking results of all ligands with the hemoglobin protein.

Ligand	Docking Score (kcal/mol)
Vitisin A	-9.144
Proanthocyanidin	-7.791
Anthocyanin a2	-7.356
Epicatechin	-6.625
(+) -Catechin	-6.625
Ampelopsin A	-6.599
Vitisin B	-6.394
Caftaric acid	-6.301
Kaempferol	-5.999
Quercetin	-5.751
Gallic acid	-5.373
Caffeic acid	-5.069
Resveratrol	-5.022
Syringic acid	-4.822
Ferulic acid	-4.681
Pterostilbene	-4.616

The results revealed that the hemoglobin molecule can interact with proanthocyanidin. Proanthocyanidin formed hydrogen bonds with two LYS99, ASP126, THR134, THR137, SER138, ARG141, and NMA141A (an unspecified residue). Additionally, it formed a salt bridge with the two LYS99 amino acids in the structure and exhibited π-cation interactions with ARG141 and LYS99. The ligand demonstrated strong interactions with numerous amino acids in the active site of the protein through a combination of hydrogen bonds, π-cation interactions, and salt bridges. The docking score of -7.791 kcal/mol suggests that the ligand confers high binding affinity to the protein and stability to the structure (Figure 2).

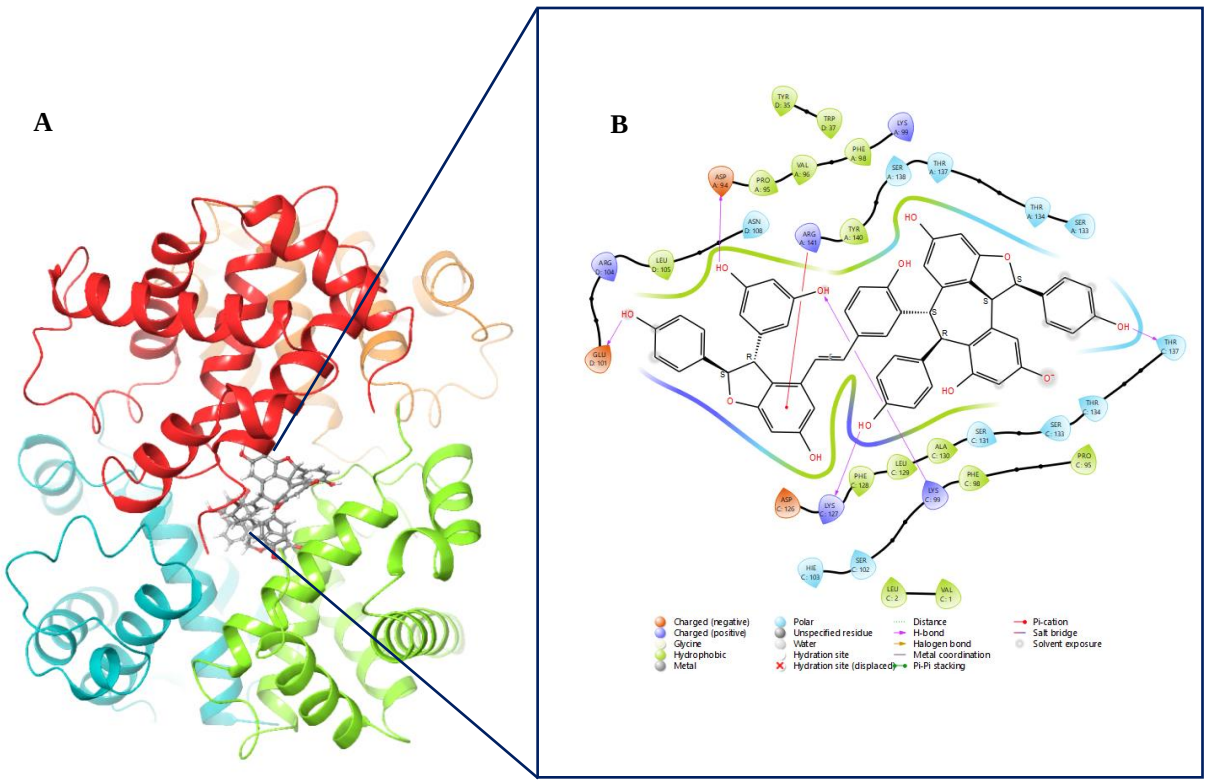


Figure 1. The 3D (A) and 2D (B) interaction representations of vitisin A with the hemoglobin protein.

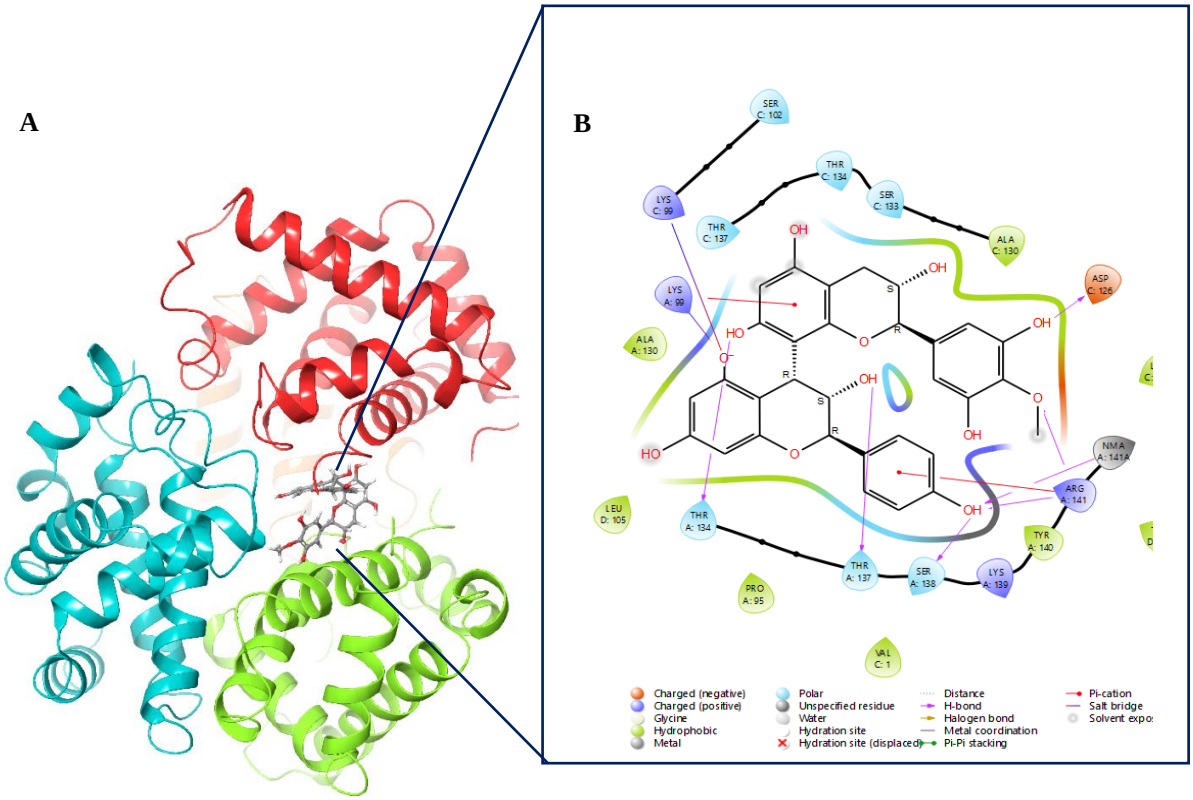


Figure 2. The 3D (A) and 2D (B) interaction representations of proanthocyanidin with the hemoglobin protein.

It has been determined that the active compound proanthocyanidin does not interact with the histidine, valine, and phenylalanine amino acids in the alpha and beta chains of the hemoglobin molecule, which facilitate oxygen binding and contribute to structural stabilization (Figure 2).

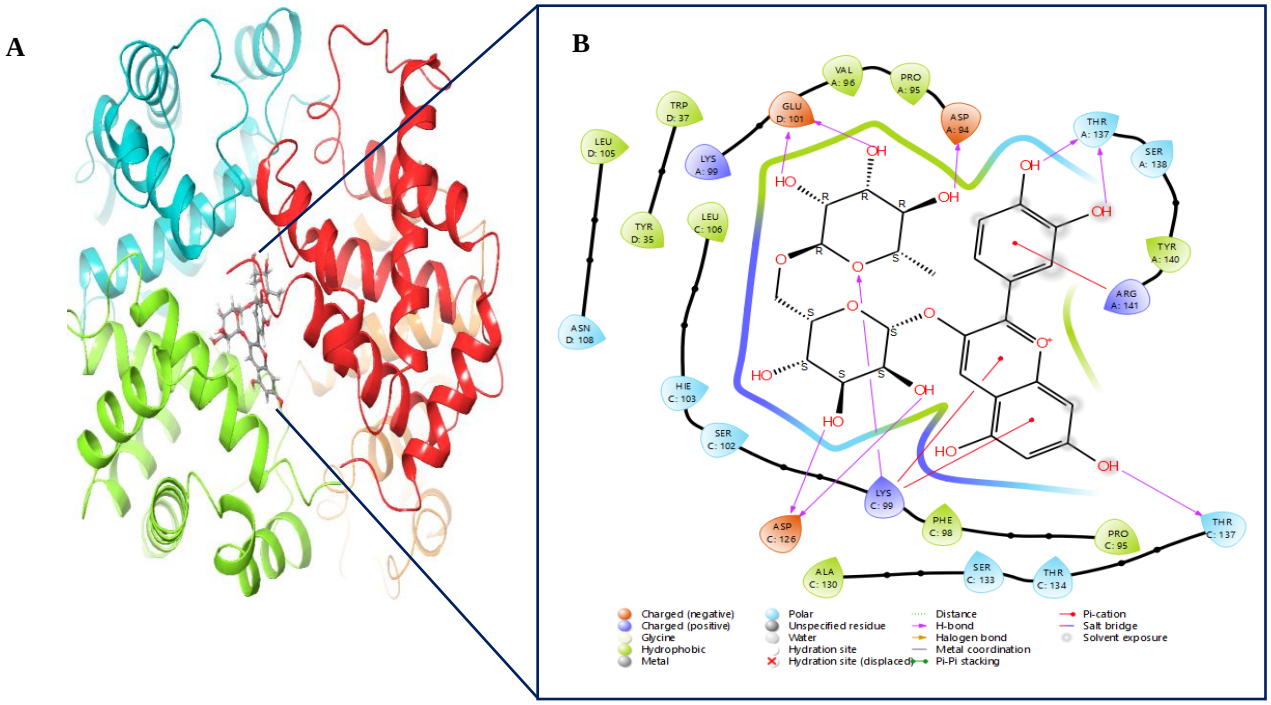


Figure 3. The 3D (A) and 2D (B) interaction representations of anthocyanin a2 with the hemoglobin protein.

The results demonstrated that the hemoglobin molecule can interact with anthocyanin a2. Anthocyanin a2 formed one hydrogen bond with ASP94, LYS99, and THR137, and two hydrogen bonds with ASP126, GLU101, and THR137. LYS99 exhibited two π-cation interactions, while ARG141 showed one π-cation interaction. Consequently, it can be concluded that anthocyanin a2 has relatively lower protein-binding affinity compared to other ligands. Nevertheless, it achieved a satisfactory docking interaction with a docking score of -7.356 kcal/mol. Like the other active compounds, the anthocyanin A2 molecule also did not form any bonds with histidine, valine, and phenylalanine.

In general, all three bioactive compounds were observed to interact with and bind to the asparagine, lysine, glutamine, threonine, and serine amino acids in the hemoglobin molecule. Asparagine and glutamine are negatively charged, whereas lysine and arginine are positively charged. This charge difference enables all three active compounds to form hydrogen bonds, facilitating their interaction with the hemoglobin protein.

Discussion

Anemia is a blood disorder caused by insufficient oxygen delivery to tissues due to low hemoglobin levels within erythrocytes, a reduced number of erythrocytes in the blood, or inadequate functional hemoglobin and erythrocytes resulting from iron deficiency (2). Therefore, the hemoglobin molecule is a key protein in diseases related to the respiratory system. However, in recent years, research has focused not only on its connection to anemia but also on its capacity to reversibly bind various active compounds. This property has led to the idea of utilizing hemoglobin proteins as carriers and distributors for therapeutic purposes by delivering drug-like

molecules, drugs, or bioactive compounds to even the most capillary-level units of the body.

Many plant species are traditionally used to treat various diseases (31). The most commonly used plant species for anemia are reported to be *Vitis vinifera*, *Urtica dioica*, *Rubus canescens*, *Morus nigra*, *Morus alba*, and *Lepidium sativum*. (28). Within the *V. vinifera* species, 16 essential secondary metabolites have been identified through studies (Table 1) (26).

In this study, the interactions between 16 significant phytochemical compounds present in *V. vinifera* and the hemoglobin protein were investigated. The results of this study demonstrate the interaction between human hemoglobin protein (HbA) and 16 bioactive compounds found in grapes, offering an opportunity to evaluate the function of the hemoglobin molecule, which is directly involved in the processes causing anemia, from a different perspective and potentially contributing to anemia treatments. However, it should be noted that focusing solely on the interaction with the hemoglobin protein, while disregarding other processes within the scope of this study, is entirely an in vitro scenario. On the other hand, demonstrating the interaction of the 16 bioactive compounds in grapes with hemoglobin, a carrier protein, contributes to the development of therapeutic approaches based on the reversible transport of bioactive compounds such as tannins and flavonoids via hemoglobin in the future. The results revealed that hemoglobin protein exhibited strong interactions with vitisin A, proanthocyanidin, and anthocyanin a2. The binding affinities of compounds interacting with hemoglobin protein were assessed based on docking score values. Generally, docking scores with binding energy values more negative than -5 kcal/mol indicate stronger ligand binding to the protein, while highly negative scores suggest robust interactions with active sites (32, 33). All ligands were evaluated using the Maestro Schrödinger software package, and the results are summarized in Table 2. Among the 16 phytochemical molecules, the three molecules demonstrating the strongest binding to hemoglobin were vitisin A (-9.144 kcal/mol), proanthocyanidin (-7.791 kcal/mol), and anthocyanin a2 (-7.356 kcal/mol).

All ligands were evaluated using the Maestro Schrödinger software package, and the results are summarized in Table 2. Among the 16 phytochemical molecules, the three exhibiting the strongest binding to hemoglobin were vitisin A (-9.144 kcal/mol), proanthocyanidin (-7.791 kcal/mol), and anthocyanin a2 (-7.356 kcal/mol).

Vitisin A is an anthocyanin-derived compound (34). Anthocyanins, belonging to the flavonoid class, are reported to exhibit antioxidant, antimicrobial, and anticarcinogenic activities (35-39). Anthocyanins serve as the primary and fundamental colorants in grapes. Vitisin A, one of the pyranoanthocyanins, forms through the reaction between malvidin-3-O-monoglucoside and pyruvic acid, an intermediate product of alcohol fermentation. Consequently, pyranoanthocyanins are hypothesized to be present only in stored grapes and aged red wines, and not in fresh grapes (40, 41).

The second highest binding score in this study was observed for proanthocyanidin (-7.791 kcal/mol). Proanthocyanidins are condensed tannins, comprising oligo- or polymers of monomeric flavan-3-ols, which are the end products of the flavonoid biosynthetic pathway. These compounds demonstrate a range of biological effects, including antioxidant, antimicrobial, anticancer, and antidiabetic properties (42-44).

Anthocyanin a2, which achieved the third-highest binding score in our study, has been widely studied for its biological activities, spanning from applications in cancer treatment to contributions to human nutrition, as reported in various studies (45).

As highlighted in the studies above, anthocyanin-derived compounds have been reported to play a significant role in various diseases. Chaudhuri et al. investigated the interactions of two flavonoids, fisetin (3,7,3′,3′,4′-OH flavone) and 3-hydroxyflavone (3-HF), with normal human hemoglobin (HbA) and found that the binding free energy for fisetin was -8.80 kcal/mol, while for 3-HF it was -8.04 kcal/mol. In this study, anthocyanin molecules, one of the active compounds of *V. vinifera*, exhibited stronger binding and interactions with hemoglobin compared to other active compounds (29). It was observed that vitisin A (-9.144 kcal/mol), proanthocyanidin (-7.791 kcal/mol), and anthocyanin a2 (-7.356 kcal/mol) demonstrated more effective results compared to quercetin

(-5.751 kcal/mol) and kaempferol (-5.999 kcal/mol), which are recognized as effective compounds in numerous studies.

Chowdhury et al. investigated the interaction of taxifolin, a flavonoid, with hemoglobin, which functions as both an effective substrate and carrier for various drugs (46). They reported that taxifolin, with a docking score of -5.28 kcal/mol, may be a promising compound for the treatment of blood-related diseases in the future. In this study, the docking scores of vitisin A, proanthocyanidin, and anthocyanin a2 interacting with hemoglobin protein were even lower than -5 kcal/mol, indicating stronger binding affinities.

Normal human hemoglobin (HbA) has the potential to reversibly bind to many endogenous and exogenous molecules or drug compounds (47). Therefore, HbA can enhance the bioavailability of various drugs or flavonoids by binding to them and facilitate their distribution throughout the body via the bloodstream (48). For this reason, understanding the binding properties of therapeutically important flavonoids to HbA and other functionally significant cellular proteins is crucial for elucidating the mechanisms underlying their pharmacological effects. However, to date, little is known about the specific interactions of various secondary metabolites with HbA. In this study, the interactions of 16 active compounds found in grapes with hemoglobin were investigated, and it was observed that three of them (vitisin A, proanthocyanidin, and anthocyanin A2) showed stronger interactions with hemoglobin. This finding highlights their potential promise for future applications in the transport of hemoglobin-bound flavonoids or drugs. The in vivo pharmacological effects of secondary metabolites are closely related to their binding to cellular targets, including proteins, making research on the binding of active compounds to proteins highly significant. This study found that HbA plays an important role in the distribution and bioavailability of flavonoids (48).

One of the notable findings of this study is that none of the three active compounds bind to the regions of hemoglobin involved in oxygen transport. If these active compounds, with their significantly high negative binding scores, were to bind to a region affecting hemoglobin's primary function (e.g., the vicinity of the heme group), such binding could inhibit hemoglobin's oxygen transport capacity, negatively impacting oxygen binding and delivery. In such a scenario, these compounds would be considered inhibitors. To evaluate the inhibitory effects, it is essential to identify the specific binding sites of all three compounds on hemoglobin and conduct more detailed molecular dynamics simulations. Additionally, their effects on oxygen binding and release kinetics should be examined. Studies using cell cultures and animal models are required to assess their impact on the oxygen transport capacity of erythrocytes. Furthermore, pharmacodynamic experiments and molecular biology studies should be performed. This study, in its current state, is considered to provide a guiding framework for future research.

Conclusion

In this study, the interactions between hemoglobin protein and the active compounds in *V. vinifera* were investigated using the molecular docking method. The best-interacting molecules in the plant content have been identified as anthocyanin-derived compounds from the flavonoid class. The interaction of Vitisin A, proanthocyanidin, and anthocyanin A2 with the hemoglobin protein at low binding energies suggests that various active compounds found in *Vitis vinifera* could potentially be effective in the treatment of anemia, provided that other causes such as chronic and autoimmune diseases or deficiencies in iron, B12, and folate are ruled out. On the other hand, the reversible binding properties of various flavonoid- and tannin-derived active compounds with the hemoglobin protein highlight the potential use of the hemoglobin molecule in developing therapeutic approaches for various diseases and drug delivery models. Demonstrating the interactions between the bioactive compounds found in *V. vinifera* and HbA represents a pioneering study in this field.

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Research Article

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Determination of Antimicrobial Activity of Fruit, Branch and Leaf Extracts of Pistachio (*Pistacia vera* L.)

Antep Fıstığı (*Pistacia vera* L.)' nın Meyve, Dal ve Yaprak Özütlerinin Antimikrobiyal Aktivitelerinin Belirlenmesi

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ABSTRACT

Aim: The aim of this study is to investigate the potential of some specific extracts of pistachio plant to be used as antimicrobial agents.
Method: Antimicrobial activity of pistachio plant was determined by agar diffusion test using *Escherichia coli* (ATCC 25922) and *Pseudomonas aeruginosa* (ATCC 27853) strains.
Results: As a result of the study, it was determined that pistachio leaf and branch extracts were effective on both *Escherichia coli* (ATCC 25922) and *Pseudomonas aeruginosa* (ATCC 27853) strains. It was determined that pistachio fruit extract was effective only on *Pseudomonas aeruginosa* (ATCC 27853) strain.
Conclusion: This study showed that pistachio plant has the potential to be used as antimicrobial agents.

Keywords: *Pistacia vera* L., Antimicrobial activity, *Escherichia coli, Pseudomonas aeruginosa,* Gaziantep

ÖZET

Amaç: Bu çalışmanın amacı, antep fıstığı bitkisinin bazı spesifik ekstraktlarının antimikrobiyal ajan olarak kullanılma potansiyelini incelemektir.
Yöntem: Antep fıstığı bitkisinin antimikrobiyal aktivitesi *Escherichia coli* (ATCC 25922) ve *Pseudomonas aeruginosa* (ATCC 27853) suşları kullanılarak agar difüzyon testi ile belirlenmiştir.
Bulgular: Yapılan çalışma sonucunda, antep fıstığının yaprak ve dal özütlerinin hem *Escherichia coli* (ATCC 25922) hem de *Pseudomonas aeruginosa* (ATCC 27853) suşu üzerinde etkili olduğu tespit edilmiştir. Antep fıstığının meyve özütünün ise sadece *Pseudomonas aeruginosa* (ATCC 27853) suşu üzerinde etkili olduğu belirlenmiştir.
Sonuç: Bu çalışma antep fıstığı bitkisinin antimikrobiyal ajan olarak kullanılabilme potansiyeli olduğunu göstermiştir.

Anahtar Kelimeler: *Pistacia vera* L., Antimikrobiyal aktivite, *Escherichia coli, Pseudomonas aeruginosa,* Gaziantep

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Introduction

Humanity has used plants for many of its needs and requirements since its existence and has benefited greatly from them. One of the most common areas of plant use has been the treatment of diseases. People have used and tried to develop many plants that differ according to the region and climate they live in (1). Today, plants are still seen as the most important source in the search for new drugs and in the development of existing drugs. Every day, resistant strains that cause disease are identified and studies are carried out to combat these strains (2). Antibiotics obtained as a result of these studies are used in many fields.

Antibiotics are secondary metabolites produced by plants, animals and microorganisms, which cause other microorganisms in their environment to grow or die. Today, with the unconscious use of antibiotics, various microorganisms living in the human body are becoming resistant to antibiotics (National Academies of Sciences and Medicine, 2018). Many public service announcements and advertisements on antibiotic resistance draw attention to the sensitivity of this issue.

There are only two classes of antibiotics that have been developed and approved by international pharmaceutical organizations (US Food and Drug Administration and European Medicines Agency) in the last 20 years. These are lipopeptides and oxazolidinones. In the last 10 years, the interest of pharmaceutical companies in research and development of new antibiotics has declined and the available antimicrobials are not sufficient for antibiotic resistant bacteria. Due to the decline in interest, re-examination of traditional medicines has become widespread.

The potential for new antimicrobial products from traditional medicine and food plants and the use of pure extracts of plants with traditional antibiotics holds great promise in enhancing the effects of existing antibiotics.

In the literature researches on pistachio (*Pistacia vera* L.) plant, it is seen that their very high nutritional values, many secondary metabolites and phenolic compound richness they contain will enable these organisms to be used as natural antioxidant removers and antimicrobial agent producers. These compounds show that this plant is a producer of many molecules with antimicrobial effects. At the same time, many studies on pistachio trees have indicated that they have antimicrobial effects with the molecules they contain (3).

In this study, the potential of some specific extracts of the pistachio plant, which has high commercial value among the public, to be used as antimicrobial agents was investigated. It is thought that the findings obtained as a result of the study and the high antimicrobial effect value results may lead to future studies on determining active ingredients, optimizing active ingredients and identifying potential new agents.

Materials and Method

Samples were collected as fresh fruit and leaves from commercially produced pistachio trees located in Şahinbey and Nizip districts of Gaziantep province (Figure 1).

Figure 1. Images of pistachio trees (*Pistacia vera* L.) from which the samples were collected.

The collected materials were dried in an oven at 60°C and 80°C. These samples were crushed with a mortar and pestle to prepare the solvent. For pistachio tree samples, 100 ml ethanol and 100 ml DMSO were used as solvents. The solvents were removed by evaporator and dissolved in a mixture of 50% ethanol and 50% water at concentrations of 10%, 20% and 40%. The solvent and raw material mixtures were shaken at 110 rpm in a 25° C and 75° C shaking water bath for 24 hours to allow the compounds in the extract to pass into the solvent. The mixture was filtered through filter paper to eliminate large particles (Figure 2).

Figure 2. Extraction image after drying and crushing process.

For antimicrobial activity, *Escherichia coli* (ATCC 25922) and *Pseudomonas aeruginosa* (ATCC 27853) strains found in our laboratory was used. Microorganism samples were extracted from -20 stocks and bacteria was grown on LB agar medium. Agar diffusion test was performed with standard LB medium using a pour plate application. Wells were opened with a 6 mm diameter cork borer into the prepared MHA medium containing petri dishes and 200 µl of extract was added. The petri dishes were incubated at 37°C in a flat position for 24 hours and the inhibition zone diameters were measured at the end of incubation. DMSO was used as a negative control (4, 5).

Result

In this study, the antimicrobial effects of branch and leaf extracts from pistachio (*Pistacia vera* L.) plant, which are widely used as nutrients, on *Escherichia coli* (ATCC 25922) and *Pseudomonas aeruginosa* (ATCC 27853) strains were determined by the agar diffusion method.

In this antimicrobial activity study conducted against *E. coli* and *P. aeruginosa*, which are among the gram-negative bacteria that are known to cause hospital infections and are widely combated today, antimicrobial activity was observed in the studied samples. The results are given in Figure 3, Table 1 and Graph 1.

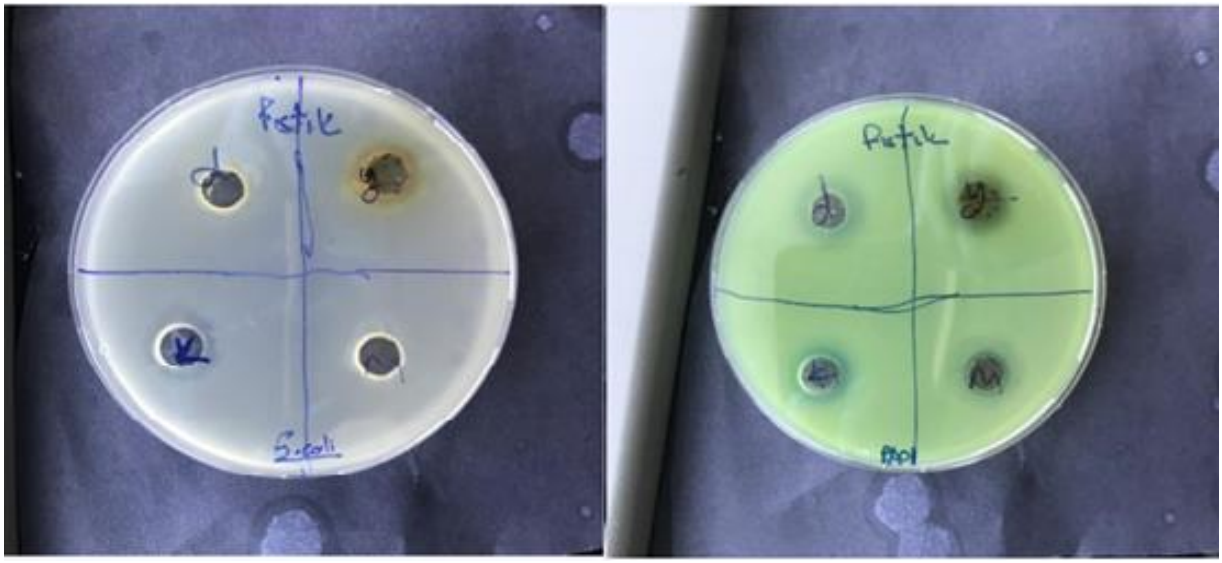
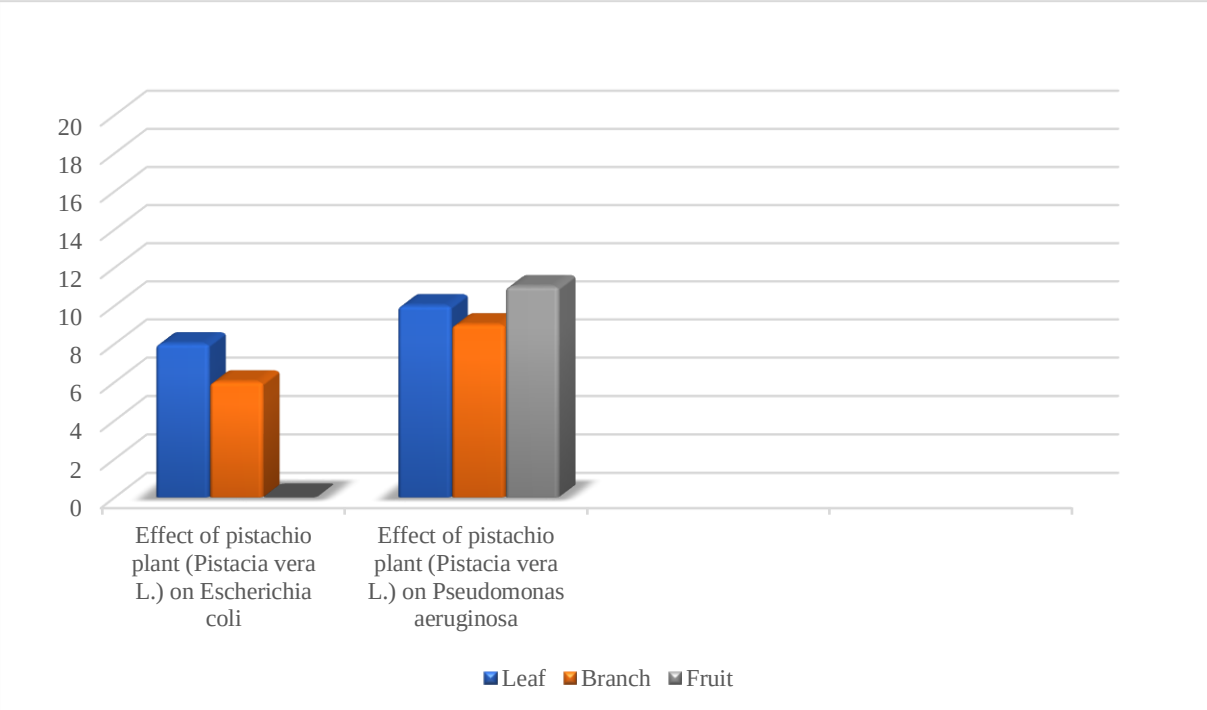


Figure 3. Agar diffusion post-images. Branches are shown as (d), leaves as (y), and the control group as (k).

Table 1. Radius of the zones formed by the control and experimental groups as a result of the experiments.

	Control group zone radii	***Escherichia coli* zone radii**	***Pseudomonas aeruginosa* zone radii**
Pistachio (*Pistacia vera* L.) leaf extract (100 ml)	0 mm	8 mm	10 mm
Pistachio (*Pistacia vera* L.) branch extract (100 ml)	0mm	6 mm	9 mm
Pistachio (*Pistacia vera* L.) fruit extract (100 ml)	0 mm	0 mm	11 mm

Graph 1. Antimicrobial activity of pistachio plant's (*Pistacia vera* L.) branch, leaf and fruit extracts against *Escherichia coli* and *Pseudomonas aeruginosa*.



Discussion

The antimicrobial activity of *Pistacia vera* L. on *E. coli* was determined by both agar diffusion method and MIC values measurements in the study conducted by Smeriglio A. et al. in 2017 by evaluating the antimicrobial activity of *Pistacia vera* L. on *E. coli* by isolating the essential oils of this plant and confirming our study. In the same study, it was reported that it did not increase the antibiotic activity on *Pseudomonas aeruginosa* ATCC 9027 but had an antimicrobial effect on *Pseudomonas aeruginosa* ATCC 9027 according to the results obtained in the experiments to determine the antimicrobial activity when used with some antibiotics (6).

In a study conducted by Atçı E. 2016, in a study to determine the antimicrobial activity of essential oils obtained from *Pistacia vera* L. collected from Şanlıurfa region by agar diffusion method; In the test using 10 µl and 15 µl of *Pseudomonas aeruginosa* extracts, zone diameters of 12 mm and 14 mm were measured, and in the extraction of these extracts with solvents such as methanol and ethyl alcohol, it

was observed that the antimicrobial effect was 14 mm and 13 mm at lower concentrations. In the antimicrobial activity studies for *E. coli* in the same study, a zone diameter of 13 mm was observed in 15 µl of the water-soluble extract, while in extracts using solvents such as chloroform, methanol, ethyl alcohol, ethyl acetate, acetone and hexane, zone diameters of 16 mm 14mm 16mm 16mm 16mm 16mm 14mm 14mm 14mm were observed, respectively (7).

Our study confirms that the results of antimicrobial activity tests of *Pistacia vera* L. on these two organisms are in parallel with our study. The presence of an improvable antimicrobial agent, especially in leaf extracts from the pistachio tree on *Escherichia coli* draws attention. The fact that the pistachio tree fruit has no effect and the presence of an agent in the leaves may lead to the discovery of a new antimicrobial agent or a metabolite that will increase the effect of existing potent agents as a result of future characterization, optimization and active ingredient determination studies on the leaves.

Conclusion

In conclusion; it is clearly seen in our study and in other studies that the antimicrobial effect of samples taken from certain parts of the pistachio plant varies depending on where it is taken. The presence of certain antimicrobial agents in this plant species will only be determined as a result of future studies that will optimize the extraction, concentration and purification techniques of these agents and the factors that will cause the antimicrobial effect and the mechanisms of action.

Author Contribution Statement

Literature review, experimental studies: ASBD
Sample collection, experimental studies: ASBD, ZY, MK

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Review Article

Journal of Health and Biological Sciences

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Earthquake and Qualıty of Life: an Evaluation on Elderly Individuals

Deprem ve Yaşam Kalitesi: Yaşlı Bireyler Üzerine Bir Değerlendirme

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ABSTRACT

Earthquakes can negatively affect the quality of life of elderly individuals in terms of physical health, psychological recovery and social relationships. Physical health problems, difficulties brought about by aging and traumas caused by earthquakes make the recovery process of these individuals more difficult and reduce their quality of life. In addition, the psychological effects of earthquakes can trigger feelings such as stress and trauma, making the psychological recovery process of elderly individuals longer and more difficult. The feeling of social isolation and loneliness experienced after an earthquake, especially when combined with the lack of social support of elderly individuals, can further negatively affect their psychological health. Inadequate housing conditions and the insecurity provided by temporary accommodation areas can disrupt the physical and psychological recovery processes of elderly individuals. Lack of comfort and security concerns in these temporary living spaces can prevent elderly people from recovering quickly. In this context, it is of great importance to develop effective strategies at the national level so that the quality of life of elderly individuals is not negatively affected by earthquakes.
The purpose of this review is to draw attention to the impact of earthquakes on the quality of life of elderly individuals and to lay the foundation for future research.

Keywords: Earthquake, Elderly Individual, Quality of Life, Public Health

ÖZET

Depremler, yaşlı bireylerin yaşam kalitesini fiziksel sağlık, psikolojik iyileşme ve sosyal ilişkiler açısından olumsuz etkileyebilmektedir. Fiziksel sağlık sorunları, yaşlanmanın getirdiği zorluklar ve depremin yol açtığı travmalar, bu bireylerin iyileşme süreçlerini zorlaştırarak yaşam kalitelerini düşürmektedir. Ayrıca depremin psikolojik etkileri; stres, travma gibi duygularını tetikleyerek yaşlıların psikolojik iyileşme süreçlerini daha uzun ve zorlu hale getirebilmektedir. Deprem sonrası yaşanan sosyal izolasyon ve yalnızlık hissi, özellikle yaşlı bireylerin sosyal destek eksiklikleriyle birleşince psikolojik sağlıklarını daha da olumsuz etkileyebilmektedir. Barınma koşullarındaki yetersizlikler ve geçici konaklama alanlarının sağladığı güvensizlik, yaşlı bireylerin fiziksel ve psikolojik iyileşme süreçlerini aksatabilmektedir. Bu geçici yaşam alanlarındaki konfor eksiklikleri ve güvenlik kaygıları, yaşlıların hızlı bir şekilde toparlanmalarını engelleyebilmektedir. Bu kapsamda bakıldığında, yaşlı bireylerin yaşam kalitesinin depremlerden olumsuz etkilenmemesi için, ulusal düzeyde etkili stratejilerin geliştirilmesi büyük bir önem taşımaktadır.
Bu derlemenin amacı, depremin yaşlı bireylerin yaşam kalitesine etkisine dikkat çekerek ileride yapılacak araştırmalar için temel oluşturmaktır.

Anahtar Kelimeler: Deprem, Yaşlı Birey, Yaşam Kalitesi, Halk Sağlığı

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Introduction

In the last century, life expectancy at birth has increased due to developments in public health, advances in medical technology, socioeconomic development, and decreases in fertility and mortality rates. Significant developments in health and health services, improved hygiene measures, and the success of modern medical interventions have resulted in an increasing number of people living longer. It is possible to say that the increase in life expectancy at birth is a result of medical, technological, social, and economic developments. Basically, there has been a gradual increase in life expectancy at birth due to developments in the quality of health services and economic development in developing countries (1). As a result of this, the elderly population has increased. In particular, the elderly population (aged eighty-five and over) has increased significantly. Although the increase in the elderly population is a desirable development, it requires societies to be prepared for this development. The increase in long life expectancy has also brought to the agenda the issue of protecting and improving the quality of life (2). This concept refers to the fact that individuals; It is a comprehensive concept that includes physical health, psychological state, level of independence, social relationships, personal beliefs and relationships with the environment (3, 4). Quality of life is defined as a person's subjective judgment about what happens in their life through their experiences (5). The World Health Organization (WHO) defines well-being as individuals' perceptions of their place in life, shaped by the culture and value systems in which they exist, as well as their goals, expectations, standards, and concerns (3, 4). In this context, it is possible to say that quality of life is an indicator of how satisfied individuals are with their living conditions such as health, social relations and economic status (6). Considering the variability and subjectivity of the concept of quality of life, in order to guide policies for successful aging, it is necessary to know what is related to well-being, happiness, personal satisfaction and finally, to increase the quality of life for the elderly (5). In this context, although there are many factors affecting the quality of life, natural disasters such as earthquakes are one of the important factors affecting the quality of life of elderly individuals (7).

This review aims to pave the way for future research by highlighting the effects of earthquakes on the quality of life of older individuals.

Materials and Method

In this review, literature published between 2000 and 2024 was examined in order to examine the effects of earthquakes on the quality of life of the elderly. International academic databases PubMed, Scopus and Web of Science were used in the literature search process. Different combinations were created in the search process using the keywords “earthquake”, “disaster”, “elderly” and “quality of life” and Boolean operators (“and”, “or”). The inclusion criteria were that the study had a scope that examined the relationship between elderly individuals and quality of life after an earthquake, was published in peer-reviewed journals and had full-text access. Case reports, conference abstracts and editorials were excluded from the review. Since there were a limited number of academic studies on the relevant subject during the literature search process, the review focused on two more primary sources. The first of these sources was a report prepared by Help Age on the displacement experiences of elderly individuals during the 2011 Great East Japan Earthquake and Tsunami. The second source is the guidelines of the Sphere Handbook (4th edition), published by the Sphere Association and setting minimum standards for humanitarian interventions. Both sources were chosen because they provide internationally accepted information, contain comprehensive data on the needs of elderly individuals after disasters, and address humanitarian standards in detail. These sources were accessed and examined via the internet, and their contents were systematically analyzed in line with the purpose of the study and integrated into the compilation.

The Impact of Earthquake on the Quality of Life of Elderly Individuals

Earthquakes are one of the most dangerous and destructive natural disasters that occur suddenly and uncontrollably, affecting the geography

where millions of people live in a very short time (8). A devastating earthquake can lead to a collective sense of mourning due to the loss of emotional relationships, material goods and daily reference points, and the need to redefine life patterns accordingly. The disruption of people's lives and their loss of certainty can affect their physical and mental health both in the short term and in the years following the disaster (9, 10). In addition, earthquakes can cause more loss of life than other types of disasters due to low predictability. Vulnerable groups constitute a high proportion of such losses of life (11). Elderly individuals are also among these vulnerable groups in disasters such as earthquakes (12). The main reasons for their presence in this group include; physical (hearing loss, visual impairment, etc.) or cognitive (dementia, etc.) disability, having one or more chronic diseases (hypertension, cardiovascular diseases, diabetes mellitus, osteoarthritis, etc.), having difficulties with preparations or adaptation before, during and after disasters such as earthquakes (13). This group in particular is disproportionately harmed by earthquakes due to factors such as age-related physical, psychological (14), social isolation, poor financial conditions, limited access to resources and communication difficulties in using modern technologies (15), and social inequality (16-18). For these reasons, elderly individuals are seen as a group that deserves special attention (14). In a study, it was observed that elderly individuals were unable to adapt to environmental changes and perform daily life activities after an earthquake because they had to leave their homes and live in unfamiliar communities and temporary housing (19). In another study, it was observed that the incidence of chronic degenerative diseases increased in elderly individuals after an earthquake and that existing conditions worsened. In this context, earthquakes can lead to many factors that negatively affect elderly individuals in various ways, and these situations can affect the quality of life of individuals (9). Because earthquakes occur without warning and do not give the population the opportunity to psychologically adapt to face the disaster. The lack of predictability, reminders of the destruction, and the need to move due to the collapse of homes can exacerbate emotional reactions associated with trauma, leading to effects ranging from discouragement to serious mental health problems (20). In addition, disasters such as earthquakes may necessitate living in temporary shelters. However, living in such shelters can cause significant changes in the physical, social, economic, and psychological environments, especially for older individuals, and this can negatively affect their health. A study shows that older individuals may have difficulty adapting when they move to a new living space, and this indirectly reduces their quality of life by causing stress, loss of control, and loss of self-identity (21). In addition to these, lack of hygiene, inadequate ventilation and crowding can cause infections to spread quickly and existing chronic diseases of elderly individuals with low resistance to worsen. It has been reported that elderly individuals who were placed in crowded temporary shelters after the earthquake in 2011 in Japan experienced inadequate ventilation, hygiene and nutrition problems (inability to access chewable and diet-friendly food) as well as privacy and adaptation problems. In addition, it has been observed that the lack of movement space in temporary shelters causes elderly individuals with limited mobility to become bedridden, while crowding and noise cause stress, sleep disturbances and fatigue (22, 23). On the other hand, the most important factor affecting the survival of elderly individuals after disasters such as earthquakes is their isolation. However, elderly individuals, who should have a greater place in society with social inclusion; Knowledge and experience in coping with problems after disasters such as earthquakes, preservation of social ties, caregiver support, resource management, and taking an active role in generating income have been effective in healing the wounds that have occurred (24). In this context, it is very important to take measures at the national level to increase the quality of life of elderly individuals (25).

Conclusion

Earthquakes create multidimensional challenges that deeply affect the quality of life of elderly individuals in terms of physical, social and psychological aspects. While physical limitations, chronic diseases and reduced mobility make it difficult for elderly people to adapt to disaster situations, environmental changes and temporary housing conditions that occur after earthquakes make it even more difficult to maintain their physical health. In addition, the disruption of social connections, the

experience of losing loved ones and the weakening of social belonging trigger feelings of loneliness and isolation in elderly individuals, causing a significant decrease in their quality of life. In terms of psychology, problems such as anxiety and depression are among the difficulties that elderly individuals frequently encounter in the post-disaster period. In this context, the development of national strategic plans that take into account the vulnerabilities of elderly individuals is extremely important. Special support services for elderly people in the post-earthquake period can promote both physical and psychological recovery. In addition, strengthening social support systems can facilitate the reintegration of elderly individuals into society. Ensuring food security, regular health screenings, service delivery by mobile health teams and post-disaster rehabilitation programs should be the basic approaches in protecting and improving the quality of life of elderly individuals. It is thought that such measures will not only increase the well-being of elderly individuals, but will also strengthen social solidarity, allowing the elderly to live a more dignified and quality life.

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Review Article

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Lotus Birth Method and Nursing Care

Lotus Doğum Yöntemi ve Hemşirelik Bakımı

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ABSTRACT

Lotus birth, or not cutting the umbilical cord, is a practice in which the umbilical cord is not separated from the placenta after birth, but is instead allowed to dry and fall off on its own. It is practised in regions such as the USA, Australia, New Zealand and India, including our country, albeit to a lesser extent. Studies on lotus birth are limited in the literature. While it has benefits such as an increase in mother-baby bonding, a healthier puerperium process for the mother, and babies whose cord is not cut immediately after birth are calmer and more peaceful than babies whose cord is cut immediately after birth, there are also risks that threaten the life of the newborn such as hyperbilirubinemia, endocarditis, idiopathic hepatitis, staphylococcal infection, sepsis and neonatal omphalitis. Healthcare workers (physicians, midwives and nurses) should be provided with in-service training on the subject and pregnant women requesting lotus delivery should be informed about the positive and negative aspects of the method and this method should be explained in detail.

Keywords: Lotus delivery, Placenta, Umbilical cord.

ÖZET

Lotus doğum veya göbek bağının kesilmemesi, göbek bağının doğumdan sonra plasentadan ayrılmadığı, bunun yerine kurumasına ve kendi kendine düşmesine izin verilen uygulamadır. Ülkemiz dahil ABD, Avustralya, Yeni Zelanda ve Hindistan gibi bölgelerinde az da olsa uygulanmaktadır. Literatürde lotus doğum ile ilgili çalışmalar sınırlıdır. Anne ile bebek bağlanmasında artış, annenin daha sağlıklı bir lohusallık süreci geçirmesine, doğumdan sonra kordonu hemen kesilmeyen bebeklerin, kordonu hemen kesilen bebeklere oranla daha sakin ve huzurlu olması gibi yararları varken, hiperbilirubinemi, endokardit, idiyopatik hepatit, stafilokok enfeksiyonu, sepsis ve neonatal omfalit gibi yenidoğanın hayatını tehdit eden riskler de bulunmaktadır. Sağlık çalışanlarına (Hekim, Ebe ve Hemşire) konu ile ilgili hizmet içi eğitim verilmesi sağlanarak, lotus doğumu talep eden gebelere yöntemin olumlu ve olumsuz yönleri hakkında bilgi verilerek bu yöntem hakkında detaylı bir şekilde açıklanmalıdır.

Anahtar Kelimeler: Lotus doğum, Plasenta, Göbek kordonu.

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Introduction

The placenta forms a life link between the foetus and the mother during pregnancy. It plays a role in distributing all the necessary nutrients and oxygen between the mother and the foetus through the vessels in this life link. By strengthening the bond between the mother and the baby, the placenta may help mothers to increase their interest in birth rituals and prefer lotus birth (1).

Lotus Birth or uncut umbilical cord is the practice of not clamping the umbilical cord after birth, instead of clamping and cutting the umbilical cord (2). Here, the umbilical cord and placenta are waited until they dry and fall off naturally from the newborn. This practice can last between 3 and 10 days on average (3). In lotus labour, the third stage of labour is managed passively, without the administration of uterotonic drugs and without pulling on the cord. After birth, the placenta is washed, salted and covered with an absorbent material. Sometimes, plants such as lavender are used as it can help to keep bad odour away (4). Lotus birth method is practised in regions such as USA, Australia, New Zealand, India and Tibet, including Turkey (5).

Lotus birth is preferred by pregnant women in our country, albeit in small numbers (6). It is important that midwives and nurses who encounter pregnant women who prefer lotus birth have information on the subject. Studies on lotus birth are limited in the literature (6, 7). In this review, it is aimed to share current information about lotus birth and to provide information about lotus birth to healthcare professionals and pregnant women.

History of Lotus Birth

In the animal world, mothers usually eat their own placenta after birth. But Jane Goodall's observations in her studies were different. Instead of eating the placenta after birth, chimpanzees left it for a long time without severing the cord and without eating the placenta. These studies inspired the emergence of Lotus Birth (7).

In the 1970s, Claire Lotus Day, a healer living in San Francisco, was conducting various researches during her pregnancy and was intrigued by the observations of the famous primatologist Jane Goodall about chimpanzees. After noticing that mother chimpanzees leave their babies attached to the placenta after birth and do not cut the cord, Claire Lotus Day began to be known as the first woman to perform Lotus Birth in the Western world after she discussed various rituals related to the baby and placenta in countries such as New Zealand and Bali. After hearing about this practice, many mothers and birth professionals who heard and adopted the idea of lotus birth paved the way for the spread of this method all over the world (8).

In 1974, when Claire Lotus Day gave birth in Australia, she requested that her baby's umbilical cord not be cut. In the same year, Shivam Rachana in Australia and Jeannine Parvati Baker, a midwife and yoga master in the USA, became strong advocates of this practice (5).

Although the prevalence of lotus birth is not known, it is known to be widespread in certain regions of Australia, Turkey, USA and Italy. Although approximately 100 women per year want to give birth with this ‘integral birth method’ or ‘lotus birth’ application, it is known that lotus births cannot be performed due to the lack of hospital procedures. The incidence of lotus birth in our country is low. There is a phenomenological qualitative study on women experiencing lotus birth in our country (6). The application steps of lotus birth are summarised in Table 1 (9, 10).

Table 1. Lotus birth application steps.

1- The umbilical cord is left intact when the baby is born. If the cord is around the baby's neck, it is removed.	**2-** The placenta is expected to be born naturally. Oxytocin is not used.	**3-** When the placenta is born, it is placed in a bowl next to the mother	**4-** Before the placental procedure is performed, a complete transfusion of umbilical blood to the baby is awaited.
5- If leakage occurs, the bag is changed daily or more frequently. Alternatively, the placenta can be covered with sea salt	**6-** The placenta is wrapped in absorbent cloth and placed in a placenta bag.	**7-** The placenta is placed in a sieve or colander for 24 hours to ensure drainage	**8-** The placenta is gently washed with water and then dried

Table 1. Lotus birth application steps (continued).

9- The mother holds and feeds her baby as she wishes	**10-** The baby is loosely covered	**11-** The doll can be washed in the usual way. The placenta is kept with the baby	**12-** Movements of the baby and placenta are kept to a minimum

Lotus Birth Types

1. Full Lotus Birth

Full lotus birth is defined as the placenta-baby-cord triad in which the umbilical cord and placenta of the newborn dry up and fall off, lasting 3-10 days (11).

2. Short Lotus Birth

Short lotus delivery is defined as the umbilical cord of the newborn remaining unclamped and uncut for 4-6 hours (11).

Benefits of Lotus Birth

As the newborn receives all the blood from the placenta, it can be adequately nourished with all the nutrients and stem cells it needs. Remembering the presence of the baby at every moment, instead of cutting out everything related to the birth, helps the mother to have a more positive and beautiful puerperium. It can have a positive effect on the attachment process of mother and baby. Keeping mother and baby together for a longer period of time can help the mother to cope with puerperium syndromes more easily. Since babies are attached to the placenta, they remain more stable and are moved less, which helps babies to feel safe. It has been observed that babies whose cord is not cut immediately after birth are calmer and more peaceful than babies whose cord is cut immediately (12).

Contraindications to Lotus Birth

The arguments for and against lotus delivery focus on the physiological effects of the placenta, umbilical cord function and fetal circulation. Will it hinder or enhance the newborn's adaptation to life outside the womb? Lotus delivery is contraindicated in maternal and neonatal emergencies such as maternal haemorrhage, separated placentas (such as placenta previa and abruption of placenta), placental abnormalities (13). Other contraindications include traumatic births and the following placental attachment abnormalities.

1. Placenta accreta - The placenta is attached too deeply into the uterus.

2. Placenta increta - Not only is the placenta attached too deep into the uterus, but the placenta extends into the muscle, even deeper into the muscle wall of the uterus.

3. Placenta percreta - The placenta grows into the uterus, muscles and surrounding organs such as the bladder and intestines.

These emergencies and other obstetric disorders can cause further harm to the patient if active treatment is not given in the third stage of labour. In some cases, such as placental attachment abnormalities, the patient may require emergency surgery for hysterectomy. In obstetric emergencies, active management of the third stage of labour may be required. It is mandatory for lotus birth practitioners to screen their patients for potential risk factors that may be contraindicated for lotus birth (13).

Risks of Lotus Birth

Critics of lotus birth argue that the potential risk of infection for the newborn increases if the placenta becomes infected. Infection can be rapidly passed to the baby. Since most health care providers are not familiar with lotus birth, it may not be allowed in some hospital settings. Also, obstetric staff may not be willing to assist with the practice. This practice may expose the newborn to potential trauma if the cord is accidentally pulled or severed. Finally, the placenta and cord can decay if not cared for properly (14).

Danger Signs After Lotus Birth

Although there are benefits of lotus birth, there are also risks such as hyperbilirubinemia,

endocarditis, idiopathic hepatitis, staphylococcal infection, sepsis and neonatal omphalitis that threaten the life of the newborn. For these reasons, attention should be paid to the following danger signs in newborns born with lotus birth;

- Body temperature more than 38º C
- Any swelling, redness, warmth in or around the umbilicus
- Sleeping more than usual
- Malnutrition

It is difficult to recommend lotus delivery method to pregnant women because of the risks mentioned for newborns. Considering the benefits of lotus delivery, it may be recommended to apply individualised developmental care, especially waiting for the pulsation to stop in cord clamping of the newborn (15).

Nurse's Role and Responsibilities in Lotus Delivery

- When nurses plan lotus delivery for pregnant women, they should question the patient's past medical history.

- The nurse should inform the patient and her relatives about the benefits and risks of lotus delivery.

- The nurse should anticipate actual and potential problems that may arise from lotus delivery.

- The nurse should prepare all materials and equipment needed for lotus delivery.

- The nurse should warn the mother to avoid pulling the placenta while breastfeeding the baby.

- The nurse should encourage the mother to care for the baby's skin and socialise with relatives.

- The nurse should inform the doctor in case of possible trauma or accidental rupture of the umbilical cord (13).

Conclusion

Lotus birth is a holistic approach that keeps the baby and placenta connected to each other after birth and allows the placenta to separate naturally. In line with the available data, lotus birth has benefits such as an increase in mother-baby bonding, a more positive puerperium process for the mother, and babies whose cord is not cut immediately after birth are calmer and more peaceful than Babies whose cord is not cut immediately after birth are calmer and more peaceful than babies whose cord is cut immediately after birth. It should be ensured that an infrastructure is established for healthcare professionals to provide the necessary training and support to pregnant women. In addition, it is important to continue social awareness-raising activities and to carry out more studies on the subject in order to raise awareness.

Author Contribution Statement

Conceptualization or/and Methodology: OP, RK, MS
Data curation or/and Analysis: OP, RK, MS
Funding acquisition: OP, RK, MS
Investigation: OP, RK, MS
Project administration or/and Supervision: OP, RK, MS
Resources or/and Software: OP, RK, MS
Validation: OP, RK, MS
Visualization: OP, RK, MS
Writing: original draft or/and review & editing: OP, RK, MS

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