

- **YouTube as a source of patient information for Diabetes:
Evaluation of Arabic content.**

Algeffari M ,Alnughaymishi A, Alghaith B, Almogbel T

- **Public Awareness of Audiology and Speech-Language Pathology
in Saudi Arabia.**

Ahmad A. Alanazi, Sarah S. Al Fraih

- **Movement sequence analysis of cephalocaudal and hip regions during
various phases of selected daily activities.**

Rae S Alqhtani

- **Nurses' knowledge about the discharge plan for patients after cardiac
surgery at the Sudan Heart Institute.**

Ahmed Abdalla Jarelnape

**IN THE NAME OF ALLAH,
THE MOST GRACIOUS,
THE MOST MERCIFUL**

Kingdom of Saudi Arabia
Ministry of Education
Majmaah University



MJHS

Majmaah Journal of Health Sciences

A Refereed Academic Journal Published Biannually by the
Publishing and Translation Center at Majmaah Universtiy

Vol. 9, Issue 2, April - 2021, Shaban - 1442 P ISSN: 1658 - 645X E ISSN: 1658 - 8223



Publishing & Translation Center - MU

About the Journal

Majmaah Journal of Health Sciences

Vision

The Majmaah Journal of Health Sciences shall be an international peer reviewed journal, which intends to serve researchers through prompt publication of significant advances, and to provide a forum for the reporting and discussion of news and issues concerning health sciences.

Mission

To lead the debate on health and to engage, inform, and stimulate the academicians, researchers, and other health professionals in ways that will improve outcomes for patients.

Objectives

To promote research & evidence based practice in health sciences, so that a firm scientific knowledge base is developed, from which more effective practice may be evolved.

To ensure that the results of the research are rapidly disseminated to the practicing clinicians and educators, in a fashion that conveys their significance for knowledge, culture and daily life.

Correspondence and Subscription

Majmaah University, Post Box 66, AlMajmaah 11952, KSA

email: info@mjhs-mu.org website: mjhs-mu.org

© Copyrights 2016 (1437 H) Majmaah University

All rights reserved. No part of this Journal may be reproduced in any form or any electronic or mechanical means including photocopying or recording or uploading to any retrieval system without prior written permission from the Editor-in-Chief.

All ideas herein this Journal are of authors and do not necessarily express about the Journal view

Majmaah Journal of Health Sciences

Editorial Board

Editor-in-Chief

Dr. Khalid Mohammad Alabdulwahhab
Associate Professor of Ophthalmology and Dean of College of Medicine
College of Medicine
Majmaah University

Members

Dr. Abdul Aziz Bin Dukhyil
Associate Professor – Biochemistry and Molecular Biology
College of Applied Medical Sciences
Majmaah University, Saudi Arabia

Dr. Mohammed Alaidarous
Associate Professor – Biochemistry and Structural Biology
College of Applied Medical Sciences
Majmaah University, Saudi Arabia

Prof. S. Karthiga Kannan
Professor – Oral Medicine and Radiology
College of Dentistry
Majmaah University, Saudi Arabia

Dr. Elsadig Yousif Mohamed
Associate Professor – Community Medicine
College of Medicine
Majmaah University, Saudi Arabia

Dr. Khalid El Tohami Medani (Secretary)
Associate Professor – Community Medicine
College of Medicine
Majmaah University, Saudi Arabia

Majmaah Journal of Health Sciences

Editorial Board

Members

Dr. Mohamed Sherif Sirajudeen
Assistant Professor – Neuromusculoskeletal Rehabilitation
College of Applied Medical Sciences
Majmaah University, Saudi Arabia

Dr. Shaik Abdul Rahim
Assistant Professor – Neuromusculoskeletal Rehabilitation
College of Applied Medical Sciences
Majmaah University, Saudi Arabia

Dr. G. Arun Maiya
Dean -School of Allied Health Sciences
Professor- Dept. of Physiotherapy, SOAHS, MAHE
Chief- Centre for Diabetic Foot Care & Research-Kasturba Hospital
Manipal, India

Dr. Kandasamy Ganesan
Consultant and Senior lecturer - Oral Surgery
Southend University Hospitals NHS Trust and University of Leeds
United Kingdom

Professor. Mark Slevin
Professor- Cell Pathology,
Manchester Metropolitan University
United Kingdom

Professor. Mazen Khalil Qato
Professor- Pharmacology, Medical Education
UIC, College of Medicine
United States of America

Majmaah Journal of Health Sciences

Editorial Board

Members

Professor. Mohamed Ahmed Abdeladir Elimam Ounsa
Dean - Faculty of Graduate Studies and Scientific Research
Professor- Obstetrics and Gynaecology,
The National Ribat University
Sudan

Professor. Mohammed Othman AIRukban
Professor- Family Medicine,
King Saud University
Saudi Arabia

Dr. Qaiser Iftikhar Sheikh
Lecturer- Molecular Biology and Biotechnology,
University of Sheffield
England, United Kingdom

Professor. Dr. B.P. Shelley
Professor and Head – Dept. of Neurology,
Yenepoya Medical College,
Mangalore, India

Professor. Dr. Abdullah Alkhenizan
Professor- Family Medicine
King Faisal Specialist Hospital and Research Center,
Alfaisal University,
Saudi Arabia

Professor. Sayed Tantawy
Professor- Physiotherapy,
College of Medical and Health Sciences,
Ahlia University,
Bahrain

Professor. Dr. B.P. Shelley
Professor and Head – Dept. of Neurology,
Yenepoya Medical College,
Mangalore, India

Majmaah Journal of Health Sciences

Associate Editors

Dr. Asad Farhan
Assistant Professor – Pediatrics

Dr. Kamran Afzal
Lecturer – Physiology

Dr. Manikandan Palanisamy
Associate Professor – Microbiology

Dr. Mohammad Alkhamees
Assistant Professor – Urology

Dr. Mohammed Nazeer
Assistant Professor – Anatomy

Dr Saikarthik Jayakumar
Assistant Professor in Anatomy

Dr. Anand Paramasivam
Professor of Physiology

Dr. Saleem Shaikh
Lecturer - Oral Pathology

Dr. Syed Yousaf Kazmi
Assistant Professor - Microbiology

Dr. Mohamed Ibrahim Waly
Associate Professor – Biomedical and System Engineering

Editorial

From Editor's Desk.....



At the outset let me express my gratitude to our beloved Rector Dr.Khalid Bin Saad Al Meqrin and Vice Rector for Graduate Studies and Scientific Research Dr. Ahmad Alromaih for the trust endowed upon me.

It's a high time for humanity in the battle against COVID-19 pandemic; the Ministry of Health has initiated mass vaccination campaign and started more than 500 centers in the Kingdom. The ministry reported that the rate of the vaccination appointments has gone up, as the "Sehhaty" app has made it easy for the citizens and residents to book their appointments and know the location of the centers providing the vaccine. The ministry also reassured the public that the vaccines approved in the Kingdom are effective and safe. The editorial team support and encourage everyone to get vaccinated as early as possible and join the fight against COVID-19 pandemic.

MJHS is happy to bring forth its 2nd issue of Vol 9: 2021 on time. The editorial team strives hard to publish all issues on time; as we believe that being punctual helps to establish reputation of MJHS as dependable and consistent. I express my sincere thanks to the international panel of experts and team of associate editors for their efforts to improve the publication process of MJHS office.

Authors who are submitting their research in MJHS are encouraged to enrich their scientific contributions by plagiarism checking and get their manuscripts professionally edited prior to submission; especially the authors for whom English is a second language. However, the language editing does not guarantee publication and any costs incurred are the sole responsibility of the author.

The editorial team would like to thank all authors, reviewers, readers for your continuous support for the success of MJHS.

Dr.Khalid Mohammed Alabdulwahhab

Editor in Chief



Contents

Original Article

YouTube as a source of patient information for Diabetes: Evaluation of Arabic content

Algeffari M ,Alnughaymishi A,Alghaith B,Almogbel T..... 1

Complete Blood Counts among chronic patients of Helicobacter pylori infection

*Ahmed Mohammed Elnour Elkhalifa, AbdElhadi M Agha, Abdelhakam G. Tamomh,
Areej FA Hassan, Fatima MH Albasheer, Sakna GK Omer, Anass M. Abbas,
Abozer Y Elderbery..... 12*

Prevalence, Predictors and Prognostic Impact of Renal Dysfunction among Hospitalized Patients with Systolic Heart Failure

*Raneem Abdulraheem Alraheili, Mohammed Abdullah Saeed, Amjad Taj Karam,
Faris Abdulmuti Alhejaili, Faisal Owdah Alatawi, Sami Abdo Al-Dubai..... 23*

Public Awareness of Audiology and Speech-Language Pathology in Saudi Arabia

Ahmad A. Alanazi, Sarah S. Al Fraih 36

Prevalence of Impacted Third Molars in AZ-Zulfi Region of Saudi Arabia: A Cross-sectional Study

*Mohammed Abdulaziz Almidaj, Rakan Mohammed Al-abduljabbar, Abdulrahman Abdullah
Altariqi, Mohammed Khalaf Almaymuni, Ahmed Abdulrahman Alahmed,
Ahmed Abdulrahman Alahmed, Divakar Thiruvankata Krishnan,
Karthiga Kannan Subramania Pillai..... 52*

Movement sequence analysis of cephalocaudal and hip regions during various phases of selected daily activities

Rae S Alqhtani..... 62

Contents

Nurses' knowledge about the discharge plan for patients after cardiac surgery at the Sudan Heart Institute

Ahmed Abdalla Jarelnape 71

Prevalence of common work-related musculoskeletal disorders among population of Najran University, Saudi Arabia

Rae S Alqhtani, Muhammad Y Mughal 80

Antagonistic Activity and Probiotic Potential of Lactobacillus sp. isolated from fermented dairy products from Majmaah

Johra khan 89

Wet cupping (Hijama) positively and significantly impacted multiple hematological parameters

Abdulraheem Alshareef, Ahmad Alsaedi, Ahmad Abdulaziz Alnakhli, Abdulrahman Amer Albeladi, Raed Saad AlHejili, Mohammed Siddig Younis..... 98

Review Article

Lumbar Segmental Instability Classification: Functional, Structural and Multiple Instability

Faisal Mohammed Alyazedi..... 113

Case Report

Third (Intermediate) head of gastrocnemius muscle; a case report and literature review

Mohammed Abdelsalam Ahmed Abdelmotalab..... 124

Original Article :

YouTube as a source of patient information for Diabetes: Evaluation of Arabic content

Algeffari M¹ ,Alnughaymishi A², Alghaith B², Almogbel T³.

1. Diabetologist Consultant, Assistant Professor of Diabetes and Family Medicine, College of Medicine, Qassim University, Buraydah, Saudi Arabia.
2. General practitioner, Ministry of Health, Buraydah, Saudi Arabia.
3. Diabetologist Consultant, Diabetes and Endocrinology Center, King Fahad Specialist Hospital, Buraydah, Saudi Arabia.

Received on July 04, 2020, Accepted October 19, 2020 dx.doi.org/10.5455/mjhs.2021.02.002

Corresponding Author:

Algeffari M: Diabetologist Consultant, Assistant Professor of Diabetes and Family Medicine, College of Medicine, Qassim University, Buraydah, Saudi Arabia.

Phone number :00966504950590

E-mail address: mgeffari@qumed.edu.sa

Abstract

Background & Aims:

We aimed in this study to evaluate the Arabic content related to diabetes mellitus, assess its accuracy, and viewers' responses.

Methods:

Using the search term "diabetes mellitus" in Arabic with the filter by relevance function, a YouTube search was performed on May 15, 2018. The first 200 videos were retrieved, and video demographic assessment was recorded (likes, dislikes, and upload dates). The content of videos was classified in three groups as 1) reliable, meaning scientifically accurate for diabetes; 2) misleading, which means the information contained scientifically inaccurate or unproven information; and 3) patient experiences, where the content pertained to the personal experiences of patients and did not provide diabetes medical information.

Result:

A total of 1,27000 videos were retrieved, the first 200 videos were evaluated, and 71 videos were excluded. In the classification for accuracy, the researchers showed a very good inter-rater agreement ($k = 0.84$).

الملخص

الخلفية و الاهداف :

تهدف الدراسة لتقييم لمحتوى العربي المرتبط بمرض السكري في موق اليوتيوب وتقييمه واستجابة المشاهدين له .

طريقة البحث :

باستخدام كلمة البحث « السكري » باللغة العربية باستخدام الفلتر في اليوتيوب بتاريخ ١٤ مايو ٢٠١٨م تم استخراج أول ٢٠٠ فيديو (٢٠٠ فيديو / ١٠ صفحات) وتم تقسيم الفيديوهات الى ثلاث مجموعات ١. صحيح او دقيق والتي تحتوي على معلومات صحيحة او علميه موثوقه , ٢. غير صحيح او اغير دقيق وهي تحتوي على معلومات علميه غير موثوقه او مغلوطة , ٣. وتجربة المريض والتي لها علاقة بتجربة المرض فقط ولا تستخدم معلومات طبيه .

النتائج :

١٢٧٠٠ فيديو استخرجت في البحث تم اختيار اول ٢٠٠ فيديو وتقييمها استبعد ٧١ فيديو اكثر من نصف الفيديوهات اعتبرت صحيحة (٧٨-٦١٪) , ٤٧ غير دقيقه (٣٦٪) , ٤ فيديوهات كتجربة مريض (٣٪). بالنسبة للفيديوهات الغير دقيقه علاج السكري باستخدام الطب البديل بنسبة عالية من المستخدمين ٧٤٪ , ٣٠ فيديو ٢٣ منهم تطرقوا الى العلاج بالاعشاب .

الإستنتاج :

هذه الدراسة تدعم أن الفيديوهات العربية الوجوده في اليوتيوب ليس ذو قيمة وفائدة كبيره . الفيديوهات المصنفة انها صحيحة او دقيقه

Overall, more than half were considered reliable (n = 78; 61%), (n=47; 36%) were determined misleading, and (n= 4; 3%) videos as patient experiences. Regarding misleading videos, the treatment of diabetes using alternative medicine comprised the largest group of users at 74.5%, n=30. Of those, 23 of the misleading videos promoted herbal medicine.

Conclusion:

This study supports that YouTube videos in Arabic are not very helpful. Overall, reliable content videos received fewer views than those determined to be misleading. Professional institutions, health care providers, and academic sources need more encouragement to develop and upload videos on the management and evidence-based treatment of diabetes.

Keywords:

Diabetes mellitus, Arabic, YouTube, patient.

حصلت على نسبة مشاهدة اقل من تلك المصنفة انها غير دقيقه . ان دور المؤسسات الصحية ومقدمي الخدمة والممارسين الصحيين والخبراء والمؤسسات الأكاديمية مهم في تطوير وتقديم فيديوهات لها علاقة بالسكري وعلاجه

Introduction

People diagnosed with diabetes mellitus (DM) has risen dramatically over the last two decades. More than 382 million cases worldwide have been reported, with 90% of those diagnosed with type-2 diabetes mellitus.¹ In Arab countries, of the 35 million people diagnosed, North Africa and the Middle East lead the world in the highest type-2 diabetes mellitus, where one in 10 people live with the disease. By 2035, the number of people with diabetes is expected to increase by 96.2%.¹ The advent of social media becoming increasingly popular provides a quick and convenient source for patients looking for health-related news and information. Recent stud-

ies have shown that the Internet serves as a primary outlet for patients seeking medical-related knowledge and information. Patients' browsing habits show that 80% of their online activity is seeking knowledge, medical support, and information.^{2,3} YouTube serves as the second most popular website visited around the globe and in Arab countries.⁴ Unfortunately, after evaluating its content, studies have concluded that YouTube consists of faulty and misleading medical-related content, with the majority of researchers agreeing that patients could be misled or misinformed about their health in accessing the site.⁵⁻¹¹ The Internet poses a major source for diabetic patients to self-educate¹² and is an ev-

er-growing outlet for health organizations and hospitals to inform patients on health-care issues. The quality of those sources, though, is not congruous to the availability of these videos. The enormity in the number of educational videos uploaded to YouTube daily oftentimes makes these videos inaccessible to users.

If diabetes-related material could be presented on YouTube in the Arabic language, it could educate Arabic patients and caregivers in a more meaningful and more widely-understood format.¹³ To the best of our knowledge, no studies exist that assess Arabic content provided by YouTube on the subject of diabetes. This study aimed to analyze Arabic content on YouTube for accuracy and assessed viewers' responses as it pertains to diabetes videos.

Methods

A YouTube search was performed on May 15, 2018, using the search term “diabetes mellitus” in Arabic with the filter by relevance function. Excluded were non-Arabic videos, duplicate videos, and those without audio functions or unrelated to our focus. Cookies and the computer's history were cleared to have no effect on the search results. Overall, 1,27000 videos were found. The first 200 (20 videos/page, ten pages) videos were retrieved as a sample, assuming that most users would not venture

beyond this point. Furthermore, similar sample sizes were used in previous work of qualitative methods assessing YouTube videos compared to our analysis.¹⁴⁻¹⁶

The video demographic assessment recorded likes, dislikes, upload dates and source information, video length, and the number of views. To assess the number of mean views per day, a calculation was determined to divide the total amount of views by the number of days since the videos had been uploaded online. Classifications were assigned to identify the upload source. These included health care professionals (HCP), personal users, academic/hospital/professional institutions (PA), and others by using information from their YouTube profile in the “about” listing. Independent two researchers watched each video and made determinations regarding their scientific merit and accuracy (Al-nughaymishi and Algeffari). A third independent researcher (Diabetologist Consultant) was used to resolve any disputes between the two researchers on the content of the videos and served as the final decision maker (Almogbel). Three groups of classifications resulted from viewing the contents of the videos as 1) reliable, meaning scientifically accurate for DM; 2) misleading, which means the information contained scientifically inaccurate or unproven information; and 3) patient ex-

periences, where the content pertained to the personal experiences of patients and did not provide DM medical knowledge. If a video content included two categories, reliable and misleading information, “misleading” was used as the default. The videos were further broken down into seven different diet, complications, interviews, education, management, symptoms, and general information.

Descriptive statistics were given for all variables. Interrater agreement was calculated using the Cohen kappa test. The kappa value was classified as a poor agreement when <0.20 , fair when $0.21-0.40$,

moderate when $0.41-0.60$, good when $0.61-0.80$, and very good when >0.81 . [17] Differences between groups were compared using one-way analysis of variance (ANOVA). A p-value of less than 0.05 was considered significant. All statistical analyses were done on version 20 (SPSS Inc., Armonk, NY: IBM Cor.).

Result

The initial search using the term “Diabetes Mellitus” in Arabic resulted in finding 1,27000 videos. Out of the first 200 videos (20 videos/page, ten pages), 129 was the final number included in the analysis after 71 videos were excluded (Fig. 1).

Figure 1: Flow diagram showing search strategy:

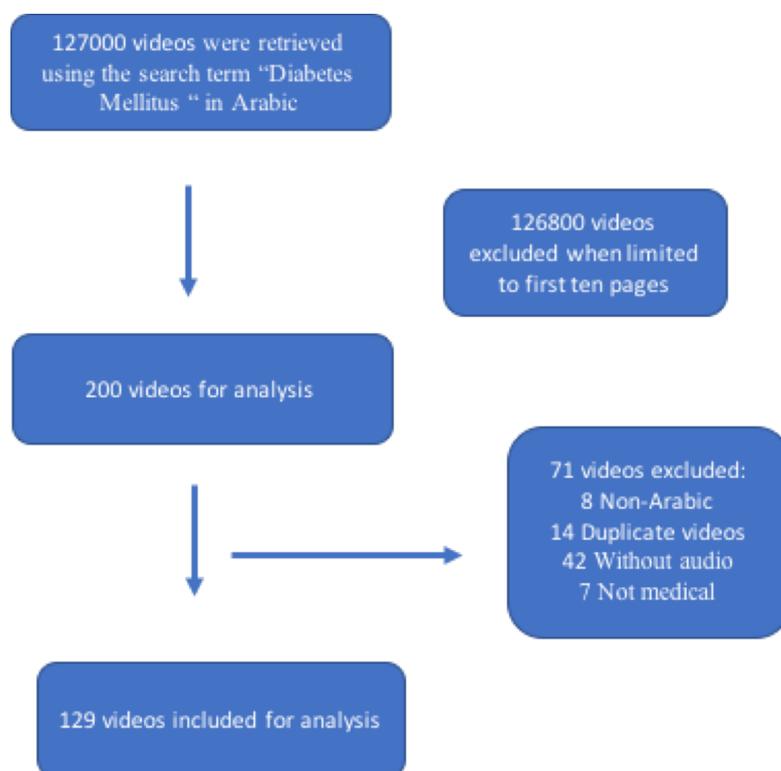


Table 1 provides a list of characteristics for the 129 videos deemed eligible for the analysis. In terms of time, the videos ranged from 40 seconds to two hours long. The median runtime was determined to be 4.1 minutes. The median total number of views was 29,464. The range for the number of views ran between 40 to 3,234,372.

Table 1: Descriptive results of the entire sample (n=129)

	Mean	Standard deviation	Min	Max
Days since upload	888	726.2	33	4004
Views	227620	558295.9	40	3234372
Likes	2317	6582.2	0	37000
Dislikes	174	482.9	0	2800
Video duration (min)	9.4	15.7	0.4	121.4
views per day	484	1460.2	0	9827

In the classification for accuracy, the researchers showed a very good inter-rater agreement ($k=0.84$). Six videos produced a dispute among the two researchers that

resulted in a resolution by virtue of discussion. Table 2 refers to the accuracy of the video.

Table 2: Basic video descriptors by the accuracy of the contents.

Descriptor	Reliable (n=78)	Misleading (n=47)	Patient Experiences (n=4)	P
Total views	12482917	16358514	521536	
Mean views (SD)	160037(528287.7)	348053(611310.6)	130384(216865.6)	0.178
Mean days since upload (SD)	901(706)	831.2(750.8)	1287.8(894.1)	0.469
Mean views per day (SD)	2781047.9)	856.3(1966.6)	131.5(221.7)	0.088
Mean video duration, min (SD)	7 (10.4)	12.0(21.1)	17.5(24.6)	0.169
Mean likes	1632(6039.2)	3412.5(7444.1)	3070.3(5953.6)	0.363
Mean Dislikes	92 (360.2)	320.3(632.6)	95.3(169.5)	0.041

Upload source	Reliable (n=78)	Misleading (n=47)	Patient Experiences (n=4)
PI	8(10.3%)	1(2.1%)	0(0.0%)
HCP	6 (7.7%)	2(4.3%)	0(0.0%)
Personal	27 (34.6%)	33(70.2%)	1(25.0%)
Other	37(47.4%)	11(23.4%)	3(75.0%)
Video content	Reliable (n=78)	Misleading (n=47)	Patient Experiences (n=4)
Education	19(24.4%)	1(2.1%)	0(0.0%)
Diet	16(20.5%)	2(4.3%)	0(0.0%)
Interview	2(2.6%)	1(2.1%)	2(50.0%)

Upload source	Reliable (n=78)	Misleading (n=47)	Patient Experiences (n=4)
Complications	10(12.8%)	1(2.1%)	0(0.0%)
Symptoms	9(11.5%)	2(4.3%)	0(0.0%)
Management	3(3.8%)	32(68.1%)	0(0.0%)
General Information	19(24.4%)	6(12.8%)	2(50.0%)

Overall, more than half were considered reliable (n=78; 61%), (n=47; 36%) were determined misleading, and (n= 4; 3%) videos as patient experiences. Regarding the total number of views, 16,358,514 viewed misleading videos, 12,482,917 viewed reliable videos, and patient experiences were viewed 521,536 times. The highest mean number of views belonged to misleading videos (348053 ± 611310.6), followed by reliable videos (160037 ± 528287.7), and patient experiences videos at 130384 ± 216865.6 (ANOVA, $p=0.178$). The mean number for “likes” of reliable videos was 1632 ± 6039.2 , a lower amount than misleading videos at 3412.5 ± 7444.1 , and patient experiences videos at 3070.3 ± 5953.6 . Correspondingly, significant differences in the mean number of “dislikes” (ANOVA, $p < 0.041$) compared to lower numbers for reliable videos. Patient experiences videos regarding length were longer (17.5 ± 24.6 min) in comparison to reliable videos (7 ± 10.4 min) and misleading videos (12.0 ± 21.1 min).

Personal users uploaded many of the videos (47.3%, n=61). 27.1%(n=35) of that videos contain information on the

management of diabetes. Personal users mostly uploaded misleading videos (70.2%, n=33), followed by other users at 23.4%(n=11). Regarding misleading videos, the treatment of diabetes using alternative medicine comprised the largest group of users at 74.5%(n=30). Of those, 23 of the misleading videos promoted herbal medicine, 5 advocated hydro-thermal therapy, and two proposed Ruqya Al Shariah therapy. A trend in alternative medicine video uploads increased over the previous two years, with 2017 figures at 37% (2017; n=11, 37%) and 2018 at 47% (n=14). The highest number of mean views belonged to alternative medicine at 402,483 times compared to other videos at 25,2000 times.

Discussion

Health education today comes from many resources. Internet videos are used frequently, with YouTube leading the pack. As of June 2018, YouTube consisted of over 5,000,000,000 videos and over 1,000,000,000 hours watched daily by users.¹⁷ The usefulness of videos relative to any given field and the sources used the most have been the subjects of many studies. This study assessed the accuracy and

scientific proven material and information available on YouTube regarding diabetes. Despite different entities increasingly using the Internet to relay medical information, Arabic information related to diabetes on YouTube has not been inspected for accuracy. From our results, we conclude that less than two-thirds of diabetes videos on YouTube provide reliable information. Reliable videos resulted in 60.5%, which is about what previous studies determined in evaluating YouTube videos on medical information in other fields. The range of reliable videos in these studies was between 54.9% to 63.6%, including topics such as gallstone disease ¹⁸, kidney stones ¹⁹, on hypertension ²⁰, and dialysis ²¹.

The videos determined to be misleading – many of which associated with alternative medicine, endorsed known myths and inaccurate information about the management of diabetes. Interestingly, those videos earned more YouTube views than reliable videos. The data about these investigations and studies point to a contradiction in results; nevertheless, most researchers agree that websites such as YouTube play a critical role in educating and informing the public.^{19,22,23} This inclination also applies to YouTube videos that pertain to medical-related issues.^{18,20,21} The popularity of videos being used as a source of information cannot be denied, regardless of factors

leading to contributions in the number of views or the content. The study presented here highlights that many of the misleading videos include alternative medicine information. Regardless of the lack of evidence or effectiveness alternative medicine provides, these videos were viewed widely all over the world. The reported prevalence in the use of alternative therapies for diabetes was pointed out in Kamel et al. as 64% in Saudi Arabia.²⁴ Given the popularity, YouTube users in Saudi Arabia are more likely to view alternative medicine videos classified as misleading.

In another study referencing cervical cancer, Adhikari et al.²⁵ found that most of the videos were being uploaded by physicians. Additionally, Gunes et al. ⁷ found that videos on varicose veins were mostly being uploaded by professional health providers. In this study, a very small amount of content was attributed to the hospital or academic professionals. The impact of what healthcare professionals contribute on YouTube is quite small and possibly intentional, given the amount of erroneous information on this platform. These results show consistency with other research and suggest that the impact is minor when healthcare professionals and organizations become involved in the manufacturing of YouTube content on health-related matters.²⁶ Personal uploads and news sour-

es were uploaded more than professional or academic sources. Personal stories, alternative medicine information, or entities selling or advertising services on the management of diabetes were shown to be more popular in uploads from independent users. This warrants discussion.

The limitations of our research include first the ever-changing Internet media environment concerning the date and time of performing searches. Second, this study used keyword searches on YouTube (diabetes mellitus in the Arabic language) using the first ten pages (20 videos/page) as its sample. The videos were then sorted by relevance, a default setting on YouTube's platform that might have affected the results due to advertisements. Although this could factor in, the results showed consistency compared to other research on health-related content and information. It also points to an unlikely event that missing variables have any real effect on outcomes.

Conclusion:

To conclude, this study supports that YouTube videos in Arabic are helpful. However, some of them have misleading information. Overall, reliable content videos received fewer views than those determined to be misleading. Professional institutions, health care providers, and academic sources need more encouragement to develop

and upload videos on the management and evidence-based treatment of diabetes. The popularity of the YouTube platform warrants further efforts to increase accuracy and promote science-based information on diabetes.

References

1. International Diabetes Federation. IDF Diabetes Atlas, 6th edition. Brussels, Belgium: International Diabetes Federation, 2013. Available from: URL: <http://www.idf.org/diabetesatlas>
2. John Powell, Nadia Inglis, Jennifer Ronnie, Shirley Large, The characteristics and motivations of online health information seekers: cross-sectional survey and qualitative interview study, PubMed entry [Internet]. [cited 2018 Nov 25]. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/21345783>
3. Kapil Chalil Madathil , A Joy Rivera-Rodriguez , Joel S Greenstein , Anand K Gramopadhye , Healthcare information on YouTube: A systematic review ,PubMed entry [Internet]. [cited 2018 Nov 25]. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/24670899>
4. Alexa - Top Sites for Countries [Internet]. [cited 2018 Nov 25]. Available from: <https://www.alexa.com/topsites/countries>
5. Janak Adhikari, Priyadarshani Sharma 1, Lubina Arjyal , Dipesh Uprety , YouTube

- as a Source of Information on Cervical Cancer. - PubMed - NCBI [Internet]. [cited 2018 Oct 30]. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/27213142>
6. Neetika Garg , Anand Venkatraman, Ambarish Pandey, Nilay Kumar , YouTube as a source of information on dialysis: a content analysis. - PubMed - NCBI [Internet]. [cited 2018 Oct 30]. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/25641264>
7. Tefvik Güneş, Mustafa Serinken, İhsan Alur, Halil Beydilli, et al. , YouTube as a source of information on varicose veins , SAGE Journals, 2016 [Internet]. [cited 2018 Oct 30]. Available from: <http://journals.sagepub.com/doi/abs/10.1177/0268355515596894?journalCode=phla>
8. Jun Suh Lee , Ho Seok Seo , Tae Ho Hong, YouTube as a source of patient information on gallstone disease, PubMed entry [Internet]. [cited 2018 Oct 30]. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/24744597>
9. Mustafa Serinken, Cenker Eken, Fikret Erdemir, Hayri Eliçabuk, et al., The reliability of national videos related to the kidney stones on YouTube , PubMed Central Link [Internet]. [cited 2018 Oct 30]. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4791085/>
10. Serpil Yaylaci , Mustafa Serinken, Cenker Eken, Ozgur Karcioğlu, et al. , Are YouTube videos accurate and reliable on basic life support and cardiopulmonary resuscitation? , PubMed entry [Internet]. [cited 2018 Oct 30]. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/25168312>
11. Nilay Kumar , Ambarish Pandey , Anand Venkatraman , Neetika Garg, Are video sharing web sites a useful source of information on hypertension? - PubMed - NCBI [Internet]. [cited 2018 Oct 30]. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/25064770>
12. Pereira K, Phillips B, Johnson C, Vorderstrasse A. Internet delivered diabetes self-management education: a review. *Diabetes Technol Ther*. PubMed - NCBI [Internet] [2015 Jan;17](1):55–63. Available from: <https://pubmed.ncbi.nlm.nih.gov/25238257/>
13. Alverdy JC. A Video Is Worth a Thousand Words. *JAMA Surg*. , 2016 Jun 1;151(6):e160476–e160476. Available from: <https://jamanetwork.com/journals/jamasurgery/article-abstract/2512055>
14. Chou W-YS, Hunt Y, Folkers A, Augustson E. Cancer Survivorship in the Age of YouTube and Social Media: A Narrative Analysis. *J Med Internet Res* [Internet]. 2011 Jan 17 [cited 2018 Oct 31];13(1). Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3221357/>
15. Gao X, Hamzah SH, Yiu CKY, McGrath

- C, King NM. Dental fear and anxiety in children and adolescents: qualitative study using YouTube. *J Med Internet Res.* [2013 Feb 22];15(2):e29. Available from: <https://pubmed.ncbi.nlm.nih.gov/23435094/>
16. Morahan-Martin JM. How internet users find, evaluate, and use online health information: a cross-cultural review. *Cyberpsychol Behav.* [2004 Oct];7(5):497–510. Available from: <https://pubmed.ncbi.nlm.nih.gov/15667044/>
17. YouTube by the Numbers (2018): Stats, Demographics & Fun Facts, omnicores [Internet]. 2018 [cited 2018 Oct 30]. Available from: <https://www.omnicoreagency.com/youtube-statistics/>
18. Lee JS, Seo HS, Hong TH. YouTube as a source of patient information on gallstone disease. *World J Gastroenterol.* 2014 Apr 14;20(14):4066–70. Available from: <https://pubmed.ncbi.nlm.nih.gov/24744597/>
19. Serinken M, Eken C, Erdemir F, Elicabuk H, Başer A. The reliability of national videos related to the kidney stones on YouTube. *Turk J Urol.* 2016 Mar;42(1):7–11. Available from : <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4791085/>
20. Nilay Kumar , Ambarish Pandey , Anand Venkatraman , Neetika Garg, Are video sharing web sites a useful source of information on hypertension? - PubMed - NCBI [Internet]. [cited 2018 Oct 30]. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/25064770>
21. Neetika Garg , Anand Venkatraman, Ambarish Pandey, Nilay Kumar, YouTube as a source of information on dialysis: a content analysis. - PubMed - NCBI [Internet]. [cited 2018 Oct 30]. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/25641264>
22. Yaylaci S, Serinken M, Eken C, Karcioğlu O, Yılmaz A, Elicabuk H, et al. Are YouTube videos accurate and reliable on basic life support and cardiopulmonary resuscitation?, *Emerg Med Australas.* 2014 Oct;26(5):474–7. Available from: <https://pubmed.ncbi.nlm.nih.gov/25168312/>
23. Liu KY, Haukoos JS, Sasson C. Availability and quality of cardiopulmonary resuscitation information for Spanish-speaking population on the Internet. *Resuscitation.* 2014 Jan;85(1):131–7. Available from: <https://pubmed.ncbi.nlm.nih.gov/24036407/>
24. Kamel FO, Magadmi RM, Hagraas MM, Magadmi B, AlAhmad RA. Knowledge, attitude, and beliefs toward traditional herbal medicine use among diabetics in Jeddah Saudi Arabia. *Complement Ther Clin Pract.* 2017 Nov;29:207–12. Available from: <https://pubmed.ncbi.nlm.nih.gov/29122263/>
25. Janak Adhikari , Priyadarshani Sharma

, Lubina Arjyal , Dipesh Uprety, YouTube as a Source of Information on Cervical Cancer. - PubMed - NCBI [Internet]. [cited 2018 Oct 30]. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/27213142>

26. Thackeray R, Neiger BL, Smith AK, Van Wagenen SB. Adoption and use of social media among public health departments. BMC Public Health. 2012 Mar 26;12(1):242. Available from: <https://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-12-242>

Original Article :

Complete Blood Counts among chronic patients of Helicobacter pylori infection

Ahmed Mohammed Elnour Elkhalifa^{1,2,*}, AbdElhadi M. Agena², Abdelhakam G. Tamomh², Areej F.A. Hassan², Fatima M.H. Albasheer², Sakna G.K. Omer,² Anass M. Abbas³, Abozer Y. Elderderly^{2,3}.

1. Department of Public Health, College of Health Sciences, Saudi Electronic University, Riyadh, Saudi Arabia

2. Faculty of Medical Laboratory Sciences, University of El Imam El Mahdi, Kosti, Sudan.

3. College of Applied Medical Science, Jouf University, Sakaka, Saudi Arabia

Received on August 23, 2020, Accepted November 27, 2020 dx.doi.org/10.5455/mjhs.2021.02.003

Corresponding Author:

Dr. Ahmed Mohammed Elnour Elkhalifa- Associate Professor

Department of Public Health, College of Health Sciences, Saudi Electronic University, Riyadh, Saudi Arabia

University of El Imam El Mahdi, Faculty of Medical laboratory Sciences, Sudan.

Tel.: 00966501976641, 00249122467181

E-mail: a.alkhalifa@seu.edu.sa ; ahmedelnour2003@yahoo.com

Abstract

Background and Aims:

Helicobacter pylori infection has a suggested association with hematological alterations and common peptic ulcer disease manifestation. This study aims to investigate the influence of H. pylori infection on Complete Blood Counts (CBC).

Methods:

A case-controlled study was carried out in 2018 at National Health Insurance Hospital, Kosti, Sudan. Out of one hundred and thirty recruited participants, 80 had confirmed H. pylori infection categorized as the case group, while 50 healthy participants were enrolled as a control group. All subjects were screened for H. pylori infection. Complete blood count was analyzed from EDTA blood samples of the participants using an automated hematology analyzer (Sysmex KX-21, Tokyo, Japan). Peripheral Blood Picture (PBP) was examined using Romanowsky stains.

Results:

Our findings showed significantly lower mean values of tRBC, Hb, HCT, MCV, and neutrophils count among H. pylori infection patients than the control

المخلص

الخلفية و الاهداف :

تعتبر جرثومة المعدة من الجراثيم ذات معدل انتشار عالي وتسبب تغيرات في صورة الدم الكاملة للمرضي كالأعراض المرتبطة بفقير الدم وتعتبر أيضا مسبب رئيسي لقرحة المعدة. والتدفئة وتهدف هذه الدراسة لمعرفة صورة الدم الكاملة لدي المرضي المصابون بجرثومة المعدة ومقارنة نتائجهم بصورة دم لأشخاص أصحاء غير مصابين بجرثومة المعدة.

طريقة البحث:

أجريت الدراسة الحالية بمستشفى التامين الصحي بكوستي في ولاية النيل الأبيض بالسودان في الفترة من مايو إلي أكتوبر بمشاركة ثمانون من المرضي الذين اثبتت التحاليل الطبية اصابتهم بجرثومة المعدة مثلوا مجموعة الدراسة، وتم اختيار خمسون شخص آخر كمجموعة ضابطة متطابقة مع مجموعة الدراسة في الجنس والعمر حيث تم عمل صورة دم كاملة للمجموعتين.

النتائج:

أظهرت نتائج الدراسة أن متوسط قيمة تعداد كريات الدم الحمراء، تركيز الهيموغلوبين، الهيماتوكريت، متوسط حجم الخلية والخلايا العدلية أقل وذات دلالة إحصائية جوهرية مقارنة بالمجموعة الضابطة بينما متوسط تعداد الخلايا الليمفاوية كان أكثر وذو دلالة إحصائية لدي المصابين بجرثومة المعدة مقارنة بتعداد الخلايا الليمفاوية لدي مجموعة الأشخاص الأصحاء. لم يظهر متوسط تعداد كريات الدم البيضاء ومتوسط تعداد الصفائح الدموية ومتبقي عناصر صورة الدم

group. The mean values were $(4.2 (\pm 0.7) \times 10^{12}/L$ vs. $4.8 (\pm 0.3) \times 10^{12}/L$; $12.04 (\pm 1.84) \text{ g/dl}$ vs. $13.4 (\pm 1.4) \text{ g/dl}$; $34.2 (\pm 6.1) \text{ l/l}$ vs. $37.2 (\pm 4.2) \text{ l/l}$; $83.1 (\pm 6.7) \text{ fl}$ vs. $86.6 (\pm 4.9) \text{ fl}$; and $49.56 \pm 12.23\%$ vs. 53.6 ± 7.8 respectively). On the other hand, the mean value of lymphocyte counts was significantly higher in H. pylori-infected patients than in the control group ($41.9 \pm 11.1\%$ vs. 35.7 ± 7.3). No significant differences were found between H. pylori infected patients and the healthy control group regarding the counts of total white blood cells (WBCs), platelets, monocytes, and eosinophils. Morphological blood film examination showed oval-shaped teardrops, microcytic hypochromic picture, lymphocytosis, neutropenia, and adequate platelets.

Conclusion:

There were significant effects on some hematological parameters in patients with H. pylori infection.

Keywords:

Helicobacter pylori, Complete Blood Counts, Total White Blood Cell counts, Platelet counts, Anemia, Sudan

الكاملة أي فروقات جوهرية ذات دلالة إحصائية بين المجموعتين. وخلصت الدراسة إلى تأثير واضح وكبير لبعض عناصر صورة الدم الكاملة لدى الأشخاص المصابين بجرثومة المعدة مقارنة مع الأشخاص الأصحاء.

Introduction

Helicobacter pylori is a Gram-negative micro-aerophilic bacterium that is the most common cause of chronic infection in humans worldwide.¹ Approximately 4.4 billion individuals were infected globally with H. pylori during 2015, with the prevalence from 8.7% to 85.5%, increasing with age and large variations regarding race, ethnicity, socioeconomic status, and geographical area, with over 80% being in developing countries²⁻⁷. Recently many researchers reported H. pylori to be

the principal cause of chronic gastritis and a main etiological agent for anemia, gastric cancer, peptic ulcer disease, ischemic cerebrovascular disease, mucosa-associated lymphoid tissue (MALT), lymphoma, dermatologic, neurologic disorders, metabolic and cardiopulmonary diseases.^{2,8-12} Furthermore, previous studies reported the association of H. pylori infection with many hematological manifestations, such as vitamin B12 deficiency, iron deficiency anemia (IDA), and Idiopathic Thrombocytopenic Purpura (ITP).

¹³⁻¹⁴ The frequency of anemia is high in many countries infected by *H. pylori*, schistosomiasis, and malaria, particularly in developing countries with serious public health problems. ^{15, 16-18} Given the high prevalence of *H. pylori* infection reported in Sudan, as the commonest etiological factor of gastritis,¹⁹ our current study rationale is to explore and establish the effect of these bacteria on the hematological parameters in Sudanese *H. pylori*-infected patients to help in the management of *H. pylori*, which is highly recommended for high-risk populations ^{8, 20}.

Methodology

Study design and study setting: A case-control study was carried out at National Health Insurance Hospital, Kosti, Sudan, from May to October 2018.

Participants and sample size: Following exclusion and inclusion criteria, one hundred and thirty participants were randomly recruited in the current study. Eighty participants had *H. pylori* infection (16 males, 64 females), aged 16-55 years, mean age (32.95±10.39); As a control, we selected 50 healthy persons matched in age and gender without gastrointestinal tract infection, and with negative *H. pylori* laboratory tests, who attended the National Health Insurance Hospital and agreed to participate.

Data collection:

Data was collected using a structural interviewing questionnaire, including personal and clinical information and laboratory investigations. Three ml of venous blood was taken and collected in sterile dry plastic syringes using standard venipuncture technique from each participant after sterilizing the puncture site with 70% ethanol. The samples were collected in Plain containers to detect antibodies against *H. pylori* organisms. The former centrifuged at 2000 rpm (revolutions per minute) for 15 minutes. ICT was carried out on the supernatant sera without preservation or delay. The ICT utilizes a combination of *Helicobacter pylori* antigen-coated particles and anti-human IgG to detect *H. pylori* antibody selectively and qualitatively in the serum.

The blood samples were collected in Ethylenediaminetetraacetic Acid (EDTA) containers were used for determination of Complete Blood Counts (CBC) using hematology-automated analyzer (Sysmex KX-21, Tokyo, Japan). Peripheral Blood Picture (PBP) was examined after staining with Romanowsky stains.

Stool samples were collected in clean, dry containers, which were examined immediately by mixing small stool amounts with ICT antigen solution. One drop of this mixture was thoroughly mixed and incu-

bated for 1 minute and then read.

Inclusion and Exclusion Criteria:

All included participants reported gastritis symptoms, had a laboratory-confirmed diagnosis of *H. pylori* infection and attended Kosti National Health Insurance Hospital. Patients were excluded from participation if they had been diagnosed with blood diseases, cardiovascular disease, or hemorrhagic disease. Also excluded were patients taking medication affecting blood parameters, those with gastric malignancy or malignant diseases, and those with other causes of thrombocytopenia. Finally, some patients who refused to participate were also excluded.

Statistical analysis:

Laboratory results were analyzed by IBM SPSS (Statistical Package for the Social Sciences) version 25. Descriptive statistics and frequency distribution were performed. Mean (M) and standard deviation (\pm SD) were calculated, and a comparison was made with a two-tailed Student's t-test to explore any significant difference between *H. Pylori* infected patients and healthy individuals' control group. The al-

pha error of 0.05 and P-value \leq 0.05 was considered significant.

Informed consent:

Before collecting the blood samples, each participant completed the informed consent form. Parents completed and signed an informed consent form for patients below 18 years old.

Ethical approval:

This was obtained from the research and ethics committee of El Imam El Mahdi University, Faculty of Medical Laboratory Sciences.

Results:

80% of the current study participants were female, 20% were male amongst both the case and control groups, 40% and 46% of the patients and controls were aged between 25-34 years old. 28.7% and 26% were between 35-44 years old, 23.8% and 20% were 45-55 years old, while 7.5% and 8% were aged between 15-24 years old. The mean age for the *H. pylori* infection group was 32.95 ± 10.39 years old and 31.36 ± 8.75 for the control group, with no statistically significant difference between the two groups (p-value = 0.900) (Table 1).

Table 1. *H. pylori* infected patients and control group age and gender

Parameter	Category	H. pylori infected N=80	Control group N=50	t	P-value
		Frequency (%)	Frequency (%)		
Gender	Male	16 (20)	10 (20)		

Parameter	Category	H. pylori infected N=80	Control group N=50	t	P-value
		Frequency (%)	Frequency (%)		
Gender	Female	64 (18)	40 (80)	0.90	0.37
	Total	80 (100)	50 (100)		
Age distribution	15-24 years old	6 (7.5)	4 (8)		
	25-34 years old	32 (40)	23 (46)		
	35-44 years old	19 (23.8)	10 (20)		
	45-55 years old	23 (28.7)	13 (26)		
	Mean ± SD	32.95±10.39 years old	31.36±8.75 years old		

Table 2 shows red cells indices of H. pylori infected and control group while Table 3 shows the white cells parameters in these groups.

Table 2. Red blood cell indices of the participants

Variable	H. pylori infected patients (%) N=80	Control group N (%) N=50
Hb		
<13.5 g/dl	56 (70%)	29(58%)
13.5-17.5 g/dl	24(30%)	21(42%)
>17.5 g/dl	0(0%)	0(0%)
PCV		
<40 l/l	71(88.7%)	40(80%)
40-52 l/l	8 (10%)	10 (20%)
>52 l/l	1(1.3%)	0(0%)
RBCs		
<4.5 x 10 ¹²	56 (70%)	1 (2%)
4.5-6.5 x 10 ¹²	23(28.7%)	49(98%)
>6.5 x 10 ¹²	1(1.3%)	0(0%)
MCV		
<80 fl	22(27.4%)	4(8%)
80-95 fl	53(66.3%)	45(90%)
>95 fl	5(6.3%)	1(2%)
MCH		
<27 pg	17(21.3%)	2(4%)
27-34 pg	60 (75%)	48(96%)
>34 pg	3(3.7%)	0(0%)

Variable	H. pylori infected patients (%) N=80	Control group N (%) N=50
MCHC		
<20%	0(0%)	0(0%)
20-35%	52(65%)	30 (60%)
>35%	28(35%)	20(40%)

Key: Hb = Haemoglobin concentration; PCV= Blood Cell Volume; RBCs = Red Blood Cells Count; MCV= Mean Cell Volume; MCH = Mean Cell Haemoglobin; MCHC= Mean Cell Haemoglobin Concentration.

Table 3: TWBC, PLT, and Differential White Blood Cell Counts group.

Variable	H. pylori infected patients (%) N=80	Control group N (%) N=50
TWBC		
<4×10 ³ /l	9(11.3%)	2(4%)
4-11×10 ³ /l	68(85%)	47(94 %)
>11×10 ³ /l	3(3.7%)	1(2%)
PLt		
<150×10 ³ /l	1 (1.3%)	0(0%)
1 5 0 - 400×10 ³ /l	70(87.4%)	45(90%)
>400×10 ³ /l	9(11.3%)	5(10%)
Neutrophil		
<40%	16(20%)	2(4%)
40-80%	2(2.5%)	2(4%)

Variable	H. pylori infected patients (%) N=80	Control group N (%) N=50
>80%	62(77.5%)	46(92%)
Lymphocyte		
<20%	1(1.3%)	0(0%)
20-40%	35(43.7%)	44(88%)
>40%	44(55%)	6(12%)
Monocyte		
<4%	10(12.5%)	6(12%)
4-10%	70(87.5%)	42(84%)
>10%	0(0%)	2(4%)
Eosinophil		
1%	18(22.5%)	2 (4%)
2-4%	41(51.3%)	26(52%)
>4%	21(26.2)	22(44%)

Key: TWBC = Total White Blood Cells Counts; PLt = Platelets count

The mean of red blood cell counts (RBCs), haemoglobin (Hb), Haematocrit (Hct), mean cell volume (MCV), neutrophil and

lymphocyte were $4.2 \times 10^{12}/L$ (± 0.7) vs. $4.8 \times 10^{12}/L$ (± 0.3); 12.0 g/dl (± 1.8) vs. 13.4 g/dl (± 1.4); 34.2 l/l (± 6.1) vs. 37.2 l/l (± 4.2); 83.1 fl (± 6.7) vs. 86.6 fl (± 4.9); and 49.6% (± 12.2) vs. 53.6% (± 7.7) and 41.9% (± 11.1) vs. 35.7% (± 7.3) in cases with H. pylori and controls respectively. Our findings show that some hematological parameters, RBCs, Hb, Hct, MCV, and neutrophil were significantly decreased among the case group compared to the control group (p values = 0.001, 0.001, 0.003, 0.002, and 0.001 respectively) except lymphocyte count, which was significantly elevated in H. pylori infected patients over controls, with p-value <0.01 , as shown in Table 4,5.

Table 4. Results of red cell indices among H. pylori infected patients against control samples

Parameter	Patient M (\pm SD) (N=80)	Control M(\pm SD) (N=50)	P-value
Hb g/dl	12.04 (± 1.84)	13.4 (± 1.4)	$<0.001^*$
PCV l/l	34.2 (± 6.1)	37.2 (± 4.2)	$<0.003^*$
RBCs $\times 10^6/L$	4.2 (± 0.7)	4.8 (± 0.3)	$<0.001^*$
MCV fl	83.1 (± 6.7)	86.6 (± 4.9)	$<0.002^*$
MCH pg	28.8 (± 7.3)	30.4 (± 2.2)	0.062
MCHC%	34. (± 2.5)	34.9 (± 1.9)	<0.185

Key: - M=Mean; *Significance at the level ≤ 0.05

Table 5: Results of TWBC, PLT, and Differential White Blood Cell Count among H. pylori infected patients against control samples

Parameter	Patient M (\pm SD) (n=80)	Control M(\pm SD) (N=50)	P-value
TWBC $\times 10^3/l$	6.0 (± 2.09)	6.4 (± 1.9)	0.818
PLt $\times 10^3/l$	284.9 (± 77.3)	292.4 (± 69.4)	0.556
Neutrophil%	49.56 \pm 12.23%	53.6 (± 7.8)	$<0.001^*$
Lymphocyte%	41.9 (± 11.1)	35.7 (± 7.3)	$<0.004^*$

Parameter	Patient M (\pm SD) (n=80)	Control M(\pm SD) (N=50)	P-value
Eosinophil%	3.4 (\pm 2.2)	4.7 (\pm 2.4)	0.673
Monocyte%	5.4 (\pm 3.0)	6.2 (\pm 2.7)	0.113

Key: - M=Mean; *Significance at the level ≤ 0.05

No significant differences between our study groups were observed in the following parameters: TWBCs, platelet, monocyte, and eosinophil counts. They were $6.0 \times 10^3/l$ (± 2.1) vs. $6.4 \times 10^3/l$ (± 1.9); $284.9 \times 10^3/l$ (± 77.3) vs. $292.4 \times 10^3/l$ (± 69.4); monocyte 5.4 % (± 3.0) vs. 6.2 (± 2.7)%; eosinophil 3.4 (± 2.2)% vs. 4.7 (± 2.4)%; MCH 28.8 pg (± 7.3) vs. 30.4 pg (± 2.2) and MCHC 34.4% (± 2.5) vs. 34.9% (± 1.9) respectively, as shown in Tables 4,5. Peripheral blood picture of most *H. pylori* infection patients was microcytic hypochromic RBCs. Macro-ovalocytes, anisocytosis, poikilocytosis with teardrop, target red cells, and Echinocyte were observed. However, the normocytic and normochromic picture was observed in some patients with *H. pylori* infection. White blood cell morphology of *H. pylori* infection patients showed lymphocytosis and neutropenia.

Discussion

H. pylori are closely related to hematological disorders such as iron deficiency anemia (IDA) and primary immune thrombocytopenia (ITP).¹¹ The current study aims to detect the effects of *H. pylori* infection

on hematological parameters among Sudanese patients attending Kosti health insurance hospital and compare their results with those of healthy individuals. Our findings were in accordance with recent studies that were conducted in other ethnic groups^{21,22} and another study done in Sudan¹², which stated a decrease in some hematological parameters (Hb, Hct, MCV, and neutrophil counts) in *H. pylori* patients. Our findings were, however, not in agreement with the results of the study done in Saudi by Nahla KI and co-workers who found no association between *H. pylori* and hematological parameters.²³ Furthermore, a retrospective study was conducted between 2012 to 2016 in China by MeiYX et al.²⁴, who found that *H. pylori* infection may reduce the level of Hb and, in turn, may be responsible for causing anemia in a Chinese population. In contrast, previous studies were carried out in a Nigerian tertiary educational institution by Benjamin OE and co-workers²⁵ who mentioned a non-significant difference in MCV values and another study done among Palestinian adult patients infected with *H. pylori* by Saleh NM and Wesam MA²⁶ who concluded

ed similar results regarding MCV which was not the same as that found here. Our results are in agreement with the previous study done by Waleed S et al. ²⁷ in 2016 in Taif City, Saudi Arabia and the study done by Saleh NM and Wesam MA ²⁶ , while inconsistent with the study by Ashraf AT, et al. ²⁸ , in 2015 in Egypt who reported insignificant difference in RBCs counts. Our results are consistent with the previous study done in Palestine by Saleh NM and co-workers ²⁶ , who reported a low level of MCH and MCHC in patients with H. pylori infection ^{12,27} . On the other hand, our current findings are consistent with the study done by Elham AI et al. ¹² in Sudan and inconsistent with other studies that concluded high total WBCs count in patients with H. pylori infection patients compared to controls ^{26,27} . Concerning Platelet counts, our results revealed no statistically significant difference between H. pylori infection patients and the control group; this finding was in line with other studies ^{26, 28} . Regarding the Neutrophil counts and the lymphocyte counts, our findings were with other studies ^{29, 30} , which indicated that H. pylori infection may be related to anemia with high neutrophil and low lymphocyte counts. The significant increase in lymphocyte count may be due to inflammations caused by H. pylori infection. The possible reasons for the differences and similarities

in blood parameters with other mentioned studies may include the degree of severity of H. pylori infection, the demographic data such as the age of the participants, and the sample size. Our findings concerning the highly variable peripheral blood film morphology are consistent with earlier studies ^{12,31} that reported oval-shaped, teardrops, microcytic hypochromic pictures among H. pylori infection patients.

Conclusion

From this study, we conclude that some hematological parameters, including Hb, Hct, MCV, and neutrophil counts, were decreased among H. pylori-infected patients. In contrast, lymphocyte counts were found to be higher among these patients. Therefore, H. pylori infection is a cause of anemia and must be considered while investigating and managing anemic patients (especially with the acid-peptic disease).

Funding:

None.

Conflict of Interest:

The authors declared no conflict of interest.

Acknowledgment:

The authors thank all participants in this study.

References:

1. Hooi JK, Lai WY, Ng WK, Suen MM,

- Underwood FE, Tanyingoh D, Malfertheiner P, Graham DY, Wong VW, Wu JC, Chan FK. Global prevalence of Helicobacter pylori infection: systematic review and meta-analysis. *Gastroenterology*. 2017 Aug 1;153(2):420-9.
2. Campuzano-Maya G. Hematologic manifestations of Helicobacter pylori infection. *World journal of gastroenterology: WJG*. 2014 Sep 28;20(36):12818.
3. Valliani A, Khan F, Chagani B, Khuwaja AK, Majid S, Hashmi S, Nanji K, Valliani S. Factors associated with Helicobacter pylori infection, results from a developing country-Pakistan. *Asian Pac J Cancer Prev*. 2013 Jan 1;14(1):53-6.
4. Yahya RZ, Rudainee MH, Alshammari SA, Alshammari A, Ahmari, AS, et al. Helicobacter pylori and Upper Gastrointestinal Diseases. *EC Microbiology SI*. 2017; 1:23-30
5. Tamokou J, Guimtsop YA, Ndebi ME, Nzesseu VL, Djokge AK, Kuate J. Effect of Helicobacter pylori Infection on Selected Biochemical Parameters of Hypertensive Patients at Dschang District Hospital in Cameroon. *International Journal of Tropical Disease and Health*. 2017; 26(1): 1-8.
6. Carabotti M, D'Ercole C, Iossa A, Corazziari E, Silecchia G, Severi C. Helicobacter pylori infection in obesity and its clinical outcome after bariatric surgery. *World Journal of Gastroenterology: WJG*. 2014 Jan 21;20(3):647.
7. Lv ZF, Wang FC, Zheng HL, Wang B, Xie Y, Zhou XJ, Lv NH. Meta-analysis: Is combination of tetracycline and amoxicillin suitable for Helicobacter pylori infection? *World Journal of Gastroenterology: WJG*. 2015 Feb 28;21(8):2522.
8. Yagura T, Egawa S, Okano A, Mizukoshi K. Chronic Gastritis Due to Helicobacter pylori Associated with Increased Serum Levels of CA54/61: A Report of Three Cases. *The American journal of case reports*. 2018; 19:951.
9. Goni E, Franceschi F. Helicobacter pylori and extragastric diseases. *Helicobacter*. 2016; 21(S1):45-8.
10. Yokota S, Konno M, Fujiwara S, Toita N, Takahashi M, Yamamoto S, et al. Intrafamilial, Preferentially Mother-to-Child and Intrasposal, Helicobacter pylori Infection in Japan Determined by Mutilocus Sequence Typing and Random Amplified Polymorphic DNA Fingerprinting. *Helicobacter*. 2015; 20(5):334-42.
11. Darvishi M, Ziari K, Mohebbi H, Alizadeh K. Association between iron deficiency anemia and Helicobacter pylori infection among children under six years in Iran. *Acta Med Iran*. 2015; 53: 220– 224.
12. Elamin EA, Suliman MA, Azoz ME,

- Ali EW, Olerile LD, Jiao Y, Zhao Y. Effect of Helicobacter pylori Infection on Haematological Parameters in Kosti Teaching Hospital, Sudan. Iranian Red Crescent Medical Journal. 2018 Feb 1;20(2).
13. Rocha AM, Botelho LF, Rocha DM (2014) Improvement of thrombocytopenia after treatment for Helicobacter pylori in a patient with immunologic thrombocytopenic purpura. Rev Bras Hematol Hemoter 36:162–164
14. Humeida AT, Abdalla MH. Association of Helicobacter pylori Infection and Vitamin B12 Level among Sudanese Patients. IOSR Journal of Dental and Medical Sciences. 2017; 16(3): 12-4.
15. McLean E, Cogswell M, Egli I, Wojdyla D, de Benoist B. Worldwide prevalence of anemia, who vitamin and mineral nutrition information system, 1993-2005. Public health nutrition. 2009; 12:444-454
16. Kumari R, Bharti RK, Singh K, et al. prevalence of iron deficiency and iron deficiency anaemia in adolescent girls in a tertiary care hospital. J Clin Diagn Res. 2017; 11(8): BC04- BC06.
17. Al-Shehri H, Stanton MC, LaCourse JE, Atuhaire A, Arinaitwe M, Wamboko A, Adriko M, Kabatereine NB, Stothard JR. An extensive burden of giardiasis associated with intestinal schistosomiasis and anaemia in school children on the shoreline of Lake Albert, Uganda. Transactions of the Royal Society of Tropical Medicine and Hygiene. 2016 Oct 1;110(10):597-603.
18. White, NJ 2018. Anaemia and malaria. Malar. J 17: 371.
19. Awad-Elkareem A, Khalid OM, Zobaida M, Elfadil M. Alaa A, Fatima A. Evaluation of serum vitamin B12 and ferritin levels in H pylori-associated gastritis. Pharm Biol Sci. 2016; 11(1):1–5.
20. Hagymasi K, Tulassay Z. Helicobacter pylori infection: New pathogenetic and clinical aspects. World J Gastroenterol. 2014; 20(21):6386-99.
21. John S, Baltodano JD, Mehta N, Mark K, Murthy U. Unexplained iron deficiency anemia: does Helicobacter pylori have a role to play? Gastroenterology report. 2018 Aug;6(3):215-20.
22. Demerdash DME, Ibrahim H, Hassan DM, Moustafa H, Tawfik NM. Helicobacter pylori associated to unexplained or refractory iron deficiency anemia: An Egyptian single-center experience. Hematology, transfusion, and cell therapy. 2018;40:219-225
23. Ibrahim NK, Al-Sayes FM, Alidrous FA, Alahmadi MM, Bakor SH, Aljohani AF. Helicobacter pylori: Prevalence and Relationship to Hematological Parameters of Symptomatic Patients who Conducted Gastroscopy at King Abdulaziz University

- Hospital, Jeddah. *Journal of Advances in Medicine and Medical Research*. 2018;1-9.
24. Xu MY, Cao B, Yuan BS, Yin J, Liu L, Lu QB. Association of anaemia with *Helicobacter pylori* infection: a retrospective study. *Scientific reports*. 2017 Oct 18;7(1):1-7.
25. Eledo BO, Allagoa DO, Onuoha E, Okamgba OC, Ihedioha AU, Ugwu IM. Evaluation of some haematological parameters among *Helicobacter pylori* infected students in a Nigerian tertiary educational institution. *Biotechnological Research*. 2018; 4:34-39
26. Mwafy SN, Afana WM. Hematological parameters, serum iron, and vitamin B12 levels in hospitalized Palestinian adult patients infected with *Helicobacter pylori*: a case-control study. *Hematology, transfusion, and cell therapy*. 2018 Jun;40(2):160-5.
27. Samy W EG, Issa LF, Sedik W. Prevalence of *Helicobacter pylori* infection and its correlation with complete blood count parameters in adult males at Taif city, Saudi Arabia. *SAS J. Med.*, 2016; 2(3):49-54
28. Abou-Taleb A, Allam A, Elsamman MK. Association between *Helicobacter pylori* infection and iron deficiency anemia among school-age children in Sohag university hospital, upper Egypt. *Open Journal of Blood Diseases*. 2016; 7:36-46
29. Guclu M, Faruq Agan A. Association of severity of *Helicobacter pylori* infection with peripheral blood neutrophil to lymphocyte ratio and mean platelet volume. *Euroasian Journal of hepato-gastroenterology*. 2017; 7:11-16
30. Nagata A, Sekiguchi N, Kurimoto M, Noto S, Takezako N. Significance of lymphocyte counts at diagnosis in the management of ITP: the relationship between lymphocyte counts and treatment success in *H. pylori*-infected patients. *International Journal of Hematology*. 2015 Mar 1;101(3):268-72.
31. Kujovich JL. Evaluation of anemia. *Obstetrics and Gynecology Clinics*. 2016 Jun 1;43(2):247-64.

Original Article :

Prevalence, Predictors and Prognostic Impact of Renal Dysfunction among Hospitalized Patients with Systolic Heart Failure

Raneem Abdulraheem Alraheili¹, Mohammed Abdullah Saeed¹, Amjad Taj Karam¹,
Faris Abdulmuti Alhejaili¹, Faisal Owdah Alatawi², Sami Abdo Al-Dubai³

1. College of Medicine, Taibah University, Medina, Saudi Arabia

2. Cardiology division, Department of Internal Medicine, College of Medicine,
Taibah University, Medina, Saudi Arabia.

3. Joint Program of Family Medicine Post Graduate Studies, and Joint Program
of Preventive Medicine Post Graduate Studies, Medina, Ministry of Health, Saudi Arabia.

Received on 16/10/2020 Accepted for Publication on 13/12/2020 dx.doi.org/10.5455/mjhs.2021.02.004

Corresponding Author:

Raneem Abdulraheem Alraheili, College of Medicine, Taibah University, Medina, Saudi Arabia
E-mail - dr.raneemalraheili@gmail.com

Abstract

Background and Aims

The interaction between heart and kidneys has increased, and parts of the pathophysiological background for the cardiorenal syndrome have been established. This study aimed to determine the prevalence, predictors, and prognostic impact of Renal Dysfunction (RD) among hospitalized patients with systolic Heart Failure (HF).

Methods

This a cross-sectional study included 1559 patients, who were admitted with a diagnosis of systolic HF during the period from 1-March-2011 till 20-June-2019 at Madinah cardiac center. RD was defined as estimated glomerular filtration rate < 60 mL/min/1.73 m².

Results

Of the total of 1559 patients, 67.2% were males, 51.3% were hypertensive, 56.1% were diabetic and 49.1% were anemic. 60.9% of patients had RD. HF patients with RD were significantly older ($p<0.001$), had a history of Hypertension (HTN) ($p<0.001$), Diabetes Mellitus (DM) ($p<0.001$), anemia ($p<0.001$), stroke ($p<0.003$) and smoking ($p<0.001$). Multivariate analysis showed that older age (OR, 1.1; 95% CI, 1.05-1.07; $p<0.001$), history of DM (OR, 1.5; 95%

الملخص

الخلفية و الاهداف :

ازدادت العلاقة بين القلب والكلى، وجزء من الخلفية الفسيولوجية بينهما تم معرفتها. تهدف هذه الدراسة لوصف معدلات الإصابة بقصور وظائف الكلى وتحديد الأسباب المؤدية إليه وتأثيره بين المرضى المصابين بفشل القلب.

طريقة البحث

شملت هذه الدراسة المقطعية ١٥٥٩ مريضاً بفشل القلب في الفترة ما بين ١ مارس ٢٠١١ حتى ٢٠ يونيو ٢٠١٩ في مركز أمراض وجراحة القلب بالمدينة المنورة. تم تقسيم المرضى الى مجموعتين على أساس معدل الترشيح الكلوي الخاص بهم. تم تعريف قصور وظائف الكلى إذا كان معدل الترشيح الكلوي اقل من ٦٠ مل/دقيقة/١.٧٣ م^٢.

النتائج

٦٧,٢٪ من العينة كانوا ذكورا، ٥١,٣٪ كانوا مصابين بارتفاع ضغط الدم، ٥٦,١٪ كانوا مصابين بمرض السكر و ٤٩,١٪ كانوا مصابين بفقر الدم. وبينت الدراسة ان من إجمالي ١٥٥٩ مريضاً بفشل القلب، ٦٠,٩٪ كانوا مصابين بقصور وظائف الكلى. ولوحظ ان المرضى المصابين بقصور وظائف الكلى كانوا أكبر سنا ($p<0.001$). بالإضافة إلى وجود تاريخ مرضي لمرض السكري ($p<0.001$)، الضغط ($p<0.001$)، فقر الدم ($p<0.001$)، الجلطة الدماغية ($p=0.003$) اوالتخخين ($p<0.001$). تحليل متعدد المتغيرات أظهر ان كبار السن (OR, 1.1; 95% CI, 1.05-1.07;)

CI, 1.14-1.86; $p=0.003$), HTN (OR, 1.4; 95% CI, 1.11-1.81; $p=0.005$), and anemia (OR, 1.6; 95% CI, 1.30-2.06; $p<0.001$) were the predictors of RD. Patients with RD had a significantly higher death rate and total length stay ($p<0.001$). However, the hospitalization rate was not significant ($p=0.111$).

Conclusion

About 60.9% of systolic HF patients had RD. Older age, history of DM, HTN, and anemia were predictors of RD. Patients with RD had a higher death rate and a total length of stay.

Keywords

Renal Dysfunction, Heart Failure, Glomerular Filtration Rate, Cardiorenal Syndrome

OR, 1.5; 95% CI, 1.14-1.86); مرض السكري ($p<0.001$ OR, 1.4; 95% CI, 1.11-), مرض الضغط المرتفع ($p=0.003$ OR, 1.6; 95% CI, 1.30-2.06); وفقر الدم (1.81 ; $p=0.005$ $p<0.001$) كانت أسباب هامة للأصابة بقصور في وظائف الكلى. أظهرت الدراسة أيضا أن معدل الوفاة وفترة التنويم بالمستشفى كان أعلى لدى المرضى المصابين بقصور وظائف الكلى مقارنة بغير المصابين ($p<0.01$).

الخلاصة

تقريبا 60,9% من مرضى فشل القلب كان لديهم قصور في وظائف الكلى. كبار السن والمرضى الذين يعانون من مرض السكري، الضغط المرتفع، او فقر الدم كانت أسباب هامة للأصابة بقصور في وظائف الكلى. معدل الوفاة وفترة التنويم بالمستشفى لدى المرضى المصابين بقصور في وظائف الكلى كان أعلى.

الكلمات المفتاحية

قصور وظائف الكلى، فشل القلب، معدل الترشيح الكلوي، متلازمة القلب والكلى

Introduction

Heart Failure (HF) is defined as an abnormality in cardiac structure or function that leads to the inability of the heart to maintain sufficient blood flow to meet the physiological requirements of the metabolizing tissues or can do so at the expense of high filling pressure¹. HF has become a high priority health issue due to its high prevalence particularly among the older age group, and the high rates of associated morbidity and mortality^{2,3}. Renal Dysfunction (RD) is a disorder of gradual or permanent loss of the renal function, resulting in renal failure⁴. The diagnosis of RD is often made based on estimated Glomerular Filtration Rate (eGFR) which provides a more precise approximation of

renal function than elevated serum creatinine alone⁵.

Our knowledge about the interaction between kidneys and heart has increased over the years, and many parts of the pathophysiological background of the cardiorenal syndrome have been recognized⁶. The heart and renal function are closely linked together by the sympathetic nervous system and neurohormone³. The cardiorenal syndrome is complex, as renal diseases and HF share the same risk factors, which they work together and potentiate each other HF is associated with a reduction in renal blood flow and a further decrease in eGFR⁶. Progressive renal ischemia leads to activation of renin angiotensin aldosterone system (RAAS) and increase in sympathet-

ic activity, which is a normal phenomenon but have toxic effects on the renal tissues if they are prolonged⁷. Angiotensin Converting Enzyme Inhibitors (ACEIs) are pivotal in the management of systolic HF, by blocking the RAAS which preserves renal function and decreases mortality rate⁸.

Renal dysfunction in HF patients has a critical role in the pathophysiology and progression of HF over time⁹. HF patients had volume overload which leads to an increase in the central venous pressure in their blood vessels with low systemic pressure, which leads to compromise in the renal perfusion pressure. Also, there is an activation of intrarenal sensors and arterial baroreceptors leading to the activation of the sympathoadrenal system, the RAAS, and intravascular volume. These factors will lead to intrarenal and peripheral vasoconstriction, which causing a further decrease in the renal blood flow and eGFR, leading to RD¹⁵.

Given the growing incidences of RD among HF patients, it is important to know the predictors and prognostic impact of RD among patients with HF. This study aimed to determine the prevalence, predictors, and prognostic impact of RD in hospitalized systolic HF patients in Madinah cardiac center.

Material and Methods

Study design, study period, and study setting

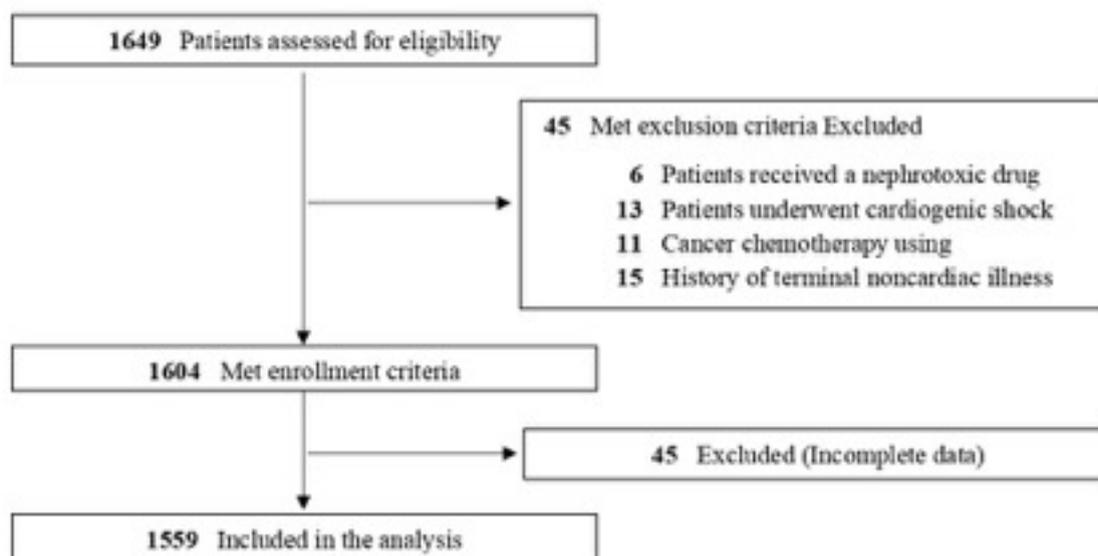
This a cross-sectional study was conducted at Madinah cardiac center involving patients with HF registered in the health management information system database during the period from 1-March-2011 till 20-June-2019.

Study population

The systolic HF registry gathered from an electronic medical records system was retrieved. A total of 1649 patients were identified as having a documented clinical diagnosis of HF and performed a serum creatinine test in the last hospital admission to calculate eGFR.

Patients with systolic HF defined as Left Ventricular Ejection Fraction (LVEF) \leq 45% were included in the study. Patients who had received any nephrotoxic drugs within two days before admission or had cardiogenic shock within one month before admission and those who undergoing cancer chemotherapy were excluded from the study. The presence of terminal non-cardiac illness which could influence the prognosis was set as an exclusion criterion as well. Ninety patients were excluded, 45 of them met the exclusion criteria and the other 45 had incomplete data. The remaining 1559 patients constituted the population of this study [Figure 1].

Figure 1



Blood measurements and eGFR estimation
GFR was estimated depending on the equation made by the chronic kidney disease epidemiology collaboration

$$\text{GFR} = 141 \times \min(\text{Scr} / \kappa, 1)^\alpha \times \max(\text{Scr} / \kappa, 1)^{-1.209} \times 0.993^{\text{Age}} \times 1.018$$

[if female] $\times 1.159$ [if black] where:

Scr is serum creatinine in mg/dL, κ is 0.7 for females and 0.9 for males, α is -0.329 for females and -0.411 for males,¹⁰. Patients were divided into normal renal function and RD according to eGFR (mL/min/1.73 m²). eGFR ≥ 60 ; normal function, and eGFR < 60 ; RD [11]. Anemia was defined as Hemoglobin (Hb) level < 13 g/dl and < 12 g/dl in male and female respectively, according to world health organization criteria for anemia¹².

Demographic variables, cardiac and non-cardiac history, medications, and laborato-

ry data including renal function tests, complete blood cells count, and lipid profile were retrieved from the electronic medical records.

Ethical Approval

Research ethics committee of Taibah University and the ethical committee board of Madinah cardiac center approved this study protocol (approval number: IRB00010413). All study parts were conforming to the declaration of Helsinki Ethical Principles for medical research involving human subjects as revised in 1975¹³.

Statistical Analysis

Data were analyzed using the Statistical Package for Social Science software version 23. Continuous data were presented as mean \pm Standard Deviation (SD) as they were normally distributed when tested by the Shapiro-Wilk test, while the categor-

ical data were presented as frequencies and percentages. Baseline demographic and clinical variables were compared between two groups by using the Pearson chi-squared test for categorical variables. To assess whether the continuous variables differed among the study two groups, we used the independent sample t-test. The predictors of RD were determined by using binary logistic regression. P-value was

considered significant if it is ≤ 0.05 .

Results

Out of 1559 patients included in the analysis, 1047 (67.2%) were males, 585 (37.5%) had a history of acute coronary syndrome (ACS), 799 (51.3%) were hypertensive, 874 (56.1%) were diabetic, 280 (18.0%) were smokers, 766 (49.1%) were anemic at the time of admission, and 188 (12.2%) were on ACEIs (Table 1).

Table 1. Sociodemographic and clinical characteristics of the study population

Variables	Number (n=1559)	(%)
Gender		
Male	1047	(67.2)
Female	512	(32.8)
Cardiac History		
Atrial Fibrillation	208	(13.3)
Arrhythmias	96	(6.2)
Valvular Heart Disease	344	(22.1)
Acute Coronary Syndrome	585	(37.5)
Rheumatic Heart Disease	34	(2.2)
Family History of Coronary Artery Disease	41	(2.6)
Percutaneous Coronary Interventions	142	(9.1)
Coronary Artery Bypass Grafting	91	(5.8)
Valve Replacement	35	(2.2)
Cardiac Device	96	(6.2)
Cardiac Arrest	47	(3.0)
Noncardiac History		
Current Smoker	280	(18.0)
Anemia	766	(49.1)
Hypertension	799	(51.3)
Diabetes Mellitus	874	(56.1)
Cerebrovascular Diseases	100	(6.4)
Peripheral Vascular Disease	20	(1.3)
Dyslipidemia	117	(7.5)
Preadmission Medications		
Aspirin	69	(4.4)

Variables	Number (n=1559)	(%)
Gender		
Clopidogrel	224	(14.4)
Angiotensin Converting Enzyme Inhibitors	188	(12.1)
Calcium Channel Blockers	31	(2.0)
Beta Blockers	264	(16.9)
Digoxin	143	(9.2)
Anticoagulants	96	(6.2)
Diuretics	107	(6.9)
Statin	179	(11.5)
Ferrous Sulfate	87	(5.6)

About 60.9% of patients had RD. Patients with RD were significantly older. Mean \pm SD of age was 70 ± 11 years in patients with RD compared to 57.7 ± 14 years in patients without RD ($p<0.001$). A slightly higher increase in mean Systolic Blood Pressure (SBP) at admission was significant in patients with RD. Mean SBP was 119 ± 23 mmHg in patients with RD compared to 116 ± 15 mmHg in patients without RD ($p=0.006$). However, diastolic blood pressure didn't change between the two groups.

Patients with RD were significantly had a history of ACS ($p=0.002$), rheumatic heart disease ($p<0.043$), Hypertension (HTN) ($p<0.001$), Diabetes Mellitus (DM) ($p<0.001$), anemia ($p<0.001$), stroke ($p<0.003$) and smoking ($p<0.001$). Among all HF patients who used beta blockers, 52.7% of them had RD, compared to 47.3% without RD ($p=0.003$). There was no significant association in valvular heart disease, atrial fibrillation, using ACEIs,

prior percutaneous coronary interventions, or coronary artery bypass grafting.

Regarding laboratory data, patients with RD exhibited a significantly lower hematological profile. Mean \pm SD of Hb level on admission was 12.2 ± 2.2 g/dl and 13.3 ± 2.2 g/dl in patients with RD and without RD, respectively ($p<0.001$). Mean \pm SD of low-density lipoprotein was 2.2 ± 1.0 mmol/L in patients with RD compared to 2.4 ± 1.1 mmol/L in patients without RD ($p<0.001$). Mean \pm SD total cholesterol was 4.0 ± 1.3 mmol/L and 3.7 ± 1.3 mmol/L in patients with RD and without RD, respectively ($p=0.005$). Detailed clinical characteristics and laboratory data are shown in (Table 2).

Table 2. Baseline clinical characteristic and laboratory data stratified by renal function (n=1559)

Clinical Variable	Renal Dysfunction (n=949) (60.9%)		Normal Renal Function (n=610) (39.1%)		OR (95% CI)		P value
	Number (%) / Mean \pm SD						
Age	70 \pm 11		57 \pm 14				<0.001
SBP mmHg	119 \pm 23		116 \pm 15				0.006
DBP mmHg	65 \pm 8		66 \pm 7				0.965
Gender							
Female	348	(68.0)	164	(32.0)	1.575	(1.261 – 1.967)	<0.001
Male	501	(57.4)	446	(42.6)			
Cardiac History							
Atrial fibrillation	136	(65.4)	72	(34.6)	1.250	(0.921 - 1.697)	0.152
Arrhythmias	54	(56.3)	42	(43.8)	0.816	(0.538 – 1.238)	0.338
Valvular heart disease	195	(56.7)	149	(43.3)	0.800	(0.628 – 1.020)	0.072
ACS	385	(65.8)	200	(34.2)	1.399	(1.131 - 1.732)	0.002
Rheumatic Heart Disease	15	(44.1)	19	(55.9)	0.500	(0.252 – 0.991)	0.043
Family History of CAD	25	(61.0)	16	(39.0)	1.004	(0.532 - 1.897)	0.989
PCI	94	(66.2)	48	(33.8)	1.287	(0.895 – 1.852)	0.173
CABG	63	(69.2)	28	(30.8)	1.478	(0.936 – 2.335)	0.092
Valve Replacement	18	(51.4)	17	(48.6)	0.674	(0.345 – 1.319)	0.247
Cardiac Device	86	(89.6)	10	(10.4)	1.108	(0.562 - 2.181)	0.768
Cardiac Arrest	44	(93.6)	3	(6.4)	0.638	(0.196 - 2.080)	0.452
Medical History							
Current Smoker	137	(48.9)	143	(51.1)	0.551	(0.425- 0.715)	<0.001
Anemia	526	(68.7)	240	(31.3)	1.917	(1.559 – 2.358)	<0.001
Hypertension	570	(71.3)	229	(28.7)	2.502	(2.030 – 3.084)	<0.001
Diabetes Mellitus	607	(69.5)	267	(30.5)	2.280	(1.852 – 2.806)	<0.001
Cerebrovascular Diseases	75	(75.0)	25	(25.0)	2.008	(1.262 – 3.195)	0.003
Peripheral vascular disease	16	(80.0)	4	(20.0)	2.598	(0.864-7.808)	0.078
Medications							
Aspirin	42	(60.9)	27	(39.1)	1.000	(0.610 – 1.640)	1.000
Clopidogrel	146	(65.2)	78	(34.8)	1.240	(0.922 – 1.667)	0.154
ACEIs	105	(55.9)	83	(44.1)	0.790	(0.581 – 1.075)	0.132
Beta Blockers	139	(52.7)	125	(47.3)	0.666	(0.510 – 0.869)	0.003
Digoxin	79	(55.2)	64	(44.8)	0.775	(0.548 – 1.096)	0.148
Anticoagulants	88	(91.7)	8	(8.3)	0.852	(0.405 - 1.794)	0.674
Diuretics	56	(52.3)	51	(47.7)	0.687	(0.464 – 1.019)	0.061
Statin	116	(64.8)	63	(35.2)	1.209	(0.873 - 1.674)	0.809
Ferrous Sulfate	48	(55.2)	39	(44.8)	0.780	(0.505 – 1.205)	0.797
Laboratory Variables							
Complete Blood Count							
Hemoglobin(g/dl)	12.2 \pm 2.2		13.3 \pm 2.2				<0.001

Clinical Variable	Renal Dysfunction (n=949) (60.9%)	Normal Renal Function (n=610) (39.1%)	OR (95% CI)		P value
	Number (%) / Mean ± SD				
HCT%	37.5±6.3	40.3±6.0			<0.001
RBC ×10 ¹² /μL	4.3±0.8	4.7±0.8			<0.001
MCV fL	87.1±7.7	86.1±7.5			0.495
WBC ×10 ³ /μL	10.5±6.2	8.9±3.8			<0.001
Platelet Count×10 ³ /μL	256.8±97.5	266.9±97.5			0.237
Kidney Function Tests					
eGFR	38±14	80±19			<0.001
Creatinine (μmol/L)	166.0±79.9	87.4±16.8			<0.001
BUN (mmol/L)	13.3±8.7	6.2±2.6			<0.001
Lipid Profile					
LDL (mmol/L)	2.4±1.1	2.2±1.0			<0.001
HDL (mmol/L)	0.9±0.4	0.9±0.5			0.201
Triglycerides (mmol/L)	1.2±0.7	1.3±0.7			0.156
Total cholesterol (mmol/L)	4.0±1.3	3.7±1.3			0.005
Sodium (mEq/L)	136.6±8.2	137.4±5.4			0.080
Troponin (mcg/L)	4.9±11.8	1.8±6.9			<0.001
SBP; Systolic Blood Pressure, DBP; Diastolic Blood Pressure, ACS; Acute Coronary Syndrome, PCI; Percutaneous Coronary Interventions, CAD; Coronary Artery Diseases, CABG; Coronary Artery Bypass Grafting, ACEI; Angiotensin Converting Enzyme Inhibitors, HCT%; Hematocrit, RBC; Red Blood Cells, MCV; Mean Corpuscular Volume, WBC; White Blood Cells, eGFR; estimated Glomerular Filtration Rate, BUN; Blood Urea Nitrogen, LDL; Low Density Lipoprotein, .HDL; High Density Lipoprotein					

Multivariate analysis showed that older age (OR, 1.1; 95% CI, 1.05-1.07; p<0.001), history of DM (OR, 1.5; 95% CI, 1.14-1.86; p=0.003), HTN (OR, 1.4; 95% CI, 1.11-1.81; p=0.005), and anemia (OR, 1.6; 95% CI, 1.30-2.06; p<0.001) were the independent predictors of RD (Table 3).

Table 3. Risk factors of renal dysfunction in systolic HF patients

Variables	Sig	Exp(B)	95% C.I. for EXP(B)	
			Lower	Upper
Age	<0.001	1.064	1.054	1.073
Female	0.311	1.139	0.885	1.466
Acute coronary syndrome	0.368	1.116	0.879	1.416
Diabetes mellitus	0.003	1.456	1.141	1.858
Hypertension	0.005	1.420	1.112	1.814
Anemia	<0.001	1.637	1.300	2.060

Patients with RD had a significantly higher death rate compared to patients with normal renal function. About 86.9% of the patients who died had RD (p<0.001). Total length stay was higher among patients with RD. Mean ± SD of the total length of stay was 8±21 days in patients with RD compared to 5±6 days in patients without RD (p<0.001). However, there was no difference regarding the hospitalization rate

between the two groups (Table 4).

Table 4. Outcomes comparison for HF patients with or without renal dysfunction

Outcomes	Renal Dysfunction (n=949) (60.9%)	Normal Renal Function (n=610) (39.1%)	OR (95% CI)	P value
	Number (%) / Mean \pm SD			
Death	721 (86.9)	26 (31.1)	4.972 (3.247 – 7.614)	<0.001
Hospitalization rate	1.86 \pm 1.61	1.73 \pm 1.46		0.111
Total length of stays (days)	8 \pm 21	5 \pm 6		<0.001

Discussion

RD in HF patients is becoming more frequent and severe¹³. In the current study, we found that 60.9% of systolic HF patients had RD (defined as eGFR <60ml/ml/min/1.73m²). Previous studies reported a high prevalence of RD in HF patients¹⁴. A recent retrospective cohort study showed that the overall prevalence of RD was 89%³. Similarly, a meta-analysis evaluated the association between RD and HF revealed that 63% of patients had RD¹⁵. Ronco et al reported that RD has been observed in 45-63% of systolic HF patients¹⁶. Baydemir et al showed that 81% of HF patients had moderate RD and 19% had severe RD¹⁷. However, in a study conducted on 1301 patients registered in a systolic HF disease management program, just 26% were found to have CKD^{18, 19}.

RD is common in HF patients and shares the same risk factors. The current study found that older age, history of DM, HTN, and anemia were predictors of RD. Several predictors of RD have been described in the previous studies. Data from the Framingham HF study found that older age, high Body Mass Index (BMI), DM, and smok-

ing were predictors of RD²⁰. Data from the national health and nutrition examination surveys suggest that older age^{18,22,23}, ethnicity^{18,21}, education^{18,21}, high BMI²³, history of DM^{15,19,24}, HTN^{14,25,26}, and cardiovascular disease^{3,28} were associated with RD.

A study done by Tarantini et al showed that moderate to severe RD was diagnosed in 59% of systolic HF patients at hospital admission and these patients were older and had a high prevalence of HTN, DM, and anemia²⁹. Another study showed that the age of more than 75 years remained an important risk factor for RD development in HF patients²⁸. Older patients have a higher prevalence of DM, HTN, anemia, MI, and HF hospitalization, thus may explain the high prevalence of RD among this group along with age-related changes and decrease in renal function²⁹. However, Fox et al showed that age was not associated with RD, demonstrating that age-related systemic effects are not specifically related to the onset of RD²².

Among HF patients with RD, the prevalence of DM ranged from 37-55% while the prevalence of HTN ranged from 68-85%. This may be explained by the fact,

that the presence of well-known risk factors of RD like DM and HTN leads to further reduction of eGFR and worsen any pre-existing RD³⁰. In univariate analysis, female gender and history of ACS were associated with RD but these links disappeared when the multivariable analysis was conducted. However, McAlister et al showed that HF patients with RD were more likely to be female³⁰.

Patients with RD had a significantly higher death rate in contrast to patients without RD. About 86.9% of HF patients who died had RD. RD is related to short and long-term mortality among HF patients¹⁸. Hillege et al found that the death rate in HF patients was associated with a decline in the eGFR than with a decline in the LVEF%³¹. Löfman et al found that the mortality rate increased from 2% in patients without RD to 30% in those with end-stage renal disease (eGFR <15), and the 5 years probability of death was 60% in those with moderate RD and 80% in patients with severe RD³.

In the current study, the total length of stays was higher among patients with RD. But there was no association between RD and the number of hospital admissions. In the Kor-HF registry, length of hospital stays, and the period of intensive care unit stay were prolonged in systolic HF patients with RD and the hospital death rate was 13.2%

³⁰. In the candesartan in HF assessment of mortality and morbidity trial, patients with eGFR <60 had increased risk of HF hospitalization and cardiovascular death, and this risk increased with decreasing eGFR³². However, Verdiani et al reported that there are no differences in re-hospitalization rates, length of stay, or mortality rate in patients with RD compared with those without RD²⁰.

Conclusion

About 60.9% of systolic HF patients had RD. Older age, history of DM, HTN, and anemia were the independent predictors of RD. Patients with RD had a significantly higher death rate and total length stays.

References

1. AlHabeeb W, Al-Ayoubi F, AlGhalayini K, Al Ghofaili F, Al Hebaishi Y, Al-Jazairi A. Saudi Heart Association (SHA) Guidelines for the Management of Heart Failure. J Saudi Hear Assoc 2019; 31(4): 204-253.
2. Sánchez-Torrijos J, Gudín-Uriel M, Nadal-Barangé M, Jacas-Osborn V, Trigo-Bautista A, Giménez-Alcalá M. Prognostic Value of Discharge Hemoglobin Level in Patients Hospitalized for Acute Heart Failure. Rev Esp Cardiol 2006; 59(12): 1276–1282.
3. Löfman I, Szummer K, Hagerman I, Dahlström U, Lund LH, Jernberg T. Prevalence and prognostic impact of kidney dis-

- ease on heart failure patients. *Open Hear* 2016; 3(1): e000324.
4. Silverberg DS, Wexler D, Blum M, Ker-
en G, Sheps D, Leibovitch E. The use of
subcutaneous erythropoietin and intrave-
nous iron for the treatment of the anemia
of severe, resistant congestive heart failure
improves cardiac and renal function and
functional cardiac class, and markedly re-
duces hospitalizations. *J Am Coll Cardiol*
2000; 35(7): 1737–1744.
 5. Heywood JT, Fonarow GC, Costanzo
MR, Mathur VS, Wigneswaran JR, Wynne
J. High Prevalence of Renal Dysfunction
and Its Impact on Outcome in 118,465
Patients Hospitalized With Acute Decom-
pensated Heart Failure: A Report From
the ADHERE Database. *J Card Fail* 2007;
13(6): 422–430.
 6. Pai P. Cardiorenal syndrome. *Hong
Kong J Nephrol* 2015; 17(2): 36–45.
 7. Yu HT. Progression of Chronic Renal
Failure. *Arch Intern Med* 2003; 163(12):
1417–1429.
 8. Smith GL, Lichtman JH, Bracken
MB, Shlipak MG, Phillips CO, DiCap-
ua P. Renal Impairment and Outcomes
in Heart Failure. Systematic Review and
Meta-Analysis. *J Am Coll Cardiol* 2006;
47(10): 1987–1996.
 9. Ärnlöv J. Diminished renal function and
the incidence of heart failure. *Curr Cardiol
Rev* 2009; 5(3): 223–227.
 10. Valente MAE, Hillege HL, Navis G,
Voors AA, Dunselman PHJM, Van Veld-
huisen DJ. The Chronic Kidney Disease
Epidemiology Collaboration equation out-
performs the modification of Diet in Renal
Disease equation for estimating glomerular
filtration rate in chronic systolic heart fail-
ure. *Eur J Heart Fail* 2014; 16(1):86–94.
 11. Myers GL, Miller WG, Coresh J, Flem-
ing J, Greenberg N, Greene T. Recommen-
dations for improving serum creatinine
measurement: A report from the Laborato-
ry Working Group of the National Kidney
Disease Education Program. *Clin Chem*
2006; 52(1): 5–18.
 12. World Health Organization. Haemo-
globin Concentrations for the Diagnosis
of Anaemia and Assessment of Severity.
Miner Nutr Inf Syst World Heal Organ
2013;1–6.
 13. World Medical Association Declaration
of Helsinki. *JAMA* 2013; 310(20):2191.
 14. Ahmed A, Campbell RC et.al. Epi-
demiology of Chronic Kidney Disease
in Heart Failure. *Heart Fail Clin* 2008;
4(4):387–399.
 15. Liu PP. Cardiorenal syndrome in heart
failure: A cardiologist’s perspective. *Can J
Cardiol* 2011; 24(7):25-29.
 16. Ronco C, Di Lullo L. Cardiorenal Syn-
drome in Western Countries: Epidemiolo-

- gy, Diagnosis and Management Approaches. *Kidney Dis* 2016; 2(4):151–163.
17. Baydemir C, Ural D, Karaüzüm K, Balci S, Arğan O, Karaüzüm I. Predictors of Long-Term Mortality and Frequent Re-Hospitalization in Patients with Acute Decompensated Heart Failure and Kidney Dysfunction Treated with Renin-Angiotensin System Blockers. *Med Sci Monit* 2017;23:3335–3344.
18. Sarnak M. A Patient with Heart Failure and Worsening Kidney Function. *Clinical Journal of the American Society of Nephrology* 2014; 9(10):1790-1798.
19. Hebert K, Dias A, Delgado MC, Franco E, Tamariz L, Steen D. Epidemiology and survival of the five stages of chronic kidney disease in a systolic heart failure population. *Eur J Heart Fail* 2010; 12(8):861–865.
20. Verdiani V, Lastrucci V, Nozzoli C. Worsening Renal Function in Patients Hospitalized with Acute Heart Failure: Risk Factors and Prognostic Significances. *Int J Nephrol* 2010; 2011:1–5.
21. Kottgen A, Russell SD, Loehr LR, Crainiceanu CM, Rosamond WD, Chang PP. Reduced Kidney Function as a Risk Factor for Incident Heart Failure: The Atherosclerosis Risk in Communities (ARIC) Study. *J Am Soc Nephrol* 2007; 18(4):1307–1315.
22. Fox CS, Larson MG, Leip EP, Cullerton B, Wilson PWF, Levy D. Predictors of New-Onset Kidney Disease in a Community-Based Population. *J Am Med Assoc* 2004; 291(7):844–850.
23. Matsushita K, Kwak L, Hyun N, Bessel M, Agarwal SK, Loehr LR. Community burden and prognostic impact of reduced kidney function among patients hospitalized with acute decompensated heart failure: The Atherosclerosis Risk in Communities (ARIC) Study Community Surveillance. *PLoS One* 2017; 12(8).
24. Alsuwaida AO, Farag YMK, Al Sayyari AA, Mousa D, Alhejaili F, Al-Harbi A. Epidemiology of chronic kidney disease in the Kingdom of Saudi Arabia (SEEK-Saudi investigators) - a pilot study. *Saudi J Kidney Dis Transplant* 2010; 21(6): 1066–1072.
25. Forman DE, Butler J, Wang Y, Abraham WT, O'Connor CM, Gottlieb SS. Incidence, Predictors at Admission, and Impact of Worsening Renal Function among Patients Hospitalized with Heart Failure. *Journal of the American College of Cardiology* 2004; 43(1): 61–67.
26. Costanzo MR. Cardiorenal syndrome in heart failure patients I . Cardiorenal Syndrome : What every physician needs to know . II . Diagnostic Confirmation : Are you sure your patient has Cardiorenal Syn-

- drome ? 2019;1–33.
27. Go AS, Yang J, Ackerson LM, Leper K, Robbins S, Massie BM. Hemoglobin Level, Chronic Kidney Disease, and the Risks of Death and Hospitalization in Adults With Chronic Heart Failure. *Circulation* 2006; 113(23): 2713–2723.
28. Cheitlin M. Renal Function as a Predictor of Outcome in a Broad Spectrum of Patients With Heart Failure. *Yearbook of Cardiology* 2007; 327-328.
29. Tarantini L, Cioffi G, Gonzini L, Oliva F, Lucci D, Di Tano G. Evolution of renal function during and after an episode of cardiac decompensation: results from the Italian survey on acute heart failure. *Journal of Cardiovascular Medicine* 2010; 11(4): 234-243.
30. McAlister F, Ezekowitz J, Tonelli M, Armstrong P. Renal Insufficiency and Heart Failure. *Circulation* 2004; 109(8): 1004-1009.
31. Afsar B, Ortiz A, Covic A, Solak Y, Goldsmith D, Kanbay M. Focus on renal congestion in heart failure. *Clinical Kidney Journal* 2015; 9(1):39-47.
32. Smilde T, Hillege H, Navis G, Boomsma F, de Zeeuw D, van Veldhuisen D. Impaired renal function in patients with ischemic and nonischemic chronic heart failure: association with neurohormonal activation and survival. *American Heart Journal* 2004; 148(1): 165-172.

Original Article :

Public Awareness of Audiology and Speech-Language Pathology in Saudi Arabia

Ahmad A. Alanazi^{1,2*}, Sarah S. Al Fraih¹

1. Department of Audiology and Speech Pathology, College of Applied Medical Sciences, King Saud bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia
2. King Abdullah International Medical Reseach Center, Riyadh, Saudi Arabia

Received on 22.10.2020, accepted for publication on 31/12/2020 dx.doi.org/10.5455/mjhs.2021.02.005

Corresponding Author:

Dr. Ahmad A. Alanazi, College of Applied Medical Sciences, King Saud bin Abdulaziz University for Health Sciences, P.O. Box 3660, Riyadh, 11481 Mail Code 3129, Saudi Arabia. Phone: +966112499999 Ext. 95117.
E-mail: alanaziahm@ksau-hs.edu.sa

Abstract

Background :

There is a literature gap addressing the Saudi general public's understanding of audiology and speech-language pathology (SLP). This study aimed to examine the public awareness of audiology and SLP professions in Saudi Arabia.

Methods:

This was a cross-sectional study design consisted of two parts. The pre-test part aimed to provide content validation for the major questionnaire study. The full-scale study addressed the aim. An electronic questionnaire was prepared and distributed. The questionnaire contained three sections: demographics, experience with hearing and communication disorders, and audiology and SLP knowledge.

Results:

A total of 50 and 512 participants completed the questionnaires for both parts, respectively. Most of participants were Saudi citizens (98.8%), aged 18–30 years, and lived in Riyadh. The questions with the most correct response rates were mostly inductive (e.g., workplace), but some audiology and SLP services (e.g., diagnosis and management of tinnitus, vestibular and swallowing disorders) were not well-identified by the participants. Of the total, 78.7% and 87.5% of participants correctly identified that the work of audiologists and speech-language pathologists (SLPs) was not like the work of teachers of deaf and hard of hearing and special education teachers, respectively.

المخلص

الخلفية:

هناك فجوة بحثية بخصوص فهم المجتمع السعودي لتخصص علم أمراض واضطرابات السمع والتخاطب. هدفت هذه الدراسة إلى تحديد مدى وعي المجتمع السعودي لهذا التخصص.

طريقة البحث :

تم تصميم دراسة مقطعية وصفية لتحقيق هدف الدراسة. كان الجزء الأول عبارة عن اختبار تجريبي هدف إلى التحقق من صحة المحتوى الذي سوف يستخدم في الدراسة الرئيسية. بينما كان الجزء الثاني عبارة عن الاستبيان الأساسي لتحقيق هدف الدراسة الرئيس. تم قياس مستوى الوعي من خلال إعداد استبيان إلكتروني وتوزيعه حيث احتوى على ثلاثة أقسام: التركيبة السكانية، والخبرة في اضطرابات السمع والتخاطب، والمعرفة بتخصص علم أمراض واضطرابات السمع والتخاطب.

النتائج:

أكمل 50 مشاركاً الاختبار التجريبي، بينما أكمل 512 مشاركاً الاستبيان الرئيس. غالبية المشاركين كانوا من المواطنين السعوديين (98,8٪)، الذين تتراوح أعمارهم بين 18-30 سنة، ويعيشون في الرياض. كانت الأسئلة (على سبيل المثال: مكان العمل) ذات معدلات الاستجابة الأكثر دقة، بينما الأسئلة التي كانت تتعلق ببعض الخدمات الصحية في السمع والتخاطب (مثل تشخيص وعلاج طنين الأذن واضطرابات الجهاز الدهليزي والبلع) لم يتم الإجابة عليها بدقة من قبل المشاركين. من مجموع المشاركين، 78,7٪ منهم استطاع التفريق بشكل صحيح بين عمل أخصائيي السمع وعمل معلمي الصم وضعاف السمع، بينما 87,5٪ منهم استطاع التفريق بين عمل أخصائيي أمراض النطق واللغة وعمل معلمي التربية الخاصة.

Conclusion:

A reasonable level of public awareness of audiology and SLP in Saudi Arabia was identified. Still, more public awareness campaigns and educational materials about audiology and SLP are needed. Stakeholders are advised to strengthen public awareness efforts at the national level.

Keywords:

Audiology; awareness; communication disorders; hearing loss; Saudi Arabia; speech-language pathology.

الخلاصة:

بيّنت هذه الدراسة مستوى معقول من وعي المجتمع بتخصص علم أمراض واضطرابات السمع والتخاطب في المملكة العربية السعودية. ومع ذلك، لا تزال هناك حاجة إلى المزيد من حملات التوعية العامة والمواد التعليمية حول هذا التخصص. لذلك يُنصح أصحاب المصلحة بتعزيز جهود التوعية العامة على المستوى الوطني.

الكلمات المفتاحية:

علم أمراض واضطرابات السمع والتخاطب، الوعي، اضطرابات التواصل، المملكة العربية السعودية.

Introduction

According to Article 19 of the Universal Declaration of Human Rights, it is every human's right to communicate.¹ However, there is a global lack of awareness of the needs of people with communication disorders.² Therefore, six international audiology and speech-language pathology (SLP) professional bodies established the "International Communication Project (ICP)" to raise awareness about communication disorders.³ The ICP focuses on identifying potential opportunities for the acknowledgment of communication disorders by governing bodies and advocate for accessing services.² A steppingstone to this acknowledgment and advocacy is assessing the general public's level of knowledge on audiology and SLP.

The professions of audiology and SLP are "inextricably linked".⁴ Both professions provide various services to a wide array of individuals from pediatrics to geriatrics.

The following is a list of audiology service delivery areas as per the Saudi Society of Speech-Language Pathology and Audiology (SSSPA): hearing, balance, tinnitus, cognition and auditory processing.⁵

SLP service delivery areas include: speech production, language, fluency, cognition, voice, resonance, feeding and swallowing, auditory habilitation and rehabilitation.⁶ However, limited public awareness of hearing and communication disorders remains. For example, according to a survey distributed among American Speech and Hearing Association (ASHA) members, audiologists, and speech-language pathologists (SLPs) indicated that public awareness of the early warning signs of communication disorders is low.⁷ Both professions are considered relatively new in Saudi Arabia. Many audiologists mentioned that "Saudi Arabia needs better understanding of the field among other healthcare professionals and in the com-

munity”.⁸ SLPs also stated that there needs to be “better recognition of the profession by national authorities”.⁸ There is an imbalanced distribution of audiologists and SLPs across Saudi healthcare sectors. A contributing factor to this phenomenon might be the limited public awareness about the professions.⁹ Getting an idea of the public’s understanding of the services audiologists and SLPs provide will help identify areas of ambiguity and potentially clarify them. Different studies were carried out pertaining to public awareness of audiology, SLP and hearing and communication disorders in different countries. For example, awareness of dysfluency in Brazil and China,^{10,11} awareness of aphasia in England,¹² awareness of audiology, hearing and hearing health in South Africa,¹³ and ear and hearing health among mothers of young children in India.¹⁴ Yet, limited research was done on public awareness of audiology and SLP in Arab countries. For example, Mahmoud et al. found that public awareness and knowledge of SLP in Amman, Jordan was limited.¹⁵ Alshehri et al. investigated the public awareness of ear health and hearing loss in Jeddah, Saudi Arabia and found that the overall awareness was fair.¹⁶ They illustrated the need for preparing educational materials for the community including those with hearing loss and their families. There is still a gap

in the literature addressing levels of understanding the Saudi general population has pertaining to audiology and SLP professions and the role of audiologists and SLPs. Addressing this gap will better identify current public awareness levels and serve as a segue to remediate any misunderstandings about both fields.

Methods

This cross-sectional, descriptive study was designed to examine the public awareness of audiology and SLP professions including their roles in Saudi Arabia.

This study was approved by the Institutional Review Board of King Abdullah International Medical Research Centre (#RC20/031/R). Informed consent was obtained from all voluntarily willing participants. No identifiable or health information was collected. Only the authors had access to the data.

This study was established in Riyadh, Saudi Arabia. The inclusion criteria included all people who lived in Saudi Arabia and who aged ≥ 18 years old at the time of completing the questionnaire. Healthcare providers and incomplete questionnaires were excluded. Healthcare providers’ awareness of audiology and SLP in Saudi Arabia will be investigated by the authors in a separate study.

This questionnaire was established and

conducted in two parts. The pre-test part aimed to provide valuable content validation for the major study. The second part, the full-scale study, investigated the awareness level that public has about both professions in Saudi Arabia.

The pre-test part

A self-administered English questionnaire was developed for data collection after a review of the literature and a focus group of experts in the fields. This questionnaire consisted of 22 questions distributed into three sections: demographics, experience with hearing and communication disorders, and knowledge of audiology and SLP (<https://drive.google.com/file/d/1cjdndIW0nDnHlrwtaOrhgHoCmag5el9q/view?usp=sharing>). In the first section of the questionnaire, participants responded to nine questions related to personal and demographic data: gender, age, nationality, region of residency, education, occupation, place of work, marital status, whether or not they have children, and number of children if applicable. The second section included five questions that invited participants to comment on their experiences with hearing and communication disorders. The third section consisted of eight questions that explored the participants' awareness of audiology and SLP. Because Arabic is the primary language in Saudi Arabia, the authors followed the WHO process of translation and adapta-

tion of instruments.¹⁷ The original English questionnaire was translated into Arabic by two independent bilingual (in English and Arabic) experts. Then, the expert panel identified and resolved any inadequate expressions or concepts of the translation. The Arabic version was then translated back into English by two independent bilingual (in English and Arabic) experts. Later, 50 participants were presented with hard copies of the questionnaire for the pre-test part. Before completing and submitting the questionnaire, the participants had to read and complete the informed consent that included necessary elements, such as the purpose of the research, inclusion criteria, benefits and risks, handling of data, and contact information. Those 50 participants were not included in the sample size of the main study. To ensure no misunderstanding of any question, the participants in the pre-test part were asked about the clarity of all questions. They had correct understanding of the questions, and no comments were received.

The face validity and internal consistency of the final version of questionnaire was established. The data of 50 participants were analysed by using Statistical Package for Social Sciences (SPSS) for Windows v. 25.0 (IBM SPSS Statistics, IBM Corporation, Armonk, NY, USA). Cronbach's α score was calculated and Principal Com-

ponents Analysis (PCA) was performed for validation of the questionnaire. A Cronbach's α score of 0.71 was obtained, KMO and Bartlett's test yielded results depicting that variables are significantly correlated on PCA. No changes were done on the translated version which was considered to be the final version of the questionnaire used in the main study.

The full-scale study

According to the results from the pre-test part, the content of the questionnaire was not modified. A convenience sampling technique was used in this research. The questionnaire was prepared electronically on Google Forms (Google LLC, Mountain View, California, United States) to reach many people all over Saudi Arabia in a time-efficient and cost-effective way. The link to the questionnaire was emailed to a random sample of people and posted on and shared via social media (Twitter, Facebook, LinkedIn, and WhatsApp). An electronic informed consent was obtained in the full-scale study as well. Because the total population in Saudi Arabia is around 33,660,923 excluding approximately 584,708 healthcare providers,[18,19] the sample size was calculated to be 385 participants using Raosoft sample size calculator (Raosoft, Inc., United States) with 5% margin of error, 95% confidence level, and 50% response distribution. The question-

naire link was accessible for five months. Monthly electronic reminders were sent. Participation was voluntary, and answers were anonymous.

Results

A total of 512 participants were included in the analysis based on the inclusion criteria. Data were analysed using descriptive statistics. Seven uncompleted surveys were excluded. The results were prepared according to the following sections: (a) demographics, (b) experience with hearing and communication disorders, and (c) knowledge of audiology and SLP.

Nine items explained background characteristics of participants. Most of the participants (98.8%) were Saudi citizens, residing in the region of Riyadh. Of the total, 52% participants were male, and the majority aged 18–30 years. Of the participants, 18.9% aged between 31–40 years, 13.3% belonged to the age group of 41–50 years old, 11.3% aged between 51–60 years old, and 8.2% aged between 61–70 years old. Only 0.8% participants were older than 70 years. Regarding education, more than half of the participants had a minimum of a bachelor's degree or higher. The greater proportions of participants were either students or employed individuals. Exactly, 45.7% of participants reported having children. Of the participants who had children, 56% of them had three

to five children. The participants' demographics are summarized in Table 1.

Table 1: Demographics of participants

Variables	Answer Options	Responses <i>n</i> (%)
Age Range	18–30	243 (47.5)
	31–40	97 (18.9)
	41–50	68 (13.3)
	51–60	58 (11.3)
	61–70	42 (8.2)
	71 and over	4 (0.8)
Region	Riyadh	434 (84.7)
	Eastern	38 (7.4)
	Makkah	29 (5.6)
	Northern Borders	5 (1.1%)
	Asir	3 (0.6)
	Bahah	2 (0.4)
	Qassim	1 (0.2)
Educational Level	Bachelor's degree	239 (46.7)
	High school or equivalent	153 (29.9)
	Master's degree	53 (10.4)
	Diploma	35 (6.8)
	Doctor of philosophy	22 (4.2)
	Below high school	10 (2)
Occupation	Student	198 (38.7)
	Employed	170 (33.2)
	Retired	71 (13.9)
	Unemployed	55 (10.7)
	Self-employed	18 (3.5)
Marital Status	Married	254 (49.6)
	Single	239 (46.7)
	Divorced	11 (2.1)
	Widow	8 (1.6)
Children	No	278 (54.3)
	Yes	234 (45.7)
Number of children	3–5 children	131 (56)
	6 children or more	53 (22.6)
	2 children or less	50 (21.4)

Of the total, 67% of participants have never personally visited or had one of their family members visit an audiologist or a speech-language pathologist. Of those who had, a bigger portion (18.8%) visited audiologists than SLPs (6.8%), whereas 7.4% participants visited both professionals. Most of participants 87.3% have nev-

er been diagnosed with hearing loss or a communication disorder. Forty-six (9%) participants were diagnosed with hearing loss, 14 (2.7%) with communication disorders, and five (1%) with both.

Over half of the participants (56.6%) knew someone with hearing loss, a communication disorder or both. Those who reported knowing people with hearing loss were more than double those who reported knowing people with communication disorders. Of the total, 47.4% of the participants stated their relationship to individuals with hearing loss or communication disorders. First degree relatives were the biggest portion of responses where 84 participants (34%) had a parent, full sibling or child with hearing loss or a communication disorder. This was followed by friends and acquaintances with 58 responses (24%), then third-degree relatives, such as first cousins, which had a 23% response rate (n=55). Exactly, 36 respondents (15%) had a second degree relative such as aunts, uncles, nieces, nephews, grandchildren, grandparents and half-siblings with hearing loss or a communication disorder. More than half of the participants have never seen, heard, or read anything about hearing and communication disorders. Among those who had, 115 (22.5%) participants encountered information for both hearing and communication disorders, 68 (13.3%)

for hearing disorders only, and 65 (12.7%) for communication disorders only.

Eight items were devoted to establishing the level of awareness of audiology and SLP. Regarding to the type of workplaces for audiologists and SLPs, most of the participants (80.9%) reported hospitals being the main workplace for both professionals, while the least responses (7.2%) were military (Figure 1).

While the majority of participants (n=201; 40.8%) indicated that no referral is needed to see audiologists or SLPs, more than a third of the participants (n=190; 36.9%) did not know if a referral is needed to access services. The remaining participants (n=115; 22.3%) reported that referrals are needed to see audiologists or SLPs. The responses to the age groups that audiologists and SLPs most commonly work with were as follows: toddlers, school-aged children, elderly, teenagers, adults then infants, respectively. Toddlers and school aged children had over 60% response rate for each. This was followed by the elderly, teenagers and adults with over 40% response rate for each. Infants had the least response rate with almost 24%. Surprisingly, 116 of the participants (22.7%) were not sure of the population audiologists and SLPs most commonly work with.

An equal portion of the participants (26.6%) believed that it takes two–three

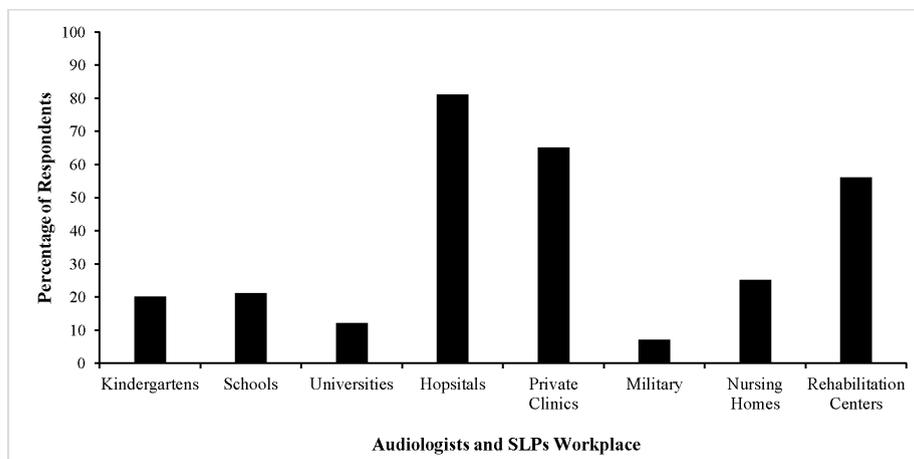


Figure 1. The distribution of potential workplaces for audiologists and speech-language pathologists (SLPs) in Saudi Arabia reported by the participants ($n= 512$). *Note.* The participants stated more than one workplace, so percentages sum to more than 100%.

or four years of study and training after high school to become an audiologist or a speech-language pathologist. Roughly, 30% of the participants indicated that it takes five years of study and training, whereas 53 (10.4%) participants believed it takes more than five years to become a specialist in either field. The remaining participants ($n=31$; 6.1%) thought it took at least a year. While the majority of the participants (78.7%) differentiated between the nature of work that audiologists and teachers of the deaf and hard of hearing do, 109 (21.3%) participants believed that audiologists and teachers of the deaf and hard of hearing do the same work. As for the nature of work that SLPs and special education teachers have, only 64 (12.5%) participants believed that SLPs and special education teachers do the same work. Again, most of the participants (87.5%)

differentiated between the two professions. Most of the participants indicated that diagnosing hearing loss, improving hearing, and prescribing and fitting hearing aids and assistive listening devices were the main services audiologists perform. Less than half of the participants believed that audiologists diagnose and manage tinnitus, whereas only 35.5% of them believed that diagnosing and managing vestibular disorders were within the services that audiologists provide. The majority identified that prescribing medication and surgical intervention were not tasks that audiologists perform. Of the total, 19.7% participants stated that they did not know the job of audiologists (Figure 2).

The most prominent responses about SLP services were all verbal communication skills. Over half the sample believed that improving speech, diagnosing, and man-

aging communication disorders and managing stuttering were within the expertise of SLPs. This was followed by improving receptive language skills and managing

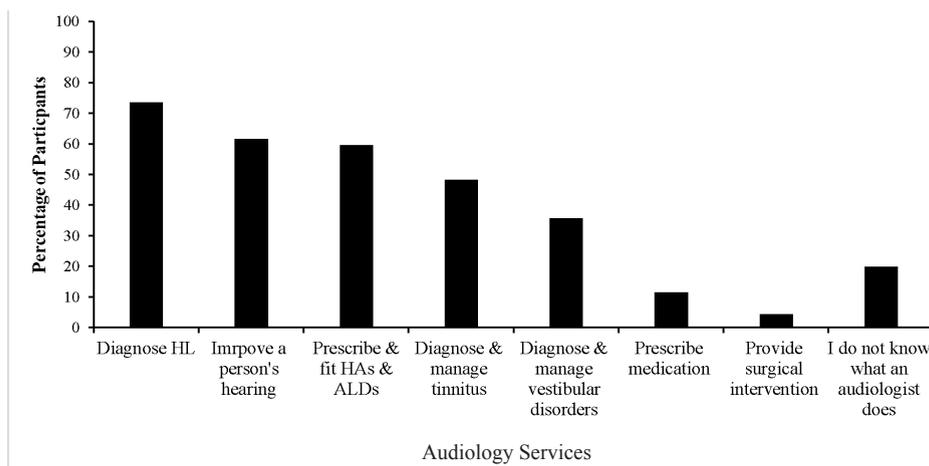


Figure 2. The distribution of the job of audiologists in Saudi Arabia indicated by the participants ($n= 512$). *Note.* The participants reported more than one service, so percentages sum to more than 100%; HL: Hearing loss; HAs: Hearing aids; ALDs: Assistive listening devices.

voice disorders with 41.4% and 40.8% response rates, respectively. Diagnosing and managing swallowing disorders had the least response rate with only 25.6% of participants believing it is within the scope of practice of SLPs. Most participants identified the foil items and did not agree that prescribing medication and surgical inter-

vention were tasks that SLPs perform. Of the total, 18.2% participants reported that they did not know the job of SLPs (Figure 3).

Discussion

In this study, a questionnaire was administered to study the public awareness of audiology and SLP professions in Saudi

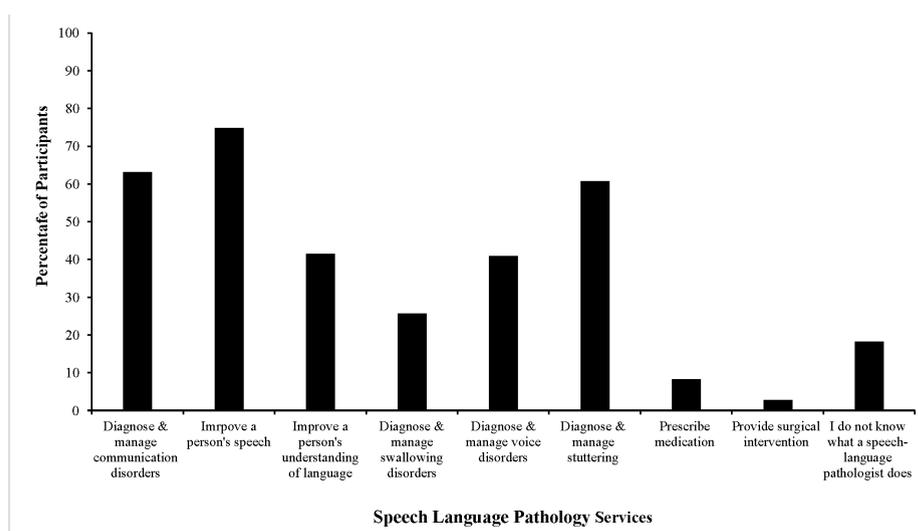


Figure 3. The distribution of the job of speech-language pathologists in Saudi Arabia opted by the participants ($n= 512$). *Note.* The participants reported more than one service, so percentages sum to more than 100%.

Arabia. A total of 512 individuals participated in the main study. Although more than half of them never visited an audiologist or a speech-language pathologist or was diagnosed with hearing loss or communication disorder, our results show an overall reasonable awareness of audiology and SLP. Most of participants were from three large regions: Riyadh, Eastern, and Makkah where audiology and SLP services are well established at different health workplaces (e.g., governmental hospitals and rehabilitation centers). Khojah and Sheeshah reported that most of the SLP services in Saudi Arabia are concentrated in these three regions.⁹ Furthermore, the current existing audiology and SLP academic programs are offered by King Saud University, Princes Noura bint Abdulrahman University and Dar AlHekmah University, are located in Riyadh and Jeddah, the two largest cities in Riyadh and Makkah regions.⁸ In our study, the majority of the population were highly educated with more than half the participants having a minimum of a bachelor's degree. This indicates an association between level of education and overall awareness of audiology and SLP. All these reasons might explain the level of awareness found in this study.

Only a few participants were diagnosed with hearing loss, a communication dis-

order or both; however, more than half of the participants knew someone with hearing and communication disorders. Most of participants who knew someone with a hearing and/or communication disorder were related in a first degree. The General Authority for Statistics in Saudi Arabia estimated that 1.4% of all citizens have mild, moderate or severe hearing difficulties.²⁰ Approximately 21.3% of disabilities among Saudi citizens are caused by congenital malformations.²⁰ Congenital hearing loss has been found in many families because of consanguineous marriage.²¹ Interestingly, only 29% (n=149) of the study participants knew a second or third degree relative, friend or acquaintance with a hearing or communication disorder. Given the nature of some auditory and communication disorders, they may be not as visible and noticeable to others. In addition to the possible stigmatization associated with such disorders, some individuals with these disorders might shy away from sharing personal information within their community. That said, it is noteworthy that nearly half of the participants have never seen, heard, or read anything about hearing and communication disorders.

Although there is limited information about audiologists and SLPs employed in Saudi Arabia and their current practices,⁸ the participants' awareness of the potential

workplaces for audiologists and SLPs was good. Most of participants correctly identified that hospitals, private clinics, and rehabilitation centres were the most workplaces for audiologists and SLPs. It is estimated that most audiologists and SLPs in Saudi Arabia worked in hospitals.⁸

Regardless the percentage of participants who selected schools and universities as potential workplaces for audiologists and SLPs in Saudi Arabia, there are limited numbers of audiologists and SLPs work in such places. Additionally, many in the educational field strongly agreed to the need of services delivered by both professionals in schools as well.²² Toddlers and school aged children were selected as the age groups that audiologists and SLPs most commonly work with followed by the elderly, teenagers, and adults. Audiologists and SLPs work with all ages from infancy to adulthood. According to ASHA, SLPs practicing in the United States spent 60% of their clinical services time with adults, 14 % with infants and toddlers, 14% with pre-school children, and 13% with school-age children.²³ In the present study, a few participants might correlate words 'speech' and 'language' with infants and children, so kindergartens were selected as one of the workplaces of audiologists and SLPs in Saudi Arabia. The majority of participants believed a physician's refer-

ral was not required to see an audiologist or a speech-language pathologist, whereas more than a third of the total participants did not know if a referral is needed to access services. Whether the referral is required or not depends on where audiologists and SLPs practice. Since most audiologists and SLPs in Saudi Arabia work in healthcare settings; referrals from physicians are mandatory. However, with a 'direct access' system, patients will be able to see either professionals without a referral from physicians or other healthcare providers.²⁴

The fact that 53.2% of participants reported two-four years after high school were required to be an audiologist or a speech-language pathologist is indicative of the community's limited recognition of the services provided by both professionals. In Saudi Arabia, a bachelor's degree is the entry level to work as an audiologist or a speech-language pathologist. The duration of study for this degree is five years including a training year (i.e., internship). It is encouraging evidence that the majority of participants differentiated audiologists from teachers of the deaf and hard of hearing, and SLPs from special education teachers. Only 21.3% of participants believed that audiologists and teachers of the deaf and hard of hearing do the same work, whereas 12.5% of participants be-

lieved that SLPs and special education teachers share similar work responsibilities. Although audiologists, SLPs, teachers of the deaf and hard of hearing, special education teachers are partners in education, their scopes of practice are different. Audiologists and SLPs should continue their efforts to educate the community about the services both professionals provide.

Most of the participants identified diagnosing hearing loss, improving hearing and prescribing and fitting hearing aids and assistive listening devices as the main services audiologists perform. These areas of practice are the main services audiologists practicing in Saudi Arabia provide.¹⁰ Less than half of the participants believed that audiologists diagnose and manage tinnitus and vestibular disorders. Most practicing audiologists in Saudi Arabia did not perform tinnitus and vestibular assessment and rehabilitation.⁸ The participants were aware that prescribing medication and surgical intervention were not tasks audiologists perform.

Most of the participants identified that SLPs provide services pertaining to verbal communication skills including improving speech, diagnosing, and managing communication disorders and managing stuttering. All of which are more noticeable disorders given their nature. These areas of practice are the main daily jobs of practicing

SLPs in Saudi Arabia in addition to improving receptive language skills. Also, it is worth noting that the Arabic translation of the term “speech-language pathologist” elicits an understating of professionals dealing with verbal communication disorders, whereas the scope of practice is wider than that.⁶ Diagnosing and managing voice had 40.8% response rate. Another study reported similar findings where less participants identified voice and literacy to be within the speech-language pathologist’s scope of practice as well.²² It is estimated that approximately 32.4% of practicing SLPs in Saudi Arabia work with patients with voice and resonance disorders.⁸

In the current study, 25.6% of the participants believed that SLPs diagnose and manage swallowing disorders. Despite the lower rate of participants that believed swallowing was within the scope of SLPs, it is still a promising percentage as only 4% of registered nurses that participated in a hospital study identified SLPs as the professionals responsible for diagnosing and treating swallowing difficulties (i.e., dysphagia).²⁵ According to Alanazi, only 27% of SLPs worked with dysphagic patients in Saudi Arabia.⁸ The majority of participants were aware that prescribing medication and surgical intervention were not tasks SLPs perform. The response rates of participants who did not know what the job of

audiologists and SLPs were nearly similar. This study calls for collaborative efforts between audiologists and SLPs, SSSPA, audiology and SLP academic programs, and other stakeholders (e.g., Ministry of Health, Ministry of Education) to continuously work together towards improving community awareness about both professionals' roles in addition to hearing and communication disorders at the national level.

Limitations

Although the required sample size was obtained, the sample did not represent all Saudi regions equally. Our questionnaire was designed and professionally reviewed, and was validated through the pre-test part; however, it is a new questionnaire that was not validated in other environments and countries. The correlation of variables, such as educational levels and experience with hearing and communication disorders with the participants' knowledge was not investigated. This an area warrant research attention. Future research will investigate healthcare providers' awareness about audiology and SLP in Saudi Arabia. Further research is also needed to investigate the public's awareness about specific hearing and communication disorders.

Conclusion

The present study investigates the pub-

lic awareness of audiology and SLP professions in Saudi Arabia. Results suggest a reasonable level of public awareness. The main concept of both professions was present, but some audiology and SLP services were not well-identified by the participants. Although professional ethics prevent advertising, there is apparently a need for the public to be informed of the available audiology and SLP services. It is the responsibility of audiologists and SLPs to provide education about such services through media and public educational campaigns. Audiology and SLP services should be extended to reach rural areas in all Saudi regions which will consequently enhance public awareness. The use of tele practice at any time particularly during times, such as the time of Coronavirus disease 2019 (COVID-19) pandemic, is one of the solutions to overcome the shortage of such services in these areas.

References

1. United Nations. International covenant on civil and political rights; 1966. Available from <http://www.ohchr.org/EN/ProfessionalInterest/Pages/CCPR.aspx>. [Last accessed on 2020 September 23]
2. Mulcair G, Pietranton A, Williams C. The international communication project: Raising global awareness of communication as a human right. *Int J Speech-Lang*

- Path 2018;20(1):34–8. <https://doi.org/10.1080/17549507.2018.1422023>
3. International Communication Project. Universal declaration of communication rights; 2014. Available from <https://internationalcommunicationproject.com/> [Last accessed on 2020 September 23]
4. Prelock P. Audiology and speech-language pathology: The magic of our connection. *ASHA Lead* 2013;18(12):6–7. <https://doi.org/10.1044/leader.FTP.18122013.7>
5. Saudi Society of Speech-Language Pathology and Audiology [SSSPA]. Scope of practice: Audiology and balance [Internet]; 2020 May 30. Available from: <https://twitter.com/SSSLPA/status/1266807631299174403?s=20> [Last accessed on 2020 September 24]
6. Saudi Society of Speech-Language Pathology and Audiology [SSSPA]. Scope of practice: Speech-language pathology [Internet]; 2020 May 30. Available from: <https://twitter.com/SSSLPA/status/1266808070778368001?s=20> [Last accessed on 2020 September 24]
7. American Speech-Language-Hearing Association. Poll of Florida professionals: Public unaware of early warning signs of communication disorders; 2019. Available from: <https://www.asha.org/News/2019/Poll-of-Florida-Professionals--Public-Unaware--of-Early-Warning-Signs-of-Communication-Disorders/> [Last accessed on 2020 September 23]
8. Alanazi AA. Audiology and speech-language pathology practice in Saudi Arabia. *Int J Health Sci* 2017;11(5):43–55.
- [11] Khoja M, Sheeshah H. The human right to communicate: A survey of available services in Saudi Arabia. *Int J Speech-Lang Path* 2018, 20(1), 102–7. <https://doi.org/10.1080/17549507.2018.1428686>
9. Khoja M, Sheeshah H. The human right to communicate: A survey of available services in Saudi Arabia. *Int J Speech-Lang Path* 2018, 20(1), 102–7. <https://doi.org/10.1080/17549507.2018.1428686>
10. De Britto Pereira MM, Rossi JP, & Van Borsel J. Public awareness and knowledge of stuttering in Rio De Janeiro. *J Fluency Disord* 2008,33(1):24–31. <https://doi.org/10.1016/j.jfludis.2007.10.001>
11. Ming JX, Jing Z, Wen ZY, Van Borsel J. Public awareness of stuttering in Shanghai, China. *Logop Phoniatr Voco* 2001;26:145–50. <https://doi.org/10.1080/14015430127771>
12. Flynn L, Cumberland A, Marshall J. Public knowledge about aphasia: A survey with comparative data. *Aphasiology* 2009;23(3):393–401. <https://doi.org/10.1080/02687030701828942>
13. Joubert K, Sebothoma B, Kgare, KS. Public awareness of audiology, hearing

- and hearing health in the Limpopo Province, South Africa. *S Afr J Commun Disord* 2017;64(1):a557. <https://doi.org/10.4102/sajcd.v64i1.557>
14. Narayansamy N, Ramkumar V, & Nagaraja R. Knowledge and beliefs about ear and hearing health among mothers of young children in a rural community in South India. *Disability CBR Incl Develop* 2014;25(4):119–35. <https://doi.org/10.5463/dcid.v25i4.328>
15. Mahmoud H, Aljazi A, Alkhamra R. A study of public awareness of speech-language pathology in Amman. *College Stud J* 2014;48(3): 495–510.
16. Alshehri KA, Alqulayti WM, Yaghmoor BE, Alem H. Public awareness of ear health and hearing loss in Jeddah, Saudi Arabia. *S Afr J Commun Disord* 2019;66(1):e1-e6. <https://doi.org/10.4102/sajcd.v66i1.633>
17. World Health Organization. Process of translation and adaptation of instruments; 2020. Available from: https://www.who.int/substance_abuse/research_tools/translation/en/ [Last accessed on 2020 August 24]
18. General Authority for Statistics. The total population; 2018. Available from: https://www.stats.gov.sa/sites/default/files/stats_report_2018_0.pdf [Last accessed on 2020 August 20]
19. Saudi Commission for Health Speciality. Number of Saudi and non-Saudi health practitioners licensed in Saudi Arabia [Internet]; 2020 August 23. Available from: <https://twitter.com/schsorg/status/1297492906035613696?s=21> [Last accessed on 2020 August 29]
20. General Authority for Statistics. Disability Survey; 2017. Available from: https://www.stats.gov.sa/sites/default/files/disability_survey_2017_en.pdf [Last accessed on 2020 August 29]
21. Zakzouk SM, Abul Fadle KA, Al Anazy FH. Familial hereditary progressive sensorineural hearing loss among Saudi children. *Int J Pediatr Otorhinolaryngol* 1995;32:247–55.
22. AlAbdulkarim L. The role of speech-language pathologists and audiologists in the schools in Saudi Arabia. *Int J Health Econ Dev* 2015;1(2):62–9.
23. American Speech-Language-Hearing Association. SLP health care survey. Caseload characteristics; 2019. Available from <https://www.asha.org/uploaded-Files/2019-SLP-HC-Survey-Caseload.pdf> [Last accessed on 2020 August 28]
24. American Speech-Language-Hearing Association. Medicare Audiology Services Enhancement Act of 2015 (H.R. 1116); 2015. Available from: <https://www.asha.org/news/2015/set-the-record-straight-about-h-r--1116/> [Last accessed on 2020

September 22]

25. Khoja M. Registered nurses' knowledge and care practices regarding patients with dysphagia in Saudi Arabia: A cross-sectional study. Int J Health Care

Qual Assur 2018;31(8):896–909. <https://doi.org/sdl.idm.oclc.org/10.1108/IJHC-QA-06-2017-0106>

Original Article :

Prevalence of Impacted Third Molars in AZ-Zulfi Region of Saudi Arabia: A Cross-sectional Study

Mohammed Abdulaziz Almidaj¹, Rakan Mohammed Al-abduljabbar¹, Abdulrahman Abdullah Altariqi¹,
Mohammed Khalaf Almaymuni¹, Ahmed Abdulrahman Alahmed¹,
Divakar Thiruvenkata Krishnan ², Karthiga Kannan Subramania Pillai³

1. Intern, Maxillofacial surgery and Diagnostic sciences, College of Dentistry, Majmaah University, Saudi Arabia -11932;
2. Assistant Professor. Department of Maxillofacial surgery and Diagnostic Sciences, College of Dentistry, Majmaah University. Al Zulfi, Riyadh Province, Saudi Arabia -11932
3. Karthiga Kannan Subramania Pillai. Professor & Head of Dental Education, College of Dentistry, Majmaah University, Al Zulfi, Riyadh Province, Saudi Arabia -11932.

Received on 09.12.2020, accepted for publication on 1/1/2021 dx.doi.org/10.5455/mjhs.2021.02.006

Corresponding Author:

Divakar Thiruvenkata Krishnan. Department of Maxillofacial surgery and Diagnostic Sciences, College of Dentistry, Majmaah University, Saudi Arabia -11932. Fax-064227184, Mobile-+966531496728. E-Mail: d.krishnan@mu.edu.sa

Abstract

Background:

This study aims to evaluate the prevalence of the impacted third molars and their associated pathologies in the population of Az Zulfi, Saudi Arabia.

Method:

This study was conducted in the clinics of the College of Dentistry, Majmaah University, Saudi Arabia. A total of 1695 orthopantomograms (OPG) from December 2018 and December 2019 were evaluated using the third molar characteristics evaluation form (TMCEF).

Results:

Minimum of one impacted third molar had been found in 240 OPG among 1695 studied. Among the gender, males (15.6%) showed more impacted teeth prevalence than females (3.1%). The incidence of mandibular molar impaction (23%) is more when compared to that of the maxilla (14.3%). The mandible shows more prevalence of mesioangular impaction (50.44%) and in the maxilla, it is vertical impaction (49.39%). Depending upon the space available between the second molar distal surface and the mandibular anterior ramus, Class II (51.09%) pattern is

الملخص

الخلفية:

تهدف هذه الدراسة إلى تقييم مدى انتشار الأضراس الثالثة (العقل) المطمورة والأمراض المرتبطة بها في مجتمع الزلفي بالمملكة العربية السعودية.

طريقة البحث:

أجريت هذه الدراسة في عيادات كلية طب الأسنان، جامعة المجمعة، المملكة العربية السعودية. تم تقييم ما مجموعه ١٦٩٥ اشعة بانوراما من ديسمبر ٢٠١٨ حتى ديسمبر ٢٠١٩ باستخدام نموذج تقييم الخصائص المولية الثالث.

النتائج:

من بين ١٦٩٥ تمت دراستها. بين الجنسين، أظهر الذكور تم العثور على الأقل ضرر ثالث (عقل) مطمور في ٢٤٠ (١٥,٦٪) انتشار أسنان مطمورة أكثر من الإناث (٣,١٪). نسبة حدوث انطمار ضرر عقل في الفك السفلي (٢٣٪) هي أكثر عند مقارنتها بتلك الموجودة في الفك العلوي (١٤,٣٪). يُظهر الفك السفلي انتشارًا أكبر للانطمار المتعلق بالزاوية الأنسية (٥٠,٤٤٪) وفي الفك العلوي هو تأثير عمودي (٤٩,٣٩٪). اعتمادًا على مستوى الانطمار، وجد أن الموضع ب (٤٥,٩٥٪) والموضع ج (٥٩,٨٣٪) أكثر شيوعًا في الفك السفلي والعلوي، على التوالي. من بين الأسنان المطمورة ١٨٧ كان لها بعض الأمراض المرتبطة بها وكان تسوس

found to be more common than the other two Classes. Depending on the level of impaction Position B (45.95%) and Position C (59.83%) were found to be more common in the lower and upper jaw, respectively. More than 66% of maxillary impactions had close approximation to the maxillary sinus floor on both sides. Among the impacted teeth 187 had some associated pathology and dental caries were the most frequent one among all the other pathology reported.

Conclusion:

The most common impacted tooth in Az Zulfi, Kingdom of Saudi Arabia is mesioangular and position B in the mandible and vertical and position C in the maxilla.

Keywords:

Mandible, Maxilla, Third molar, Tooth, Impacted.

Introduction:

The functional and topographical position of the third molar had made the prevalence of these teeth more variable and significant when compared to other teeth. Various theories had been put forward to explain the nature of eruption and prevalence of impacted third molar, but none of the theories hold good with all kind of impaction. Third molars were more commonly associated with the development of pathological cyst, TMJ disorders, cheek bite, etc. and hence the prevalence studies on the third molar in the specific region suggest the need for the specific dental care and needs of that region. The erupting pathway and position of the third molar can be related not only to the ethnicity of the population but also to the masticatory efficiency, and hereditary

الأسنان الأكثر شيوعاً بين جميع الأمراض الأخرى التي تم الإبلاغ عنها.

الخلاصة:

أكثر الأسنان المتأثرة شيوعاً في الزلفي بالمملكة العربية السعودية هي الأسنان المتعلقة بالزاوية الأنسية والموضع ب في الفك العلوي والموضع ج في الفك السفلي.

influences¹.

Impacted teeth has been defined as a tooth that doesn't reach the anatomical position because of insufficient space, bony interference, or any trauma leading to deviation in the path of the eruption². In Saudi Arabia, recently more studies have been done on the impacted third molar prevalence, because of its clinical and functional significance. However, there are no such studies found in the literature specific to the Az Zulfi region of Saudi Arabia. The primary objective of this study was to assess the prevalence of impacted third molars and also to evaluate any associated pathology with the impacted third molar among the patients attending the dental clinic, College of Dentistry, Majmaah University in Al-Zulfi region, Kingdom of Saudi

Arabia,

Materials and methods:

This cross-sectional retrospective radiographic study was done in the clinics of the College of Dentistry, Majmaah University after getting approval from the Deanship of Scientific Research with project number HA-01-R-088. A total of around 1695 orthopantomograms (OPG) of the patients who were reported to the Maxillofacial Department of College of dentistry, Majmaah University from December 2018 and December 2019 were evaluated based on the classifications of Pell & Gregory and Winter. Only those records with panoramic radiographs were selected by simple random sampling method. The medical records of patients who did not have panoramic radiographs and those who did not exhibit complete root formation of the third molars were considered not eligible for the study. The two experts in dental radiology with more than fifteen years of experience were given the third molar characteristics evaluation form (TMCEF) to evaluate all the records included in the study.

(Appendix 1)

The evaluation criteria for typing the impaction in the present study were Pell and Gregory classification³ and Winter's Classification^{4,5}. The earlier classification was based on the occlusal plane level as

A, B, C, where the third molar occlusal plane was at the same level or between the occlusal surface and the cemento-enamel junction of the second molar or the occlusal surface of the third molar was apical to the cemento-enamel junction of the second molar respectively. Based on the space available between the posterior part of the second molar and the anterior border of the ramus, the impaction can be typed as Class I (third molar tooth present in front of the ramus), Class II (ramus have partially embedded teeth) & Class III (fully embedded in the ramus).

Winter's classification of impaction is based on the angle formed by the longitudinal axis of the impacted third molar with the second molar. They are classified as vertical impaction (10° to -10°), Mesioangular impaction (11° to 79°), Horizontal impaction (80° to 100°), Distoangular impaction (-11° to -79°), other categories (111° to -80°), Buccolingual impaction (if in buccolingual direction).

For this study, the proposed null hypothesis was that there exists no difference in the third molar impactions types and the related features (age group, vertical position to the second molar, mandibular canal, and maxillary sinus) in Al Zulfi in comparison to other studies from different locations of the world. The collected data were statistically analyzed using

SPSS version 21(SPSS Inc; Chicago, IL, USA). The prevalence of the third molar impactions and its type, age predilection, and root abnormalities, and its relation to inferior alveolar nerve canal was assessed by percentage and frequency.

Results:

One thousand six hundred and ninety-five (1695) Orthopantomograms (OPG) of patients ranging in age from 18 to 83 years were evaluated to determine the prevalence of impacted third molars in their population. Among 1695 OPG studied 240 OPGs showed a minimum of one impacted third molar impacted. Among the gen-

der, males (15.6%) showed more impacted teeth prevalence than females (3.1%) (Table 1.A). The impacted mandibular molar prevalence (780, 23%) was more when compared to that of the maxilla (486, 14.3%). The mandible shows more prevalence of mesioangular impaction (50.44%) and in the maxilla, it was vertical impaction (49.39%). The left side of the mandible (23.9%) showed more impaction than the right side (22.1%). But in the maxilla, there is no great difference between the right (14.5%) and left side (14.2%) (Table 1.B).

Table 1

Gender	Impaction Prevalence		Total
	Maxilla	Mandible	
Male	424	631	1055
	12.5%	18.6%	15.6%
Female	62	149	211
	1.8%	4.4%	3.1%
Total	486	780	1266
	14.3%	23%	18.7%

		Distoangular	Horizontal	Mesioangular	Vertical	Buccolingual	Total	Percentage
UPPER	Right	83	6	23	120	11	246	14.5
	Left	78	9	25	120	8	240	14.2
LOWER	Right	17	74	182	101	1	375	22.1
	Left	10	80	212	101	2	405	23.9

		A	B	C	TOTAL
UPPER	Right	15	82	149	246
	Left	15	82	143	240

LOWER	Right	126	184	65	375
	Left	169	174	62	405

Table: 1.D: Prevalence of different classes of impaction in the lower third molar according to Pell & Gregory's Classification

	RIGHT		LEFT	
	Frequency	Percent	Frequency	Percent
Class I	174	42.96	158	42.02
Class II	206	50.86	193	51.33
Class III	25	6.17	25	6.65
Total	405	100	376	100

Table: 1.E: Approximation of maxillary sinus in relation to the impacted upper third Molars

APPROXIMATION TO MAXILLARY SINUS	RIGHT		LEFT	
	Frequency	Percent	Frequency	Percent
YES	230	67.25	223	66.77
NO	112	32.75	111	33.23
Total	342	100	334	100

There was no significant difference in the status of the molar impaction according to the age of the group (upper left $P < 0.08$, lower right $P < 0.65$, lower left $P < 0.36$) except the upper right side status of molar

($P < 0.02$) (Table: 2.A, 2.B, 2.C, 2.D) and hence the null hypothesis was rejected as there was a difference in the prevalence of impacted teeth in upper right side impacted teeth.

Table 2

TYPE OF IMPACTION	Mean age	SD	ANOVA							
			95%CONFIDENCE INTERVAL				Sum of Squares	df	Mean Square	F
Lower Bound	Upper Bound									
Distoangular	28.1	8.9	26.1147	30.1417						
Horizontal	32.1	10.4	24.0452	40.177						
Mesioangular	25.5	5.9	23.0116	27.9484						
Vertical	25.9	7.7	24.5282	27.3218	543.136	4	135.784	2.088	0.083	
Buccoangular	25.4	6.4	19.9581	30.7919						
Total	26.8	8.1	25.7737	27.843						

Distoangular	31.5	8.80	27.0617	36.1147						
Horizontal	28.9	7.31	27.2513	30.6406	280.672	4	70.168	1.074	0.369	
Mesioangular	28.3	8.40	27.0838	29.5425						

Vertical	27.5	7.89	25.9563	29.0734					
Buccoangular	26	.	.	.					
Total	28.3	8.08	27.5444	29.1863					

Distoangular	28.9	7.35	23.63	34.161					
Horizontal	28.4	7.98	26.660	30.214					
Mesioangular	28.853	7.92873	27.7803	29.9272	171.569	4	42.892	0.608	0.657
Vertical	27.5	9.697	25.61	29.439					
Buccoangular	23.5	4.94	20.971	67.971					
Total	28.4	8.38	27.595	29.233					

Distoangular	29.1	8.98	27.1587	31.0823	Sum of Squares	df	Mean Square	F	Sig.
Horizontal	27.5	7.55	19.57	35.43	866.342	5	173.268	2.699	0.022
Mesioangular	25.3	7.31	22.1846	28.5111					
Vertical	25.4	7.15	24.1646	26.752					
Buccoangular	28	9.44	21.655	34.345					
Total	33.6	13.05	1.2457	66.0876					

The status of the right side molar influences the status of the left side molar ($P < 0.00$) (Table 3.A, 3.B).

Table 3

		Status of upper right third molar * Status of upper left third molar Cross-tabulation							
		Status of upper left third molar							
		Missing	Present	Impacted	Total	Pearson Chi Square	df	p	
Status Of upper right third molar	Missing	Count	238	103	36	377	9.245	4.00	0.00
		% within Status of upper right third molar	63.10%	27.30%	9.50%	100.00%			
		% within Status of upper left third molar	53.70%	10.20%	15.00%	22.20%			
		Present	Count	166	855	51	1072		

		% within Status of upper right third molar	15.50%	79.80%	4.80%	100.00%			
		% within Status of upper left third molar	37.50%	84.50%	21.20%	63.20%			
	Impacted	Count	39	54	153	246			
		% within Status of upper right third molar	15.90%	22.00%	62.20%	100.00%			
		% within Status of upper left third molar	8.80%	5.30%	63.80%	14.50%			
Total		Count	443	1012	240	1695			
		% within Status of upper right third molar	26.10%	59.70%	14.20%	100.00%			
			100.00%	100.00%	100.00%	100.00%			

Table:3. B Cross Tabulation with Chi Square test performed to evaluate whether status of lower right-side molar is independent with lower left side molar

Status of lower left third molar * Status of lower right third molar Crosstabulation									
			Missing	Present	Impacted	Total	Pearson Chi-Square	df	p
Status of lower left third molar	Missing	Count	262	109	63	434	1.016E3a	4.00	0.00
		% within Status of lower left third molar	60.40%	25.10%	14.50%	100.00%			
		% within Status of lower right third molar	67.90%	12.10%	15.60%	25.60%			
	Present	Count	88	712	86	886			
		% within Status of lower left third molar	9.90%	80.40%	9.70%	100.00%			
		% within Status of lower right third molar	22.80%	78.80%	21.20%	52.30%			
	Impacted	Count	36	83	256	375			

		% within Status of lower left third molar	9.60%	22.10%	68.30%	100.00%			
		% within Status of lower right third molar	9.30%	9.20%	63.20%	22.10%			
Total		Count	386	904	405	1695			
		% within Status of lower left third molar	22.80%	53.30%	23.90%	100.00%			
		% within Status of lower right third molar	100.00%	100.00%	100.00%	100.00%			

The prevalence of impacted third molars according to level of eruption shows that Position B (45.95%) in the mandible and Position C (59.83%) in the maxilla were more common (Table 1.C).

The order of occurrence of the level of impaction A, B, C types was analyzed and was found to be C>B>A in the maxilla, and in mandible, it was B>A>C. The Class II (51.09%) pattern is found to be more common than the other two classes (Table 1.D). The less common type of impaction found in the maxilla were horizontal and buccolingual types, whereas in mandible the less commonly found impaction was the buccolingual type (Table 1.B). More than 66% of maxillary impactions had close approximation to the floor of the maxillary sinus on both sides (Table 1.E). Of the impactions, 187 had some pathology associated with the impacted tooth (Ta-

ble 4) and dental caries were found to more common among all the other pathologies.

Discussion:

A large number of patients visit dentists seeking treatment for tooth impaction as it is a more common clinical finding in day-to-day practice. The early detection of the impaction and necessary intervention plays an important role to prevent the various harmful consequences of the impacted teeth. Among the radiographic methods available, OPG is commonly preferred to assess the impacted tooth in detail including their angulations, amount of bone covered, and their depth of impaction within the bone, their association with the adjacent normal anatomic structures like maxillary sinus and the mandibular canal and the presence of pathologies associated with them.

In the AZ-Zulfi Region of Saudi Arabia,

mesioangular impacted mandibular molar and vertically impacted maxillary molar were found to be the most common among all the other angulations (Table 2). This result was similar to the study conducted by Syed KB ⁶, Hassan AH ⁷, Hashemipour MA et al ⁴. A study conducted by Kumar Pillai A ⁸ showed vertical impaction most common in both maxilla and mandible in contrary to this study which had found that the mesioangular type was more common in mandible whereas the vertical type more common in maxilla signifying the region-specific nature of the type of impacted teeth. The maxillary third molar tooth bud normally develops and erupts in the maxillary tuberosity region in the vertical pattern favoring the vertical type of impaction. If the maxillary growth is inadequate, the maxillary third molar gets impacted against the second upper molar ⁹. The proximity of 66% impacted maxillary third molar to the floor of maxillary sinus had suggested taking proper surgical care and precaution on attempting the removal of those teeth.

In the Al-Zulfi Region of Saudi Arabia, the prevalence of the impacted teeth was more in mandible which was similar to the results of the study conducted by Hassan AH⁷, Hashemipour MA et al ⁴, Kumar Pillai A⁸, and Kamran Bokhari Syed ⁶.

Among our study group, the most com-

mon pathology that was seen in association with the impacted tooth was dental caries (75.94%). This result was like the results of the study by Al-Khateeb TH¹⁰. The second commonly encountered problem was the close association with the inferior alveolar canal. Injury to the Inferior alveolar nerve during impacted third molar removal had been more prevalent ^{11, 12}. So, all possible care should be taken to prevent any damage to the nerve in all such cases (8.56%). The other problems encountered are caries involving the pulp with or without periapical pathology and pericoronitis like problems. The study results had rejected the proposed null hypothesis as there was a statistically significant difference in the type of impacted teeth and the associated features like age, vertical position to the second molar, mandibular canal, and maxillary sinus position.

Conclusion:

Until now there is no prevalence study done in the region of Az Zulfi, Riyadh Province in Kingdom of Saudi Arabia regarding the third molar impaction status. Understanding the prevalence of impaction among our population helps in the deeper understanding of the incidence of different types of impaction based on different classifications and their association with the pathologies. Methodical and sys-

tematic evaluation of each case in the right way using the radiograph helps in providing the necessary proper intervention when required on a case-by-case basis in the specific region.

References

1. Alling C, Alling R. Indications for management of impacted teeth. *Impacted teeth*. 1993;46-64.
2. Archer WH. *Oral surgery; a step-by-step atlas of operative techniques*. Philadelphia: Saunders; 1961.
3. Pell GJ. Impacted mandibular third molars: classification and modified techniques for removal. *Dent Digest*. 1933;39:330-8.
4. Hashemipour MA, Tahmasbi-Arashlow M, Fahimi-Hanzaei F. Incidence of impacted mandibular and maxillary third molars: a radiographic study in a Southeast Iran population. *Med Oral Patol Oral Cir Bucal*. 2013;18(1):e140-5.
5. Alfergani SM, Latif K, Alanazi YM. A pattern of impacted mandibular third molars in a Saudi population. *Pakistan Oral & Dental Journal*. 2017;37(3):407-10.
6. Syed KB, Zaheer KB, Ibrahim M, Bagi MA, Assiri MA. Prevalence of impacted molar teeth among the Saudi population in the Asir region, Saudi Arabia—a retrospective study of 3 years. *Journal of international oral health: JIOH*. 2013;5(1):43.
7. Hassan AH. The pattern of third molar impaction in a Saudi population. *Clin Cosmet Investig Dent*. 2010;2:109-13.
8. Pillai AK, Thomas S, Paul G, Singh SK, Moghe S. Incidence of impacted third molars: A radiographic study in People's Hospital, Bhopal, India. *Journal of oral biology and craniofacial research*. 2014;4(2):76-81.
9. Olasoji HO, Odusanya SA. Comparative study of third molar impaction in rural and urban areas of South-Western Nigeria. *Odontostomatol Trop*. 2000;23(90):25-8.
10. Al-Khateeb TH, Bataineh AB. Pathology associated with impacted mandibular third molars in a group of Jordanians. *J Oral Maxillofac Surg*. 2006;64(11):1598-602.
11. Rood JP, Nooraldeen Shehab BAA. The radiological prediction of inferior alveolar nerve injury during third molar surgery. *British Journal of Oral and Maxillofacial Surgery*. 1990;28(1):20-5.
12. Hillerup S. Iatrogenic injury to oral branches of the trigeminal nerve: records of 449 cases. *Clin Oral Investig*. 2007;11(2):133-42.

Original Article :

Movement sequence analysis of cephalocaudal and hip regions during various phases of selected daily activities

Rae S Alqhtani¹

1. Department of Physical Therapy, College of Applied Medical Sciences, Najran University, Najran, KSA

Received on 2.10.2020, accepted for publication on 25.1.2021 dx.doi.org/10.5455/mjhs.2021.02.007

Corresponding Author:

Rae S Alqhtani. E-mail: hyanirae@gmail.com. Mobile: +966507668958

Abstract

Background:

The previous studies conducted that the contribution of lumbar spine segment and hip motion during functional activities of daily livings, however, it is still unknown whether different spinal segment and hip motion occur in a specific sequence during functional tasks. The current study aimed to identify the movement sequence of cephalocaudal and hip regions while performing several dominant daily activities.

Methods:

Twelve male participants (mean age = 29.6 ± 4.2 years; weight = 73.4 ± 8.4 kg; height = 1.76 ± 0.08 meters) recruited in this study. Five Tri-axial accelerometer sensors used to collect data of a novel approach to understand the multi-cephalocaudal regions and hip movement sequences when performing several dominant daily activities.

Results:

Regional sequences during flexion and extension tasks at starting phase of movement illustrated (92%) of participants move their head cervical region first as well as object lifting (80%). first. Regional sequences during standing-to-sitting task at starting phase of movement found (70%) of participants move their lumbar region first, while (78%) of participants during sitting-to-standing task moved their hip first

Conclusion:

This study indicates variations of movement sequence of cephalocaudal and hip regions at different phase. While the head-cervical region moved first in starting phase of flexion, extension, and lifting task, hip region moved first in the end phase of flexion, extension, and standing-to-sitting task.

Keywords:

Words, Spine, Hip, Sequence, Movement, Cephalocaudal, Regions, Daily activities

الملخص

الخلفية:

أجريت الدراسات السابقة على مساهمة الجزء السفلي من العمود الفقري وحركة الورك أثناء الأنشطة الوظيفية للحياة اليومية، ومع ذلك، لا يزال من غير المعروف ما إذا كانت حركة العمود الفقري والورك مختلفة من جانب التسلسل في الحركة أثناء المهام الوظيفية. تهدف الدراسة الحالية إلى تحديد تسلسل حركة مناطق الرأس والعمود الفقري والورك أثناء أداء عدد من الأنشطة اليومية المعتادة.

طريقة البحث:

أجريت الدراسة على اثني عشر مشاركًا (متوسط العمر = $29,6 \pm 4,2$ سنة ؛ الوزن = $73,4 \pm 8,4$ كجم ؛ الطول = $1,76 \pm 0,08$ متر)، وفي هذه الدراسة استخدمت تقنية جديدة وهي عبارة عن حساسات تقيس الحركة مع الوقت وهي ثلاثية المحاور التي جمع من خلالها بيانات عدد من مناطق الجسم حددت وعددها خمسة وبنهج جديد يقيس حركة المناطق وإيها تحرك قبل الآخر عند أداء العديد من الأنشطة اليومية.

النتائج:

تم توضيح التسلسلات الإقليمية أثناء مهام الانثناء للأمام والثني للخلف في مرحلة بدء الحركة وكان (92٪) من المشاركين يحركون منطقة الرأس والرقبة أولاً وكذلك رفع الأشياء، (80٪) من المشاركين تحرك الرأس والعنق أولاً. أثناء مهمة الجلوس في مرحلة بدء الحركة (70٪) من المشاركين قاموا بتحريك منطقة أسفل الظهر أولاً، بينما قام (78٪) من المشاركين أثناء مهمة الوقوف بتحريك الورك أولاً.

الخلاصة:

تشير هذه الدراسة إلى اختلافات في تسلسل الحركة لمناطق الرأس والورك في مراحل مختلفة. بينما تحركت منطقة الرأس - والرقبة أولاً في مرحلة البدء لمهمة الانثناء للأمام، وثني الظهر للخلف، والرفع، وتحركت منطقة الورك أولاً في المرحلة النهائية من الثني للأمام، ثني الظهر للخلف، ومهمة الوقوف إلى الجلوس.

Introduction:

Evaluations of hip and spine mobility is vital for the assessment of low back pain (LBP)¹. There are various available methods used for the assessment of spinal and hip mobility. For instance, Modified-Schober Test has been validated to assess lumbar mobility during forward bending of spine². Although this test is simple and easy to use, it is unable to detect different motions occurring at multiple spinal segments and hip. Previous studies identified a specific movement patterns at various spinal segments while performing functional and clinical movement^{1,3-6}. Additionally, a relationship between specific movement patterns at different spinal segments and functional activities of daily living (ADLs) is not well established[7]. For example, sit-to-stand is a common functional activity that involve a specific movement patterns at hip and spine. Therefore, accurate knowledge of physiological movement of each spinal segment and hip region and the behavior of each regional movement is important.

Various functional tasks including lifting, sit-to-stand, flexion, and extension have been associated with LBP and spinal injury^{8,9}. Spine and hip motions are connected during many daily tasks^{10,11}, indicating that any limitation in spine or hip motion

will affect the performance of functional ADLs. In particular, sit-to-stand activities are commonest tasks performed daily by working people¹². Previous studies have reported the quantitative relationship between the lumbar spine and hip motion during daily tasks¹³⁻¹⁶. However, they have considered lumbar spine as a single unit in their measurement. Consequently, other clinicians evaluated the contribution of multisegmented lumbar motion in patient population^{17,18} and healthy adults^{19,20}.

Although previous studies reported the contribution of lumbar spine segment and hip motion during functional ADLs, it is still unknown whether different spinal segment and hip motion occur in a specific sequence during functional tasks. Therefore, the current study aimed to identify the movement sequence of cephalocaudal and hip regions during several dominant daily activities including flexion, extension, lifting, and standing-to-sitting tasks.

Methods:

Participants

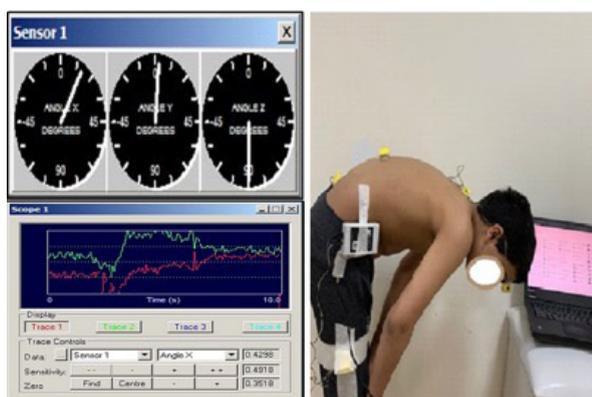
Twelve male participants (mean age = 29.6 ± 4.2 years; weight = 73.4 ± 8.4 kg; height = 1.76 ± 0.08 meters) were recruited. No participant had any history of cervical, thoracic, lumbar pain or not complain of radiated pain to the upper or lower extremities within the last one year. The Ethics

Committee of Najran University approved this study. All participants asked to complete a written informed consent form.

Instrumentation

Five Tri-axial accelerometer sensors used as described in the published study[3] to collect data of a novel approach to understand the multi-cephalocaudal regions and hip movement sequences when performing a number of dominant daily activities.

Figure 1: The dial display for sensor 1 and a "Scope" display showing two data traces on LT and schematic represents the location of three sensors on forehead and spinous processes of T1, T12, and S1 and on the lateral aspect of the thigh midway between the lateral epicondyle and greater trochanter on the iliotibial band (ITB) on RT.



Procedures

When participants attended the laboratory at Physiotherapy Clinic, Applied Medical Science, Collage, Najran University, they returned a signed consent form, which had been provided earlier. The participant should move to a private area to change their clothes and wear shorts. Each participant was instructed to perform forward, backward, rotations, and lateral flexions of head cervical and spine several times be-

fore placing the sensors on the body. The participants were asked to lean forward on the table (waist level) to determine the specific spinous processes. Five sensors were attached using double-sided adhesive tape on different parts of the body (e.g., forehead, spinous processes of first thoracic vertebra (T1), twelfth thoracic vertebra (T12), first sacral vertebra (S1), and middle point at lateral aspect of thigh). Four different anatomical regions of interest were created including Head-cervical (HC), Thoracic (T), Lumbar (L), and Hip (H) to quantify regional movement.

Data analysis

The data was analyzed using SPSS. Regional spinal movement time curves were generated and the values of HC, T, L, and Hip at the beginning, peak, and end movement were calculated. Descriptive statistics were reported. The percentage of participants who performed the task in a specific sequence were calculated: Percentage (%) = (number of participants who achieve task's phase/12 (Total number of subjects)) × 100.

RESULTS

Table1: The movement sequence of cephalocaudal and hip regions during various phases of selected daily activities

Regional movements	Subjects' percentage at start of flexion task (%)	Sequences	Subjects' percentage at peak of flexion task (%)	Sequences	Subjects' percentage at end of flexion task (%)	Sequences
Head-cervical region	92	1	60	1	55	3
Thoracic region	70	2	60	1	62	2
Lumbar region	70	2	52	2	72	1
Hip region	62	3	52	2	72	1
	Subjects' percentage at start of extension task (%)	Sequences	Subjects' percentage at peak of extension task (%)	Sequences	Subjects' percentage at end of extension task (%)	Sequences
Head-cervical region	92	1	62	2	45	4
Thoracic region	60	3	62	2	62	2
Lumbar region	72	2	75	1	53	3
Hip region	60	3	75	1	70	1
	Subjects' percentage at start of object lifting task (%)	Sequences	Subjects' percentage at peak of object lifting task (%)	Sequences	Subjects' percentage at end of object lifting task (%)	Sequences
Head-cervical region	80	1	60	2	70	1
Thoracic region	60	2	60	2	70	1
Lumbar region	50	3	70	1	60	2
Hip region	60	2	60	2	60	2
		Sequences		Sequences		Sequences
	Subjects' percentage at start of standing-to-sitting task (%)	Sequences	Subjects' percentage at peak of standing to-sitting task (%)	Sequences	Subjects' percentage at end of standing-to-sitting task (%)	Sequences
Head-cervical region	64	2	60	1	50	2
Thoracic region	64	2	60	1	60	1
Lumbar region	70	1	60	1	50	2
Hip region	64	2	60	1	60	1

	Subjects' percentage at start of sitting-to standing task (%)	Sequences	Subjects' percentage at peak of sitting-to standing task (%)	Sequences	Subjects' percentage at end of sitting-to standing task (%)	Sequences
Head-cervical region	54	3	70	3	90	1
Thoracic region	54	3	70	3	67	2
Lumbar region	65	2	80	2	67	2
Hip region	78	1	88	1	67	2

%= (number of subjects who achieve task's phase/12 (Total number of subjects)) ×100

1= Segment which move firstly, 2= Segment which move secondly, 3= Segment which move thirdly 4= the last segment which move

Table 1 details the results. During flexion task, while the regional sequences at starting phase showed that the most of the participants moved head cervical region (92%) first followed by thoracic and lumbar (70%) together, and hip (62%) regions, the hip and lumbar regions (70% each) moved at the same time followed by

thoracic (62%), and head-cervical (55%) regions at the end phase ((Figure 2, Figure 4). Whereas, the regional sequences at peak phase showed head-cervical and thoracic regions (60%) moved at the same time, followed by lumbar and hip regions (52%), those moved at the same time ((Figure 3).

Figure 2: The movement sequence of cephalocaudal and hip regions by percentage at start of flexion,

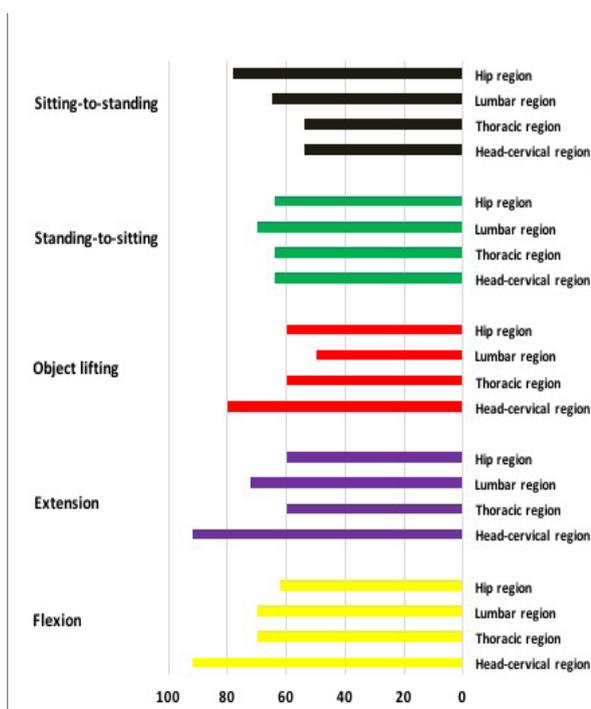


Figure 3: The movement sequence of cephalocaudal and hip regions by percentage at peak of flexion, extension, object lifting, standing to sitting and sitting to standing tasks

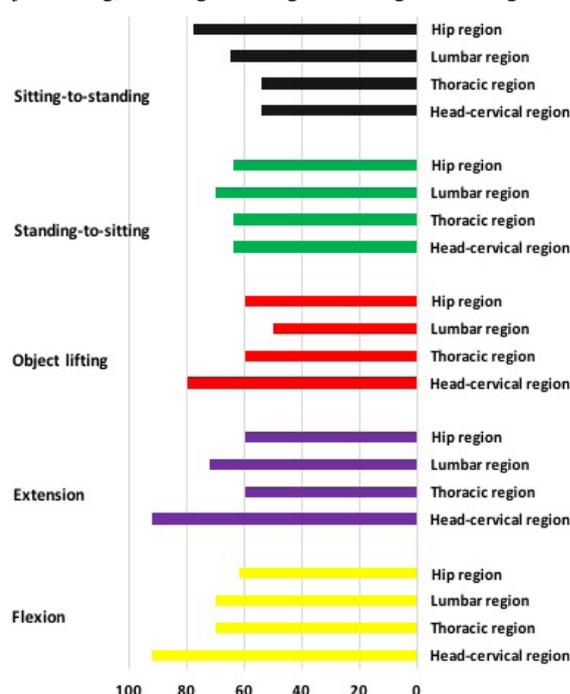
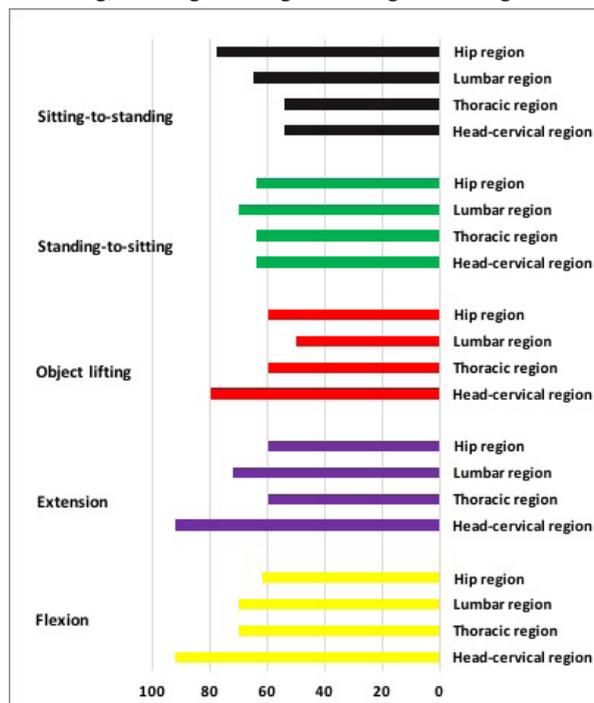


Figure 4: The movement sequence of cephalocaudal and hip regions by percentage at end of flexion, extension, object lifting, standing to sitting and sitting to standing tasks



Discussion

This study aimed to identify the movement sequence of cephalocaudal and hip regions during several dominant daily activities including flexion, extension, lifting, standing-to-sitting and sitting-to-standing tasks. The results of the current study identify distinguished temporal changes in the movement sequence of cephalocaudal and hip regions during several dominant daily activities. For instance, head-cervical region moved first at the starting phase of flexion, extension, and lifting task. Whereas, the lumbar and hip regions moved first at the starting phase of standing-to-sitting and sitting-to-standing task, respectively. However, in the peak phase, head-cervi-

cal and thoracic regions moved first during flexion task, while lumbar and hip regions moved first during extension task. While lumbar and hip regions moved first at the peak phase of lifting task and sitting-to-standing task, respectively, all the regions moved together at the peak phase of standing-to-sitting- task. In contrast, in the end phase of flexion and extension, hip and lumbar regions and hip region moved first, respectively. Whereas, head-cervical and thoracic regions and hip and thoracic regions moved first in the end phase of lifting and standing-to-sitting task, respectively. The head-cervical region moved first in the end phase of sitting-to-standing task.

Although previous studies were more focused on the assessment of range of motion, LBP may be associated with impaired movement sequence at cephalocaudal and hip regions^{21,22}. There were conflicting studies indicating the pattern and contribution of spine and hip motion between healthy adults and LBP patients. For instance, in healthy adults, lumbar spine dominates the movement in initial phase while hip motion dominates peak and terminal phase during spinal flexion motion^{13,23,24}. Similarly, in the current study, the head-cervical region dominates the starting phase, while head-cervical and thoracic regions equally dominate the peak phase and hip and lum-

bar region dominates the end phase of spinal flexion. Previous studies also reported greater contribution of spine in the early phase of flexion task while hip region contributed more than spine at the terminal phase of flexion task ^{13,14}.

However, there are some methodological differences exist in the previous studies in the measurement of movement sequence. While previous studies limited to lumbar and hip motions, the current study included movement sequence of cervical, thoracic, lumbar, and hip regions. In addition, the current study used several dominant daily activities such as flexion, extension, lifting, and standing-to-sitting and sitting-to-standing tasks to measure movement sequence of cephalocaudal and hip regions. No previous studies have investigated the movement sequence of cephalocaudal and hip regions during these tasks.

Limitation

The current study has potential limitations. First, the sample size was small, including only 12 subjects. Second, since all participants were male, the results cannot be generalized to female population. Third, other factors such as spine length, leg length, and pelvic angulation might affect the pattern of movement sequence during these tasks. Furthermore, the study participants were all healthy university staffs and students,

therefore, the sample population may not be truly representative of all groups of young males.

Conclusion

This study indicates variations of movement sequence of cephalocaudal and hip regions at different phases of dominant daily activities. While the head-cervical region moved first in the starting phase of flexion, extension, and lifting task; the hip region moved first in the end phase of flexion, extension, and standing-to-sitting task. Such findings will add new information for clinicians and physiotherapist during spinal assessment.

Acknowledgement

The authors would like to express their Gratitude's to the ministry of education and the deanship of scientific research – Najran University – Kingdom of Saudi Arabia for their financial and Technical support under code number (NU/MID/16/053).

References

1. Dankaerts W, O'Sullivan P, Burnett A, Straker L. Differences in sitting postures are associated with nonspecific chronic low back pain disorders when patients are subclassified. *Spine (Phila Pa 1976)* 2006. <https://doi.org/10.1097/01.brs.0000202532.76925.d2>.
2. Tousignant M, Poulin L, Marchand S, Viau A, Place C. The Modified-Modi-

- fied Schober Test for range of motion assessment of lumbar flexion in patients with low back pain: A study of criterion validity, intra-and inter-rater reliability and minimum metrically detectable change. *Disabil Rehabil* 2005. <https://doi.org/10.1080/09638280400018411>.
3. Alqhtani RS, Jones MD, Theobald PS, Williams JM. Correlation of Lumbar-Hip Kinematics between Trunk Flexion and Other Functional Tasks. *J Manipulative Physiol Ther* 2015. <https://doi.org/10.1016/j.jmpt.2015.05.001>.
 4. Alqhtani RS, Jones MD, Theobald PS, Williams JM. Investigating the contribution of the upper and lower lumbar spine, relative to hip motion, in everyday tasks. *Man Ther* 2016. <https://doi.org/10.1016/j.math.2015.09.014>.
 5. Christe G, Kade F, Jolles BM, Favre J. Chronic low back pain patients walk with locally altered spinal kinematics. *J Biomech* 2017. <https://doi.org/10.1016/j.jbiomech.2017.06.042>.
 6. Christe G, Redhead L, Legrand T, Jolles BM, Favre J. Multi-segment analysis of spinal kinematics during sit-to-stand in patients with chronic low back pain. *J Biomech* 2016. <https://doi.org/10.1016/j.jbiomech.2016.05.015>.
 7. Ogata Y, Anan M, Takahashi M, Takeda T, Tanimoto K, Sawada T, et al. Relationships Between Trunk Movement Patterns During Lifting Tasks Compared With Unloaded Extension From a Flexed Posture. *J Manipulative Physiol Ther* 2018. <https://doi.org/10.1016/j.jmpt.2017.09.007>.
 8. Dempsey PG. A critical review of biomechanical, epidemiological, physiological and psychophysical criteria for designing manual materials handling tasks. *Ergonomics* 1998. <https://doi.org/10.1080/001401398187332>.
 9. McGill SM. The biomechanics of low back injury: Implications on current practice in industry and the clinic. *J Biomech* 1997;30:465–75. [https://doi.org/10.1016/S0021-9290\(96\)00172-8](https://doi.org/10.1016/S0021-9290(96)00172-8).
 10. Mayer TG, Tencer AF, Kristoferson S, Mooney V. Use of noninvasive techniques for quantification of spinal range-of-motion in normal subjects and chronic low-back dysfunction patients. *Spine (Phila Pa 1976)* 1984. <https://doi.org/10.1097/00007632-198409000-00009>.
 11. Percy M, Portek I, Shepherd J. The effect of low-back pain on lumbar spinal movements measured by three-dimensional x-ray analysis. *Spine (Phila Pa 1976)* 1985. <https://doi.org/10.1097/00007632-198503000-00007>.
 12. Dall PM, Kerr A. Frequency of the sit to stand task: An observational study of free-living adults. *Appl Ergon* 2010. <https://doi.org/10.1016/j.apergo.2009.08.001>.

- doi.org/10.1016/j.apergo.2009.04.005.
13. Lee RYW, Wong TKT. Relationship between the movements of the lumbar spine and hip. *Hum Mov Sci* 2002. [https://doi.org/10.1016/S0167-9457\(02\)00117-3](https://doi.org/10.1016/S0167-9457(02)00117-3).
14. Wong TKT, Lee RYW. Effects of low back pain on the relationship between the movements of the lumbar spine and hip. *Hum Mov Sci* 2004;23:21–34. <https://doi.org/10.1016/j.humov.2004.03.004>.
15. Shum GLK, Crosbie J, Lee RYW. Movement coordination of the lumbar spine and hip during a picking up activity in low back pain subjects. *Eur Spine J* 2007. <https://doi.org/10.1007/s00586-006-0122-z>.
16. Shum GLK, Crosbie J, Lee RYW. Effect of low back pain on the kinematics and joint coordination of the lumbar spine and hip during sit-to-stand and stand-to-sit. *Spine (Phila Pa 1976)* 2005;30:1998–2004.
17. Williams JM, Haq I, Lee RY. The effect of pain relief on dynamic changes in lumbar curvature. *Man Ther* 2013. <https://doi.org/10.1016/j.math.2012.09.004>.
18. Williams JM, Haq I, Lee RY. A novel approach to the clinical evaluation of differential kinematics of the lumbar spine. *Man Ther* 2013. <https://doi.org/10.1016/j.math.2012.08.003>.
19. Leardini A, Biagi F, Merlo A, Belvedere C, Benedetti MG. Multi-segment trunk kinematics during locomotion and elementary exercises. *Clin Biomech* 2011. <https://doi.org/10.1016/j.clinbiomech.2011.01.015>.
20. Parkinson S, Campbell A, Dankaerts W, Burnett A, O’Sullivan P. Upper and lower lumbar segments move differently during sit-to-stand. *Man Ther* 2013. <https://doi.org/10.1016/j.math.2013.02.001>.
21. Esola MA, McClure PW, Fitzgerald GK, Siegler S. Analysis of lumbar spine and hip motion during forward bending in subjects with and without a history of low back pain. *Spine (Phila Pa 1976)* 1996;21:71–8.
22. Sahrman S, Azevedo DC, Dillen L Van. Diagnosis and treatment of movement system impairment syndromes. *Brazilian J Phys Ther* 2017. <https://doi.org/10.1016/j.bjpt.2017.08.001>.
23. Porter JL, Wilkinson A. Lumbar-hip flexion motion. A comparative study between asymptomatic and chronic low back pain in 18- to 36-year-old men. *Spine (Phila Pa 1976)* 1997. <https://doi.org/10.1097/00007632-199707010-00017>.
24. Pal P, Milosavljevic S, Sole G, Johnson G. Hip and lumbar continuous motion characteristics during flexion and return in young healthy males. *Eur Spine J* 2007. <https://doi.org/10.1007/s00586-006-0200-2>.

Original Article :

Nurses' knowledge about the discharge plan for patients after cardiac surgery at the Sudan Heart Institute

Ahmed Abdalla Ahmed Jarelnape

Assistant Professor, Al Baha University, Faculty of Applied Medical Sciences ,
Nursing Department, Saudi Arabia

Received on 15.01.2020, accepted for publication on 11/12/2020 dx.doi.org/10.5455/mjhs.2021.02.008

Corresponding Author:

Ahmed Abdalla Jarelnape, Faculty of Applied Medical Sciences, Department of Nursing,
Al Baha University, Saudi Arabia. E-mail: ahmed3636@live.com ,
Phone: 00966530689671, ORCID : <https://orcid.org/0000-0001-5327-9250>

Abstract

Background & Aims:

Discharged patients from the hospital to home after cardiac surgery require planning, guidance, and recommendations from health care providers that the patient must follow to avoid expected complications. The current study aimed to assess nurses' knowledge about the discharge plan for patients after cardiac surgery at the Sudan Heart Institute.

Methods:

This is a descriptive cross-sectional study enrolled 85 nurses and was conducted at the Sudan Heart Institute from January to May 2019. Data were collected using a structured self-designed questionnaire containing different aspects of the discharge plan to assess nurses' knowledge using multiple-choice questions.

Results:

The results of this study showed that 70% of the study population were females from 26–30 years old, 83% of the participants were single, and most nurses had a Bachelor's degree (75%). There was a significant difference between the participants' experience and the nurses' knowledge level about the discharge plan ($p=0.01$). Overall, the nurses' knowledge about the discharge plan was good at 78%.

Conclusion:

This study showed the participants had good knowledge of the discharge plan programs for patients after cardiac surgery.

Keywords:

nurses, knowledge, discharge plan, cardiac surgery

المخلص

الخلفية والاهداف:

خطة الخروج هو عملية يتم فيها تحديد احتياجات المرضى ، وخطة يتم تشكيلها لنقل المريض من مكان إلى آخر. تهدف الدراسة الحالية إلى تقييم معرفة الممرضين حول خطة الخروج من المستشفى بعد جراحة القلب المفتوح في مستشفى جراحة القلب، السودان

طريقة البحث:

أجريت هذه الدراسة الوصفية المستندة إلى المستشفى ، وتم جمع البيانات عن طريق الاستبيانات. وتم تحليلها باستخدام الحزمة الإحصائية للعلوم الاجتماعية (الإصدار ٢٣) ، تم استخدام (اختبار-ت) في اختبارات الدلالة عند مستوى (٠.٠٥) . تم العر بواسطة الجداول، صمم الباحث الاستبيان ليشمل (٢٣) سؤالاً موزعة في قسمين رئيسيين ، وزعت على (٨٥) من الممرضين يعملون في مستشفى جراحة القلب عبر تقنية أخذ العينات العشوائية.

النتائج:

أظهرت نتائج هذه الدراسة المعرفة العامة للممرضات على خطط الخروج من المرضى بعد جراحة القلب المفتوح تظهر إحصائيات مهمة (قيمة ب = ٠.٥) . الذين شاركوا في الدراسة كان لديهم معرفة كافية ببرامج خطة الخروج ، تكشف الدراسة الحالية أن أكثر من نصف عينة الدراسة (٧٠٪) كانت من الإناث ، ومتوسط عمر المشاركين بين (٢٠ - ٢٥) ، أظهرت الدراسة أيضا أن الغالبية عدد الممرضين الحاصلات على البكالوريوس (٧٥٪)

الخلاصة:

أظهرت نتائج الدراسة الحالية أن الممرضين الذين شاركوا في الدراسة لديهم معرفة كافية ببرامج خطة الخروج للمرضى بعد جراحة القلب المفتوح.

الكلمات المفتاحية:

معرفة، الممرضين، خطة الخروج

Introduction

Open heart surgery is required to treat congenital or acquired heart diseases. Heart surgery is performed to treat coronary artery blockage. Valve repair or replacement is performed in patients with the valvular disorders, and other types of cardiac surgery correct cardiac diseases¹. Cardiac surgery is a significant event in a patient's life. For revascularization surgery, patients have the chance for a successful surgery, but they also have fears about discomfort and surgical pain and concerns about fatigue and sleep disorders, loss of appetite, return to normal life and activities post-surgery, drug addiction, cardiac monitoring, duration of hospital stay, and hospitalization costs².

Discharge planning is a key element in patient care. It involves outlining the routine and health needs that should be expected upon exit from the facility, which is a link between functioning in the community and hospitalization³. Ideally, discharge planning occurs when patients are admitted for cardiac surgery. Discharge instructions after cardiac surgery include instructions about taking medications, activity restrictions, healthy diet and nutrition, wound care (including bandages, if appropriate, suture removal, bathing), and follow-up appointments (cardiologist, pri-

mary health care provider)⁴. This planning helps patients to communicate with health care professionals and primary care providers about the best way to manage their chronic needs after leaving the hospital⁵. The discharge instructions for cardiac surgery patients include monitoring for signs of swelling, checking the sleeping conditions, and observing the patient's appetite. The discharge instructions also educate the patient and urge them to pay attention to the following points: patients' activities post-cardiac surgery, nutrition, complication post-cardiac surgery, methods of preventing infection, and outpatient follow-up⁶. Discharge planning is determined as a part of all patients' management. All patients should be referred to their cardiologist with an appointment about 1 month after surgery. They should return to see the primary surgeon within 1 week. Patients should be instructed on wound care, which includes daily bathing with antibacterial soap and water. Application of ointments, salves, or lotions is to be avoided. Patients should walk as much as tolerated, and they can go up and down steps as tolerated⁷. Educating the patient and family is the responsibility of the nursing staff, and it is an important aspect of patient preparation for discharge that should take place during the hospital stay rather than waiting until the patient is being discharged. Every day,

patients must be educated about drugs, including pain medication, predictions about activity levels, diet, sternal precautions, care of incisions, signs, and symptoms of infection. Patients should be involved in their care as much as possible. Families should participate when possible, particularly family members who will take care of patient at home⁸.

Methods

Study design

This is a descriptive cross-sectional study. It was conducted to assess nurses' knowledge about discharge plans for patients after cardiac surgery at the Sudan Heart Institute in Khartoum state from January to May 2019.

Study area

The study was performed at the Sudan Heart Institute in Khartoum State. This hospital provides outpatient and inpatient services for people living in this area, and it is open all the day and receives patients from different settings in Sudan.

Study population

The study population is nurses work at Sudan Heart Institute Hospital. The sample of registered nurses for this study was randomly selected from lists of the nurses based on the inclusion and exclusion criteria.

Inclusion criteria

The inclusion criteria were as follows: nurses from different surgical sections in the hospital (included nurses working in the operating room, cardiac catheters, and intensive care unit); and male or female staff nurses who were 20 years to 40 years of age with at least 1 year of job experience.

Exclusion criteria

The exclusion criteria were as follows: head nurses, student nurses, or staff nurses who were less than 20 years or over 40 years of age with less than 1 year of experience.

Sample size and sampling technique

Random sampling was used in this study, and the sample size was calculated according to the following equation: $n = N/1+N(d^2)$

where n = sample size, N = population size, d = degree of accuracy desired (the accepted margin of error was 0.05).

$$n = 120/1+120(0.05)^2 = 120/1.3 = 92$$

Thus, the sample size should be 92 nurses, but there were 85 nurses who completed the questionnaire.

Methods of data collection

A self-administered questionnaire was used for data collection. The questionnaire was designed according to [9], which assessed nurses' attitudes towards patient perceptions of hospital discharge, to deter-

mine their level of knowledge. The questionnaire was also shared with two professors who specialized in nursing from Al Baha University and Taibah University in Saudi Arabia to express their opinion on the content. A pilot study was conducted, and it was performed with 15 nurses at the Sudan Heart Institute hospital. The participants provided their opinions about the results of the pilot study using a questionnaire, and the final questionnaire was prepared by the author. Participants in the pilot study were excluded from the main study. The first part of the questionnaire included the participant's demographic characteristics and the second part included 16 questions about their knowledge of the discharge plan.

Score grading

A common grading method was used for each variable in the questionnaire, as follows: one point for the correct option, and zero points for the incorrect answer in the knowledge section. The scoring range for the questionnaire was 0 to 16 (lowest to highest score). For knowledge about the

discharge plan, a score of < 8 was considered to be poor, 8–12 was considered to be average, and 13–16 was considered to be adequate. The total nurses' knowledge scores about the discharge plan were calculated.

Statistical analysis

The data were analyzed using the Statistical Package for Social Sciences (SPSS, version 21). Descriptive statistics were used, and the data were presented as the frequencies and percentages. Data were analyzed using the Chi-square test, and presented by cross-tabulation. $P < 0.05$ was considered to be statistically significant.

Ethics approval statement

The study was approved by the Sudan Heart Institute in Khartoum, Sudan. Participants who were willing to participate received a letter explaining the purpose and outcome of the study, and they were assured that their participation was voluntary.

Results

Table1. Shows the demographic character-

Table 1: Interpretation of score according to the knowledge level (maximum score = 16)

	Knowledge level	Score	Range (%)
1	Excellent	14–16	82–100
2	Good	11–13	64–81
3	Average	8–10	45–63
4	Below average	4–7	20–44
5	Poor	0–3	0–19

Table 2: Distribution of socio-demographic characteristics (N = 85)

		Frequency (n)	Percentage (%)
Gender	Male	25	30
	Female	60	70
Age category	20–25 years	13	15
	26–30 years	62	73
	30 years and over	10	12
Marital status	Single	70	83
	Married	13	15
	Divorce	2	2
Qualification	PhD	0	0
	BSc	64	75
	Diploma	21	25
Experience in the cardiac surgery section	Less than 5 years	55	65
	5–10 years	20	23
	More than 10 years	10	12
Training course	Yes	53	62
	No	32	38

istics of the participants. Most of the subjects (73%) were 26–30 years old. The majority of subjects (70%) were female, most of participants regarding qualification are

They had a Bachelor's degree (75%). Regarding marital status most of the subjects were single (83%)

Table 3: Distribution of correct and incorrect answers by nurses regarding knowledge about the discharge plan, Sudan Heart Institute hospital (N = 85)

	Correct N %	Incorrect N %
Nurses' knowledge regarding a patient's activities post-cardiac surgery	75 (88)	10 (12)
Nurses' knowledge regarding nutrition	59 (69)	26 (31)
Nurses' knowledge regarding indications for cardiac surgery	52 (61)	33 (39)
Nurses' knowledge regarding different types of cardiac surgery	66 (78)	19 (22)
Nurses' knowledge regarding important complications post-cardiac surgery	65 (77)	20 (23)
Nurses' knowledge regarding the methods of preventing infection	75 (88)	10 (12)
Nurses' knowledge regarding outpatient follow-up	77 (91)	8 (9)
Nurses' knowledge regarding the importance of exercise after cardiac surgery	59 (69)	26 (31)
Total nurses' knowledge about the discharge plan	66 (78)	19 (22)

Table 3. illustrates the nurses' knowledge of discharge plan. 88% know about knowledge regarding a patient's activities post-cardiac surgery. The participants of the study were asked about knowledge regarding nutrition for which 69% of the participants their correct answers. The majority of the nurses has a good knowledge of

knowledge regarding outpatient follow-up 91% their correct answers.

Table 4: Association between demographic characteristics and nurses' knowledge level about the discharge plan, cross-tabulation (N = 85)

	Knowledge level					Total	Chi-Square	P value
	Excellent	Good	Average	Below Average	Poor			
Gender								
Male	3	6	6	3	7	25	03.08 ^a	0.55
Female	6	24	10	3	17	60		
Total	9	30	16	6	24	85		
Age category								
20–25 years	1	4	3	1	4	13	13.25 ^a	0.10
26–30 years	7	33	10	3	9	62		
30 years and over	0	2	1	2	5	10		
Total	8	39	14	6	18	85		
Qualification								
PhD	0	0	0	0	0	0	08.16 ^a	0.09
BSc	5	34	11	3	11	64		
Diploma	2	5	3	2	9	21		
Total	7	39	14	5	20	85		
Experience								
Less than 5 years	1	7	4	7	36	55	23.10 ^a	0.01
5–10 years	3	7	5	1	4	20		
More than 10 years	1	3	3	1	2	10		
Total	5	17	12	9	42	85		
Training course								
Yes	2	26	20	1	4	52	06.83 ^a	0.15
No	4	15	6	2	5	32		
Total	6	41	26	3	9	85		

Table 4. showed the statistical Differences between Nurses Knowledge and their socio-demographic characteristics. The results of study showed there was high significant relationship between nurses level of knowledge and level of experience of nurses at $P = P \leq 0.05$ level.

Discussion

In the current study, the socio-demographic characteristics indicated that most of the

participants were female (70%). This result was consistent with another study that found that 81% of the participants were female [10]. In our study, participants were mostly 26–30 years of age (73% of participants), which was consistent with another study that found that the largest age group in the study sample was less than 30 years of age ¹¹.

For marital status, 83% of participants

were single. This result varies compared with another study which found that most of the nurses were married ¹².

Regarding the nurses' qualification level, more than half (75%) of the nurses in the sample had a Bachelor's degree. This finding is consistent with another study that found that most nurses in their study held a Bachelor's degree ¹³.

For the nurses' experience in the cardiac surgical unit, we found that 65% of the nurses had less than 5 years of experience. This result was consistent with a study that found that the performance of newer graduates was more effective than that of others with more experience ¹⁴.

We found that 62% of the participants attended training courses. This result agrees with the results of another study that found that most of the nurses (88%) had attended a training course about the discharge plan¹⁵.

For the nurses' knowledge about the methods of preventing infection, the results showed that 88% of the study sample knew about infection control. This result was consistent with another study that found that most of the nurses were knowledgeable about infection control methods ¹⁶.

We found that 91% of nurses had knowledge about the importance of outpatient follow-up after discharge. This result was different from that of another study that

was conducted at an Iraqi center hospital, which showed that only a small proportion of nurses (36%) had this knowledge ¹⁷.

Nurses' knowledge about routine activity post-cardiac surgery was shown to be 88%. This finding in the present study was consistent with evidence from another study that showed that the level of this knowledge level was high ¹⁷.

Nurses' knowledge regarding nutrition was 69%. This result was supported by a study that was conducted at an Iraqi hospital, which found that the nurses had good knowledge of the nutrition system after discharge from the hospital ¹⁷.

Information that was given to the patients before discharge included signs and symptoms of complications and nutrition. The results showed that the participants had knowledge about these areas (69%, 77%, and 69% respectively). This result agrees with a study that found that nurses' knowledge about providing discharge information for the patient following cardiac surgery, including information on the discharge plan, was good ¹⁸.

There were no differences between demographic characteristics and the knowledge level of nurses about the discharge plan in the current study for gender, age category, qualification, and training courses. These results are consistent with other studies that also did not show a significant differ-

ence between the nurses' age or gender and their practices ^{19, 20}.

Study limitations and strength

The limitations of the study are the small sample size. The strength of this study is that it is the first study in Sudan on the discharge plan for a patient's post-cardiac surgery. The study was widely accepted and the study participants' responses were good.

Conclusions

The results of this study showed that most of the participants had 5 years of experience in the cardiac surgical section. The only domain that had an average rate of correct answers of 61% was the nurse's knowledge regarding indications for cardiac surgery. The study participants had good knowledge of all sections and aspects of the discharge plan for patients who underwent cardiac surgery.

The study recommends holding courses and educational sessions for nurses who are working in cardiac surgery to increase their knowledge, and educational leaflets should be provided to the patients after cardiac surgery. A special unit that is responsible for the patient's discharge plan and providing adequate information and knowledge should be created.

References:

1. Pamela L, Swearingen. All-in-one Nurs-

ing Care Planning Resource: Medical-surgical, Pediatric, Maternity, and Psychiatric-mental Health. 4th ed. Elsevier Health Sciences 2015

2. Shabestari M, Parizad R. Stressors in Patients Undergoing Cardiac Surgery and Attitudes of Nurses and Patients. *Crescent J Med & Biol Sci* 2014; 1:1-3.

3. Dlabal S, Brenda M A. Historical Perspective of Treatment and Discharge Planning for the Seriously, Chronically, Mentally Ill Patient. *Advanced Practices in Nursing* 2017; 2: 1-7.

4. Hockenberry M, Wilson D, Rodgers C. Wong's Essentials of Pediatric Nursing. Elsevier Health Sciences, 2016; 5:76-87.

5. McMartin K. Discharge Planning in Chronic Conditions: An Evidence-Based Analysis. *Ontario Health Technology Assessment Series*, 2013; 4: 1-72.

6. Azer S, Abd-Elwahb M, Ahmed A. Impact of Educational Program among Open Heart Surgery Patients on Minimizing the Incidence of Post-Operative Infections, 2011; 6: 820-34.

7. Kalida A, Mustafa F. Nurses' Practices regarding Patients Discharge Planning Post-Cardiac Surgery. *Iraqi National J Nurs Specialties* 2018; 31: 143-149

8. Hodge T. Fast fact for the cardiac surgeries nurse, second edition: caring for cardiac surgeries patients in a nutshell. Springer

- Publishing Company, 2015; 3: 137-141
9. Heather H, Henry B, Donald S, Michelle B, Jennifer J. Patient perceptions of hospital discharge: reliability and validity of a Patient Continuity of Care Questionnaire. *International Journal for Quality in Health Care* 2008; 9:314– 323.
10. Velazquez EJ, et al. Coronary-artery bypass surgery in patients with left ventricular dysfunction. *New England J of Medicine* 2011; 3:107-116.
11. Dennis T, Samiran G, Ashley D, Henry C, Jeffrey S. The association of post-discharge adverse events with timely follow-up visits after hospital discharge. *journal. Pone* 2017; 3: 117-57
12. Maramba PJ, et al. Discharge planning process: applying a model for evidence-based practice. *J Nurs Care Qual* 2004;19(2):123–9
13. Younis YE. Nurse knowledge about modifiable & non-modifiable risk factor of heart failure patient in rebill teaching hospital. *Kufa Journal for nursing sciences*, 2014; 4: 217-222
14. Tsilimingra D, Bates D. Addressing post-discharge adverse event: A neglected area. *The Joint Commission Journal of Quality and Patient Safety* 2017; 33(3), 85-99
15. Henry S, Julian S, Sue R, Raj J, Ian M, David R, Advanced care nurse practitioners can safely provide sole resident cover for level three patients: impact on outcomes, cost and work patterns in a cardiac surgery program, *European Journal of Cardio-Thoracic Surgery* 2013; 34: 19-22
16. John M, Boyce M, Didier M. Guideline for Hand Hygiene in Health Care Settings. *J Hosp Infect* 2014; 51:57-44
17. Mostafa M, Fadil A, Sabah A. Assessment of nurse knowledge concerning discharge planning for patient with heart surgery. *International J of Scientific* 2016; 6: 149-153
18. Thabet O, Ghanem H, Ahmed A. Assessment of Nurse's knowledge and practice for patients undergoing Cardiac Catheterization. *Assiut Scientific Nursing Journal* 2019; 7: 95-101
19. Fashafshe I, Eqtaite F. Knowledge and practice of nursing staff toward infection control prevention measure in the Palestinian hospitals. *Journal of education Practice*, 2015; 6: 79–91.
20. Aziz SE, Lafi SS. Evaluation of nurse practice provide to the patient who undergo open-heart surges. *Kufa Journal for nursing sciences* 2013; 3: 69–81.

Original Article :

Prevalence of common work-related musculoskeletal disorders among population of Najran University, Saudi Arabia

Rae S Alqhtani¹, Muhammad Y Mughal¹

1. Assistant Professor, college of Applied Medical sciences, Najran University, KSA

Received on 20.8.2020, accepted for publication on 15.2.2021 dx.doi.org/10.5455/mjhs.2021.02.009

Corresponding Author:

Muhammad Yaseen Mughal, Department of Physiotherapy, College of Applied Medical Sciences, Najran University, KSA. Phone numbers: 00966590587187.

E-mail address: dryaseenmughal1979@gmail.com

Abstract

Background:

Work related musculoskeletal disorders are the most common occupational problems, which mostly affect the neck, upper and lower back. The objective of this study was to identify the musculoskeletal disorders among the employees of Najran University, KSA.

Methods:

This cross-sectional study was conducted among the two sixty nine employees of Najran University during the period of January 2019 to September 2019. Data were collected by using a self-administered questionnaire and a standardized Nordic questionnaire.

Results:

269 employees of Najran University participated in this study; the mean age of participants was 39.35 ± 7.2 . Most of participants 56.1% were overweight. The mean value of working experience was 6.8 ± 3.0 , mean value of pain in off days past three year was 2.06 ± 8.7 . Working hour was counted with mean value 7.13 ± 1.80 . Mean value of walking activity was 33.45 ± 32.07 and exercise was 10.07 ± 21.4 . Mean value of daily uses of computer was 5.01 ± 2.2 and cellphone was 4.65 ± 3.0 , Upper and lower extremity multiple problem was found significant with qualification of participants.

Conclusion:

Most of the participants have musculoskeletal pain/discomfort. The most affected region identified was low back and participants reported pain in this region. Few participants complained of neck pain. However, the other regions such as shoulder, wrist/ forearm, upper back, knee and ankle were found to be minimally affected. Association was found in personal and working place characteristics in different region of pain.

المخلص

الخلفية:

الاضطرابات العضلية الهيكلية المرتبطة بالعمل هي أكثر المشاكل المهنية شيوعاً، والتي تؤثر في الغالب على الرقبة وأعلى الظهر وأسفل الظهر. الهدف من هذه الدراسة هو التعرف على آلام / اضطرابات العضلات والعظام بين العاملين في جامعة نجران بالمملكة العربية السعودية

طريقة البحث:

أجريت هذه الدراسة المسحية بين اثنين وستون من موظفي جامعة نجران خلال الفترة من يناير 2019 إلى سبتمبر 2019. تم جمع جميع البيانات باستخدام استبيان النوردك الذي يستخدم لمعرفة أعراض الاضطرابات العضلية الهيكلية

النتائج:

كان متوسط عمر المشاركين 39,3 عاماً، الانحراف المعياري 7,3، مؤشر كتلة الجسم للمشاركين 30,7% أقل من الوزن الطبيعي، 26,8% من الوزن الطبيعي، 56,1% من المشاركين يعانون من زيادة الوزن، 16,4% يعانون من السمنة المفرطة. من بين اثنين وستين مشاركاً يعانون من اضطرابات مختلفة مثل آلام أسفل الظهر 32,3%، آلام الرقبة 13%، آلام مفصل الركبة 8,2%، آلام الكتف 7,8%، مشاكل متعددة في الأطراف العلوية 7,1%، مشاكل متعددة في الأطراف السفلية 5,6%، آلام الظهر العلوية 3,7%، آلام الاقدام 1,9%، آلام المعصم 0,7%، ألم مفصل الكاحل 0,7%، ألم اليد 0,4%.

الخلاصة:

استنتج من الدراسة أن غالبية المشاركين وجد أنهم يعانون من زيادة في الوزن، ولهذا السبب وجد أنهم يعانون من آلام العضلات والعظام. وكانت المنطقة الأكثر تضرراً التي تم تحديدها هي منطقة أسفل الظهر. عدد قليل من المشاركين اشتكوا أيضاً من آلام الرقبة، ومع

Key words:

Work related musculoskeletal disorders, chronic pain, occupational problem

ذلك، تم العثور على مناطق أخرى من الجسم مثل الكتف والمعصم والساعد وأعلى الظهر والركبة والكاحل حيث كانت متأثرة بشكل طفيف.

Introduction

Work-related musculoskeletal disorder is defined as damage to the musculoskeletal system resulting from work-related events, and it is one of the most general causes of chronic pain and physical disorders occurring among modern workers. Health systems are immensely affected because of work-related musculoskeletal disorders among the working population ¹. About 2/3 of the working time of these population remain in a sitting posture, and their sitting sessions typically lasts at least 30 minutes ^{2, 3}.

Inactive behavior has been well-defined as when a person uses their energy expenditure while in a reclining or sitting posture of ≤ 1.5 METs while in a sitting or reclining posture⁴. In office workplaces increase the risk of type 2 diabetes, cardio-metabolic disease obesity, musculoskeletal disorders, coronary artery disease, different kinds of cancer, and early death. ⁵⁻⁷ Musculoskeletal discomfort or pain is a huge burden nowadays and mostly population are facing the difficulties in their jobs or tasks of daily routine.

The purpose of this study was to identify the prevalence of common work-related

musculoskeletal disorders among population of Najran University

Methods

This cross-sectional study was conducted among the employees of Najran University to assess musculoskeletal disorders. A Standardized Nordic questionnaire and self-administered questionnaires were distributed among the employees of Najran University.

Self-administered questionnaire had 15 questions to ask about the personal data of the participants such as height, weight (BMI), qualification, experience, working hours, about walk, heavy exercises, about diabetes and hypertension or any other health problems, use of computers and cell phones.

Standardized Nordic questionnaires, which is very authentic and common questionnaire about the symptoms of WMSD's. This questionnaire covered the areas of body causing WMSD's: neck, shoulder, elbow, wrist/forearm, hand, upper back, lower back, hips, knees, ankle, and foot. This questionnaire contains 5 questions in each section and last question of each section has further three separate parts about the degree of pain or discomfort interfered

with your work, your life outside of work, your sleep, and how many days in the past years did participants stop the activities.

All participants were male. The participants of this study were working in different sections of Najran University, like administration, dentistry, pharmacy, physiotherapy, nursing, computer, Engineering, English department, accounts, sharia, and medicine. The teaching staff and employees who work in the offices Najran University were included.

The employees of Najran University, who don't work in the offices like security guards and cleaners, were excluded. All participants read the information sheet and signed the consents form. Statistical analysis was performed with the SPSS (version-24), Descriptive summary statistics including mean, frequencies, and percentages. The Ethics committee of Najran University granted the ethics approval and all data will be kept confidential.

Results

300 questionnaires were randomly distributed among the population of Najran University, 269(89.6%) participants responded to the questionnaire. Table -1 shows the descriptive statistics of participants in which Mean age of participants was 39.35 ± 7.2 . Most of participants 56.1% were overweight and 93.3% have not any

diabetic/hypertensive problem but 16.4% were found obese.

Table 1: Personal Characteristics

Personal Characteristics n=269	Mean±std
Age of participants	39.35±7.2
BMI	Frequency (%)
Underweight	2(0.7)
Healthy weight	72(26.8)
Overweight	151(56.1)
Obese	44(16.4)
Qualification	
Matric	6(2.2)
Higher Secondary	28(10.4)
Graduation	72(26.8)
Masters	97(26.8)
PhD	66(24.5)
Diabetic/Hypertensive	
No Problem	251(93.3)
Diabetic	15(5.6)
Hypertensive	1(0.4)
Other Problems	2(0.7)

The mean value of working experience was 6.8 ± 3.0 , mean value of pain in off days past three year was 2.06 ± 8.7 . Working hour was counted with mean value 7.13 ± 1.80 . Mean value of walking activity was 33.45 ± 32.07 and exercise was 10.07 ± 21.4 . Mean value of daily uses of computer was 5.01 ± 2.2 and cellphone was 4.65 ± 3.0 , (table2).

Table 2: Workplace characteristics

Workplace characteristics n=269	Mean±std
Working experience	6.8±3.0
How many days off in the past 3 years because of pain	2.06±8.7
Working hours	7.13±1.08
Walking activity	33.45±32.07

Workplace characteristics n=269	Mean±std
Exercise	10.07±21.4
Daily uses of computer	5.01±2.2
Daily uses of cellphone	4.65±3.0

Out 269 most of participants (87) had pain in lower back, 35 had in neck region, 22 were reported in knee, 19 were in upper extremity multiple problem 15 had in lower extremity in multiple problem and rest of participants in different regions but no

one reported in shoulder and elbow region, (shown in Table. 3).

Upper and lower extremity multiple problem was found significant with qualification of participants <0.001 and <0.017 respectively. Upper extremity multiple problem also found significant with BMI in p value <0.001 and Diabetic/ Hypertensive found significant with neck pain with value 0.002, (shown in table 4).

Table 3: common work-related musculoskeletal disorders (n=269)

MSDs	frequency of affected person
Pain in lower back	87
Pain in neck	35
Pain in knee	22
Upper extremity multiple problem	19
Lower extremity multiple problem	15
Pain in upper back	10
Pain in foot	5
Pain in wrist	2
Pain in ankle	2
Pain in hand	1

Table 4: Association between personal characteristics with Prevalence of MSD's

personal characteristics n=269	Pain in neck		Pain in lower back		Pain in knee		Pain in ankle		Upper extremity multiple problem		Lower extremity multiple problem	
	No. (%)	p	No. (%)	p	No. (%)	p	No. (%)	p	No. (%)	p	No. (%)	p
Qualification												
Matric	0(0.0)	0.599	2(0.7)	0.455	0(0.0)	0.35	0(0)	0.47	2(7)	<0.001	0(0)	0.017
Higher 2ry	3(1.1)		5(1.9)		2(7)		0(0)		9(3.3)		5(1.9)	
Graduate	11(4.1)		24(8.9)		7(2.6)		0(0)		4(1.5)		2(0.7)	
Master	10 (3.7)		31(31)		11(4.1)		2(7)		4(1.5)		7(2.6)	
PhD	11(4.1)		25(9.3)		2(7)		0(0)		0(0.0)		1(0.4)	

personal characteristics n=269	Pain in neck		Pain in lower back		Pain in knee		Pain in ankle		Upper extremity multiple problem		Lower extremity multiple problem	
	No. (%)	p	No. (%)	p	No. (%)	p	No. (%)	p	No. (%)	p	No. (%)	p
BMI												
Underweight	0(0.0)	0.305	0(0)	0.08	0(0.0)	0.407	0(0.0)	0.4	2(0.7)	<0.001	0(0)	0.695
Healthy weight	5(1.9)		23(8.6)		9(3.3)		1(0.4)		6(2.2)		3(1.1)	
Overweight	23(8.6)		43(16)		11(4.1)		0(0.0)		11(4.1)		8(3)	
Obese	7(2.6)		21(7.8)		2(0.7)		1(0.4)		0(0)		4(1.5)	
Diabetes/ Hypertension												
No	30(11.2)	0.002	81(30.1)	0.607	21(7.8)	0.995	2(0.7)	0.986	19(7.1)	0.690	14(5.2)	0.976
Diabetes	3(1.1)		6(2.2)		1(0.4)		0(0)		0(0)		1(0.4)	
Hypertension	0(0.0)		0(0.0)		0(0.0)		0(0)		0(0)		0(0)	
Others	2(7)		0(0.0)		0(0.0)		0(0)		0(0)		0(0)	

Lower extremity multiple was found significant with walking activity with p value 0.021, association was found in pain in upper back with age of participants, off days in past three year because of pain and working hours with p value 0.07, 0.006, and 0.009 respectively. Association was found of knee pain with working hours,

daily uses of computer and exercise with p value 0.00, 0.45 and 0.006 respectively. And association of upper extremity multiple problem was found with age of participants, walking activity and exercise with p value 0.00, 0.007 and 0.037 respectively, (Table. 5)

Table 5: Association between workplace characteristics and MSDs, n=256

characteristics	Pain in lower back		Lower extremity multiple problem		Pain in upper back		Pain in neck		Pain in knee		Upper extremity multiple problem	
	Mean ±SD	P	Mean ±SD	P	Mean ±SD	P	Mean ±SD	P	Mean ±SD	P	Mean ±SD	P
Age												
yes	40.31 ±7.03	.137	38.5 ±8.7	.653	33.3 ±2.63	.007	40.11 ±7.3	.510	41.09 ±7.0	.244	33 ±3.1	.000
No	38.91 ±7.36		39.4 ±7.2		39.59 ±7.3		39.2 ±7.3		39.20 ±7.3		39.8 ±7.3	

characteristics	Pain in lower back		Lower extremity multiple problem		Pain in upper back		Pain in neck		Pain in knee		Upper extremity multiple problem	
	Mean ±SD	P	Mean ±SD	P	Mean ±SD	P	Mean ±SD	P	Mean ±SD	P	Mean ±SD	P
Working experience of participants												
yes	6.80 ±3.18	.994	6.0 ±2.7	.285	6.5 ±1.71	.743	6.97 ±2.4	.728	6.86 ±3.2	.926	6.9 ±3.0	.833
No	6.80 ±2.91		6.8 ±3.0		6.81 ±3.04		6.7 ±3.1		6.8 ±3.0		6.8 ±3.0	
How many days off in the past 3 years because of pain												
yes	2.86 ±9.0	.294	1.8 ±2.6	.905	9.4 ±18.7	.006	1.11 ±3.3	.490	1.81 ±5.8	.892	1.9 ±2.6	.953
No	1.67 ±8.5		2.0 ±9.0		1.77 ±18.69		2.2 ±9.1		2.08 ±8.8		2.1 ±8.9	
Working hours												
yes	7.09 ±1.06	.689	7.4 ±0.6	.320	8 ±1.24	.009	7.34 ±0.5	.212	6.36 ±1.2	.000	7.1 ±0.5	.917
No	7.14 ±1.09		7.1 ±1.1		7.1 ±1.1		7.1 ±1.1		7.19 ±1.0		7.1 ±1.1	
Walking activity												
yes	30.86 ±31.04	.361	52 ±33.0	.021	18 ±21.0	.121	41 ±41.7	.136	36.36 ±25.1	.658	52.3 ±37.3	.007
No	34.69 ±32.56		32.3 ±31.7		34.05 ±32.3		32.3 ±30.3		33.19 ±32.6		32.0 ±31.3	
Daily uses of cellphone												
yes	5.04 ±3.02	.141	6 ±11.0	.450	5.6 ±3.20	.313	5.7 ±3.3	.022	12.2 ±20.2	.616	4.2 ±10.1	.217
No	4.46 ±3.0		10.3 ±21.9		4.61 ±3.0		4.4 ±2.9		9.87 ±21.5		10.5 ±22.0	
Daily uses of computer												
yes	4.93 ±2.33	.674	4 ±2.5	.073	6 ±1.56	.160	5.37 ±2.2	.317	4.1 ±1.2	.045	4.31 ±2.6	.162
No	5.05 ±2.22		5.0 ±2.2		4.98 ±2.27		4.9 ±2.2		5.1 ±2.3		5.0 ±2.2	
Exercise												
yes	8.39 ±19.07	.374	3.6 ±2.6	.192	14 ±20.7	.556	10 ±20.5	.982	3.0 ±1.2	.006	3.2 ±2.7	.037
No	10.88 ±22.47		4.7 ±3.0		9.92 ±21.48		10.08 ±21.6		4.8 ±3.1		4.7 ±3.0	

Discussion

Many studies showed that increase in the sitting time ultimately increases the chances of obesity and diabetes by 5% and 7 %⁸, whereas musculoskeletal disorders particularly low back pain was also found to be increased with extended sitting time ⁹. Most studies had also shown that musculoskeletal problems are also common in office workers especially in the low back, upper limb, shoulder, and neck ¹⁰. And the prevalence of musculoskeletal disorders ranged 40- 80% in office workers ¹¹.

Similar results were observed in our study. The most affected region identified was low back, upper back, knee pain, lower and upper extremity found associated with characteristics of working place. Participants reported pain in these regions.

Findings of the Sherise Epstein conducted a study on the incidence of work-related musculoskeletal disorders among Interventionists and surgeons. Results showed that 17% of the population suffered from cervical spine disorders, 18% tend to have rotator cuff problems, 19% is suffering from lumbar spine diseases and 9% population is suffering from carpal tunnel syndrome ¹². Another study conducted by Meisha DE et al who studied the prevalence of work-related musculoskeletal disorders among dentists and found 70% of the population were affected by WMSDs.

The most region affected was lower back (85%), 84.6% of them reported neck was the commonest affected region. Female population was found to be more affected as compared to males because of the lack of physical activity or exercise. Carpal Tunnel Syndrome was also identified in 9% of the population working in private sectors and its chances increases with age. Whereas the least reported work-related musculoskeletal disorders were found in orthodontists maxillofacial surgeons ¹³. However, in our study few of the participants also complained about the neck pain. However, the other regions such as shoulder, wrist/ forearm, upper back, knee, and ankle were found to be minimally affected. Another study by Liping Li showed that prevalence of work-related musculoskeletal disorders was found to be common among teachers. The regions mostly affected are shoulder, low back, elbow, wrist/ hand ¹⁴.

A study by Ashiyat K.Akodu showed that lower back pain was found to be the most prevalent work-related musculoskeletal disorder among the respondents ¹⁵.

A study was conducted in Saudi Arabia to find the patterns of MSD patterns and its associated factor of risk among the higher education academicians MSDs found lower among the occupations of higher academic. However, neck, knee pain and back

found common and also highlighted that it was significant association with these regions of body ¹⁶.

Another study was conducted on the faculty members of Majmaah University, to find the prevalence of WMSDs. Most of participated were found affected with WMSDs, the neck was found mostly affected of WMSD. There was lack of training of ergonomic and using computer associated with WMSDs in most of body regions ¹⁷. Whereas in our study the findings revealed that majority of the participants have musculoskeletal pain/discomfort whereas only few numbers of participants are suffering from this condition. The most affected region identified was low back and participants reported pain in this region.

Conclusion

It has been concluded from the study that majority of participants have musculoskeletal pain/discomfort. The most affected region identified was low back and participants reported pain in this region. Few of the participants also complained about neck pain. However, the other regions such as shoulder, wrist/ forearm, upper back, knee, and ankle were found to be minimally affected. Association was found in personal and working place characteristics in different region of pain.

References

1. Sin Ho Chung, Jin Gang Her, Taesung

Ko, Jooyeon Ko, Heesoo Kim, Ju Sang Lee,et.al, phys. Work-related Musculoskeletal Disorders among Korean Physical Therapists. Ther. Sci.2013. 25: 55–59,

2. Evans RE, Fawole HO, Sheriff SA, Dall PM, Grant PM, Ryan CG.et.al Point-of-choice prompts to reduce sitting time at work: a randomized trial. Am J Prev Med. 2012; 43:293–7. doi: 10.1016/j.amepre.2012.05.010.

3. Thorp AA, Healy GN, Winkler E, Clark BK, Gardiner PA, Owen N et.al, Prolonged sedentary time and physical activity in workplace and non-work contexts: a cross-sectional study of office, customer service and call centre employees. Int J Behav Nutr Phy. 2012; 9:128. doi: 10.1186/1479-5868-9-128.

4. Cart L. Letter to the editor: standardized use of the terms “sedentary” and “sedentary behaviours” Appl Physiol Nutr Metab. 2012; 37:540. doi: 10.1139/h 2012-024.

5. Kazemi SS, Javanmardi E, Ghazanfari E. Relationship between general health and musculoskeletal disorders among tarbiat modares university students. Int J Musculosk Pain Prev. 2017;2(3):287-91.

6. Thorp AA, Owen N, Neuhaus M, Dunstan DW. Sedentary behaviors and subsequent health outcomes in adults: a systematic review of longitudinal studies, Am J Prev Med. 1996–2011. 2011; 41:207–15. doi: 10.1016/j.amepre.2011.05.004.

7. Tremblay MS, Colley RC, Saunders TJ, Healy GN, Owen N. Physiological and health implications of a sedentary lifestyle. *Appl Physiol Nutr Metab*. 2010; 35:725–40. doi: 10.1139/H10-079.
8. Paixão MS, Tassiano RM, Siqueira GR. Prevalence of musculoskeletal discomfort and associated factors in college students. *Rev Bras Promoção Saúde*. 2013;26(2):242-50.
9. Gianoudis J, Bailey C, Daly R. Associations between sedentary behavior and body composition, muscle function and sarcopenia in community-dwelling older adults. *Osteoporosis Int*. 2015; 26:571–9. doi: 10.1007/s00198-014-2895-y.
10. Lorusso A, Bruno S, L'Abbate N. Musculoskeletal disorders among university student computer users. *Med Lav*. 2009; 100:29–34
11. Almhdawi KA, Mathiowetz V, Al-Hourani Z, Khader Y, Kanaan SF, Alhasan M. Musculoskeletal pain symptoms among allied health professions' students: prevalence rates and associated factors. *J Back Musculoskelet Rehabil*. 2017;30(6):1291-1301.
12. Sherise Epstein; Emily H. Sparer, ScD; Bao N. Tran, MD; Qing Z. Ruan, MD; Jack T. et al. Prevalence of Work-Related Musculoskeletal Disorders Among Surgeons and Interventionists A Systematic Review and Meta-analysis. *JAMA Surgery* February 2018 Volume 153, Number 2: 1-11.
13. Meisha DE1, Alsharqawi NS2, Samarah AA3, Al-Ghamdi MY . Prevalence of work-related musculoskeletal disorders and ergonomic practice among dentists in Jeddah, Saudi Arabia. *Clin Cosmet Investig Dent*. 2019 Jul 5;11:171-179.
14. Li L, Yue P, Liu F. Work-related musculoskeletal disorders among schoolteachers in China, prevalence, and occupational factors. *Injury Prevention* 2012; 18: A162.
15. Ashiyat K.Akodu .Zainab O.Ashalejo. Work-related musculoskeletal disorders and work ability among hospital nurses. *Journal of Taibah University Medical Sciences*. Volume 14, Issue 3, June 2019, Pages 252-261A.
16. Algarni FS, Kachanathu SJ, Al-Abdulwahab SS. A Cross-Sectional Study on the Association of Patterns and Physical Risk Factors with Musculoskeletal Disorders among Academics in Saudi Arabia. *BioMed Research International*. 2020 Aug 15;2020.
17. Sirajudeen MS, Alaidarous M, Waly M, Alqahtani M. Work-related musculoskeletal disorders among faculty members of college of Applied Medical Sciences, Majmaah University, Saudi Arabia: A cross-sectional study. *International journal of health sciences*. 2018;12(4):18-25.

Original Article :

Antagonistic Activity and Probiotic Potential of *Lactobacillus* sp. isolated from fermented dairy products from Majmaah

Johra khan

Department of Medical Laboratory Sciences, College of Applied Medical Sciences,

Majmaah University, PO Box 7921, Majmaah 11952, Saudi Arabia

Received on 23- 3-2020 accepted for publication on 15-9- 2020 dx.doi.org/10.5455/mjhs.2021.02.010

Corresponding Author:

Johra khan Department of Medical Laboratory Sciences, College of Applied Medical Sciences,

Majmaah University, PO Box 7921, Majmaah 11952, Saudi Arabia. j.khan@mu.edu.sa

E-mail: j.khan@mu.edu.sa, Phone: +966538077360

Abstract

Background And Aims:

In much scientific research, it has been found that antagonistic activity is one of the important properties of a probiotic bacterium to attach in the intestine to reduce attachment of pathogenic bacteria in the intestine. *Lactobacillus* sp., isolated from fermented dairy products, shows a positive impact on human health.

This study was designed to study *Lactobacillus* sp. isolated from fermented dairy products for their antagonistic activity and probiotic potential.

Methods:

In this study, we used the *Lactobacilli* strain isolated from yogurt samples by a dilution plating method and were screened for their antagonistic activities and potential probiotics. The isolates were tested for their growth in the presence of 0.3% bile salt and pH 2.0 and 3.0.

Result:

Out of the 52 strains, 30 strains (60%) had survival rates above 90% after 2 h of incubation at pH values of 2.0 or 3.0. Further screening was performed for their growth at 0.3% bile salt. From 30 strains, only ten strains showed tolerance to 0.3% bile salt. Two *Lactobacilli* strains exhibited antagonistic activity. Moreover, all eight strains were found suitable for the potential probiotic activity, included *Lactobacillus casei* MU01, MU02, *Lactobacillus reuteri* MU 113, *Bifidobacterium lactis* MU85, *Lactobacillus salivarius* MU18, MU31, *Lactobacillus plantarum* MU211 3032, and *Lactobacillus buchneri* MU37.

Conclusion:

This study suggests that eight strains showed good antagonistic activity and probiotic potential, which can be used as supplements for good human health.

المخلص

خلفية والاهداف:

في الكثير من الأبحاث العلمية، وجد أن النشاط العدائي «المضاد» هو أحد الخصائص المهمة لبكتيريا البروبيوتيك «المعززات الحيوية»؛ حيث أن التصاقها في الأمعاء يقلل من تعلق البكتيريا المسببة للأمراض في الأمعاء. حيث أظهرت بكتيريا اللاكتوباسيلس المعزولة من منتجات الألبان المخمرة؛ تأثير إيجابي على صحة الإنسان.

تم تصميم هذه الدراسة لدراسة بكتيريا اللاكتوباسيلس المعزولة من منتجات الألبان المخمرة؛ لنشاطها العدائي المضاد وإمكانية البروبيوتيك.

طريقة البحث:

في هذه الدراسة تم استخدام سلالة اللاكتوباسيلس المعزولة من عينات الزبادي بطريقة التصفية المخفف وتم فحصها بحثاً عن أنشطتها العدائية والبروبيوتيك المحتملة. ومن ثم اختبار نمو البكتيريا المعزولة في وجود 0.3% ملح الصفراء ودرجة الحموضة 2.0 و 3.0.

النتيجة:

من أصل 52 سلالة، كان لدى ثلاثين سلالة أي (60%) معدلات بقاء فوق 90% بعد ساعتين من الحضارة عند قيم الأس الهيدروجيني 2.0 أو 3.0 للمحوضة. ثم تم إجراء المزيد من الفحوصات لاختبار نموها عند 0.3% من ملح الصفراء. من بين الثلاثين سلالة أظهرت عشرة سلالات فقط قدرة تحمل الملح الصفراوي بنسبة 0.3%. و أظهرت سلالتين من اللاكتوباسيلس نشاط عدائي مضاد. علاوة على ذلك، تم العثور على ثمانية سلالات مناسبة لنشاط بروبيوتيك محتمل، بما في ذلك:

Lactobacillus casei MU01, MU02, *Lactobacillus reuteri* MU 113, *Bifidobacterium lactis* MU85, *Lac-*

Key Words:

Lactobacilli, Probiotic Potential, Antagonistic activity, Lactobacillus buchneri, acid-tolerant

tobacillus salivarius MU18, MU31, Lactobacillus plantarum MU211 3032 and Lactobacillus buchneri MU37

الخلاصة:

تشير هذه الدراسة إلى أن ثمانية سلالات أظهرت نشاطًا عدائيًا جيدًا وإمكانية البروبيوتيك، والتي يمكن استخدامها كمكملات جيدة لصحة الإنسان.

Introduction

Lactobacilli (the species of the genus *Lactobacillus*) are the major residents of the vertebrate intestine, including humans. They were found in the fermentation of various food products made from dairy and plants. Microorganisms that are safe and beneficial for health are characterized as probiotics¹. Other than *Lactobacillus*, probiotic strains that are considered beneficial include *Pediococcus*, *Bifidobacterium*, and *Enterococcus*². Probiotics are defined as living microorganisms that have beneficial effects on the host and can adjust the host micro-ecological balance, improve intestinal function, and stimulate digestion and immune function. *Lactobacillus* was the earliest discovered probiotic of the three types of probiotics, which also include *Bifidobacterium* and Gram-positive cocci³. Use of probiotics dates back from the time human civilization eating fermented food, milk, and other products from plants and animals, but their use for health benefits is more in use from the last century, due to growing awareness about the health ben-

efits of probiotic bacteria⁴. These bacteria not only help to maintain the gut ecosystem balanced but also help in controlling many disease conditions like inflammatory bowel disease and inflammatory bowel syndrome¹.

The antagonistic property of probiotic bacteria is an important attribute property to be evaluated as it helps in the identification of bacterial species that can adhere to the intestine walls, reduce adhesion of pathogenic bacteria. Previous research shows the number of Lactobacilli, which originate from dairy fermented products, show the antagonistic property, but not all of them are able to grow at high acidic conditions, similar to the one found in the human stomach and at low pH like 2.0⁵. To consider any probiotic bacteria for human consumption, it must be able to withstand different pH and acidic conditions found in the human gut; also, it can attach to intestine walls and reduce the attachment of other food or waterborne pathogens⁶.

Thus, the study was designed to identify the best potential probiotic *Lactobacillus*

isolates from fermented dairy products. The in vitro probiotic properties like bile tolerance, acid tolerance, antagonistic activity, and auto and co-aggregation property of the selected strains were studied

Material and Method

Sampling

Fifty-two different fermented dairy products were collected from different local markets. Isolation was done on MRS (Man-Rogosa-Sharp) agar as per Ananthanarayan, R⁷ method and incubated at 37°C for 24 to 48 hours to apply the phenotypic and genotypic identification⁸.

Acid tolerance

Acid tolerance was studied as per the method by Chung et al.⁸. All isolates were taken in a concentration of 10 µL, incubated overnight in MRS broth into 1 mL of pH 2.0, 3.0, and 6.4 (control) MRS broths.

Culture Characters:

The streak plate method was performed to record the culture characters, and morphology was carried out according to Banson, H.J⁹. The colonies grown on MRS agar plates were carefully studied concerning size, color, opacity, form rise, and margin.

Test for Bile Toleration (pH-6.1)

For a potential probiotic bacterium, tolerance to bile concentration is an essential probiotic property. Only a few bacterial strains can resist strong bile acid, which is

one of the challenges encountered by probiotics¹⁰.

Medium:

LS broth with 0.4%- 1% bile salt (Sodium taurocholate)

Procedure:

Sodium taurocholate mixed with LS broth in different proportions of 0.4%, 0.6%, 0.8%, and 1% dispensed in test tubes. Using the loop inoculation process, the tubes were inoculated and incubated at 37 °C for 24 hours, along with a control. The result was recorded after 24 hours using the spectrophotometry method at 600 nm.

Antagonistic Activities:

To study antagonistic activity, the lactobacillus strains showing good activity for bile were grown in MRS broth at 37 °C for 24 hours, and cell-free supernatants were collected. Strains of *E. coli*, *Salmonella Enteritidis*, and *Salmonella Typhimurium* isolated from food were incubated in nutrient broth for 24 hours and then diluted to 0.06 at 600 nm equivalent to McFarland standard 0.5, and to microtiter plates. An equal amount of CFS of LAB cultures was added and incubated at 37 °C for 24 hours. The growth of pathogenic bacteria was determined using a spectrophotometer at 600 nm¹¹.

Autoaggregation and Coaggregation:

Activities of Auto and co-aggregation were measured using the method of Jena et al.

(2013)¹¹. For auto-aggregative ability assays, LAB strains cultured overnight, harvested, washed, and re-suspended in PBS. OD (optical density) of each strain was recorded at 600 nm. The selected strains were incubated at 37 °C without agitation, and OD readings were recorded at different time intervals (3 and 24 hours).

The formula for calculating the percentage of aggregation:

$$A\% = 100 \times \left(1 - \frac{A1}{A0}\right)$$

$$A\% = 100 \times (1 - A_t/A_0)$$

where A0 refers to the OD 600 values at 0 hours and At refers to OD 600 values at the indicated time points

Coaggregation assay was done by taking equal volumes of the LAB strains with pathogenic bacteria isolated from food, mixed, and OD reading was taken at 600 nm. The mixed bacterial suspensions were incubated at 37 °C, and OD values were measured at 3 and 24 hours (12).

Statistical analysis

Statistical analyses were performed using SPSS 14.0 software (SPSS Inc.; Chicago, IL, USA). Significant differences among

treatments were tested by ANOVA developed by Ronald Fisher in 1923 with a level of significance at $\alpha = 0.05$. Data were expressed as Mean Values \pm Standard Deviation (SD). All experiments were performed in duplicate and repeated three times.

Result

Morphological and colony characteristics

Morphological and colony characteristics of the isolated bacterial culture from fermented milk products samples were carried out. Five types of different bacterial colonies with distinct morphological characters were isolated.

Identification by molecular biology method

Out of 52 strains, 38 were Gram-positive, rod-shaped, and catalase-negative using the conventional method of identification, whereas, by using molecular biology technique, isolated strains were found to be *Lactobacillus casei*, *Lactobacillus salivarius*, *Lactobacillus plantarum*, and *Lactobacillus buchneri*, *Bifidobacterium lactis*, *Lactobacillus salivarius* and *Lactobacillus reuteri*.

Table 1: Strains showing the highest viability (log CFU/mL) at different pH, survival percentage, and Agitation at 600 nm of strains with a high survival rate.

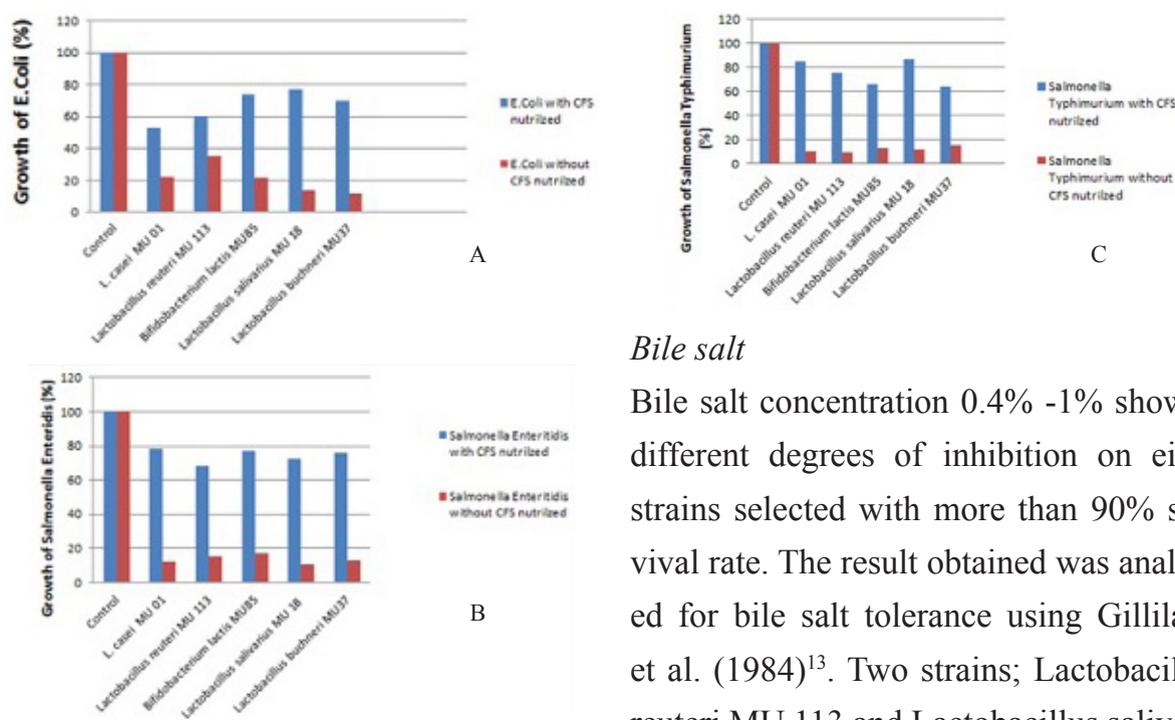
Isolates	Absorption at 600 nm (without agitation)	Absorption at 600 nm (with agitation)	pH 6.2* Viable count (log CFU/mL)	pH 3.0 Viable count (log CFU/mL)	Percentage survival (%)	pH 2.0 Viable count (log CFU/mL)	Percentage survival (%)
L. casei MU 01	0.055	0.032	6.17+0.01	5.33+0.04	90	5.70+0.02	95
L. casei MU 02	0.058	0.044	7.98+0.08	6.51+0.10	85	6.14+0.07	90

Isolates	Absorption at 600 nm (without agitation)	Absorption at 600 nm (with agitation)	pH 6.2* Viable count (log CFU/mL)	pH 3.0 Viable count (log CFU/mL)	Percentage survival (%)	pH 2.0 Viable count (log CFU/mL)	Percentage survival (%)
Lactobacillus reuteri MU 113	0.088	0.078	9.08+0.01	7.80+0.01	97	7.89+0.26	95
Bifidobacterium lactis MU85	0.097	0.076	8.97+0.01	8.07+0.02	92	8.99+0.21	95
Lactobacillus salivarius MU 18	0.059	0.023	9.07+0.31	8.77+0.21	96	8.47+0.09	92
Lactobacillus salivarius MU 31	0.087	0.061	7.46+0.04	6.26+0.14	84	5.96+0.21	78
Lactobacillus plantarum MU 211	0.066	0.041	8.90+0.29	7.70+0.20	86	7.20+0.11	80
Lactobacillus buchneri MU37	0.037	0.024	7.26+0.02	6.96+0.12	94	5.96+0.07	81

Antagonistic Effect of Strains on Food-borne pathogens in the presence of CFS
Antagonistic activity of strains having survival rate higher than 90 % was measured in the presence of CFS with neutralization

using 1M HCl in Figure 1A E. coli, 1B for Salmonella Enteritidis, and 1C for Salmonella Typhimurium with and without neutralization was studied.

Figure 1: Inhibition of foodborne pathogens in the presence of CFS with and without neutralization using different LAB strains isolated from fermented milk products. A) E.coli B) Salmonella Enteritidis , and C) Salmonella Typhimurium.

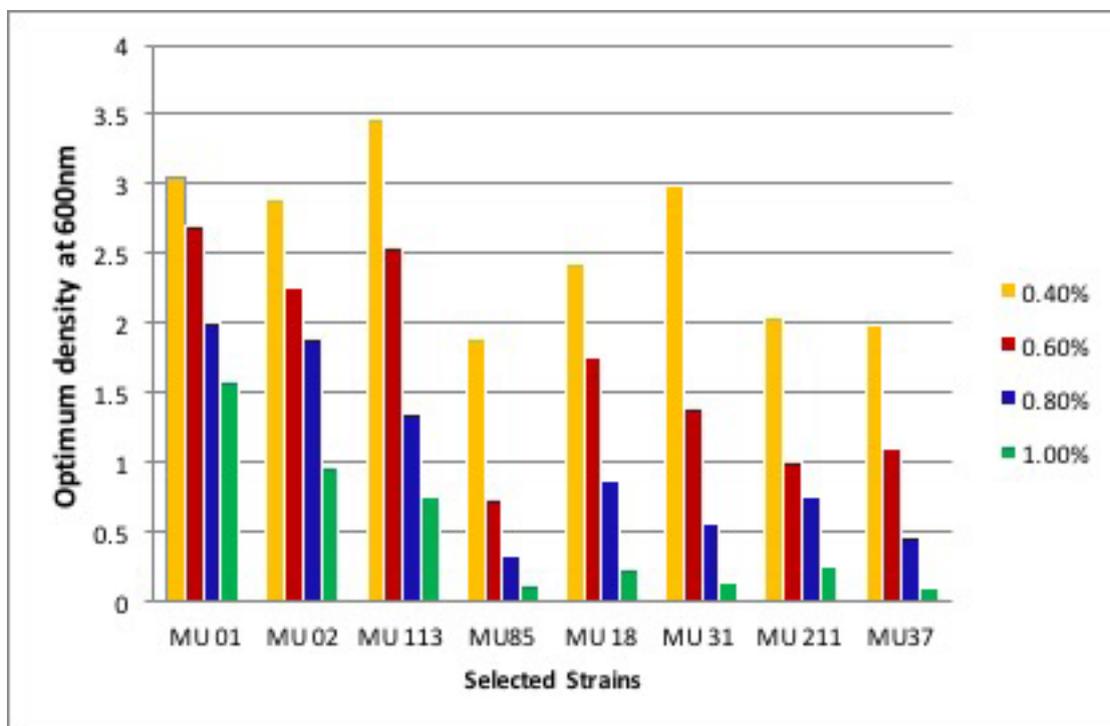


Bile salt

Bile salt concentration 0.4% -1% showed different degrees of inhibition on eight strains selected with more than 90% survival rate. The result obtained was analyzed for bile salt tolerance using Gilliland et al. (1984)¹³. Two strains; Lactobacillus reuteri MU 113 and Lactobacillus salivari-

us MU 31, were considered to be resistant ($d \leq 15$ min): Out of 8 strains, four strains were found to be tolerant strains (MU01, MU02, MU113, MU31; $15 < d \leq 40$ min); other four strains (MU18, MU85, MU37 and MU211; $40 < d < 60$) were found to be weakly tolerant strains as shown in Figure 2.

Figure 2: Bile acid tolerance (0.4% to 1.0%) of different strains at an optimum density of 600 nm.



Autoaggregation and Coaggregation activity:

To measure co-aggregation activity, the strains showing the best activity in other parameters are selected. The co-aggrega-

tion property of these strains with food-borne pathogens was determined at 37 °C at a time interval of 3 and 24 hours (Table 2).

Figure 2: Bile acid tolerance (0.4% to 1.0%) of different strains at an optimum density of 600 nm.

Strains	Co-aggregation activity (%)					
	E. coli		Salmonella Enteritidis		Salmonella Typhimurium	
	3 hour	24 hour	3 hour	24 hour	3 hour	24 hour
MU 01	13.6±0.4	42.6± 0.2	11.7±0.8	53.4±0.7	16.3±0.3	40.5±0.2
MU 02	7.5±0.4	30.1±0.5	10.6±0.4	44.6±0.3	11.5±0.2	33.6±0.1
MU 113	15.7±0.6	60.4±0.8	12.3±0.2	56.9±0.6	13.1±0.3	48.9±0.3
MU 31	11.4 ±0.5	46.7±0.2	13.2±0.4	44.6±0.3	12.6±0.5	38.7±0.6

Discussion

The bacterial species isolated from fer-

mented milk products were subjected to general bacteriological isolation tech-

niques. Among the biochemical test, the important results showed by the isolates were catalase-negative, lactic acid production from glucose, and heavy growth on Tomato juice agar¹⁴. All the isolates showed pigmentation on Tomato juice agar, which ranges from orange to brown color. The growth of isolates on MRS agar plates at pH 6.5 confirmed the lactobacillus sp.¹⁵. For a probiotic bacterium to work efficiently, it must have the capacity to survive in the gastrointestinal tract.

In many studies, the acid resistance for Lactobacillus at pH 2.0 and 3.0 was studied with MRS broth. In a study on 52 strains of lactobacilli, a favorable resistance at pH 2.0 was observed among 72% of isolate¹⁶. In the present study, more than 60% of strains showed the survival rate of $\geq 90\%$ at pH 3.0, whereas 62.5% of the strains showed the survival rate of $\geq 90\%$ at pH 2 (Table 1). Antagonistic activity of different LAB strains isolated from plant and animal products showed CFS to be a complete inhibitor without neutralization against many foodborne pathogens^{17, 18}. In our study, it was found that the MU18 strain inhibited more than 60% growth of all three foodborne pathogens with CFS without neutralization.

In the human gut, NaCl is an inhibitory substance that can inhibit the growth of the microbe, so; the isolates were grown in a

medium with NaCl concentration ranging between 0.4-1% bile concentrations^{5, 19}. It was found that all 30 strains were able to survive at 0.5% bile salt, but only eight were found to be tolerant to all concentrations between 0.4-1.0 percent, whereas the rest were found to be weakly tolerant (figure 2). The highest optimum density was shown by MU113, whereas the least OD was recorded by MU 85.

The co-aggregation properties are another important factor in selecting a probiotic strain²⁰. Most LAB strains exhibited significant co-aggregation activity with foodborne pathogens after 24 hours of incubation. As per the results of the present study (Table 2), MU113 displayed the highest co-aggregation E.coli after 24 hours of incubation, which was similar in the study by Zhang et al.^{21, 22}.

Conclusion

In conclusion, out of 52 strains, 30 strains were selected as appropriate probiotic potential strains, out of which eight were found suitable for promoting hosts' intestinal health and to maintaining healthy natural micro-flora during antibiotic treatment. Also, there is a need for an in vivo study to verify the effectiveness of selected strains.

References

1. Kim M, Chun J. Bacterial community structure in kimchi, a Korean fermented

- vegetable food, as revealed by 16S rRNA gene analysis. *International journal of food microbiology*. 2005;103(1):91-6.
2. Tulumoglu S, Yuksekdag ZN, Beyatli Y, Simsek O, Cinar B, Yaşar E. Probiotic properties of lactobacilli species isolated from children's feces. *Anaerobe*. 2013;24:36-42.
 3. de Almeida Júnior WLG, da Silva Ferrari Í, de Souza JV, da Silva CDA, da Costa MM, Dias FS. Characterization and evaluation of lactic acid bacteria isolated from goat milk. *Food Control*. 2015;53:96-103.
 4. Ahn H, Kim J, Kim WJ. Isolation and characterization of bacteriocin-producing *Pediococcus acidilactici* HW01 from malt and its potential to control beer spoilage lactic acid bacteria. *Food Control*. 2017;80:59-66.
 5. Caggia C, De Angelis M, Pitino I, Pino A, Randazzo C. Probiotic features of *Lactobacillus* strains isolated from Ragusano and Pecorino Siciliano cheeses. *Food microbiology*. 2015;50:109-17.
 6. Choi A-R, Patra JK, Kim WJ, Kang S-S. Antagonistic activities and probiotic potential of lactic acid bacteria derived from a plant-based fermented food. *Frontiers in microbiology*. 2018;9:1963.
 7. Ananthanarayan R. Ananthanarayan and Paniker's textbook of microbiology: Orient Blackswan; 2006.
 8. Chung H, Kim Y, Chun S, Ji GE. Screening and selection of acid and bile resistant bifidobacteria. *International journal of food microbiology*. 1999;47(1-2):25-32.
 9. Benson H. Antimicrobial sensitivity testing: the Kirby-Bauer method. *Microbiological Applications: Laboratory Manual in General Microbiology*, 7th ed McGraw-Hill, Boston, Massachusetts. 1998:139-41.
 10. Ayeni FA, Sánchez B, Adeniyi BA, Clara G, Margolles A, Ruas-Madiedo P. Evaluation of the functional potential of *Weissella* and *Lactobacillus* isolates obtained from Nigerian traditional fermented foods and cow's intestine. *International Journal of Food Microbiology*. 2011;147(2):97-104.
 11. Jena PK, Trivedi D, Thakore K, Chaudhary H, Giri SS, Seshadri S. Isolation and characterization of probiotic properties of lactobacilli isolated from rat fecal microbiota. *Microbiology and immunology*. 2013;57(6):407-16.
 12. Coconnier M-H, Bernet M-F, Kernéis S, Chauvière G, Fourniat J, Servin AL. Inhibition of adhesion of enteroinvasive pathogens to human intestinal Caco-2 cells by *Lactobacillus acidophilus* strain LB decreases bacterial invasion. *FEMS Microbiology Letters*. 1993;110(3):299-305.
 13. Gilliland S, Staley T, Bush L. Importance of bile tolerance of *Lactobacillus ac-*

- idophilus used as a dietary adjunct. Journal of dairy science. 1984;67(12):3045-51.
14. Helander IM, von Wright A, Mattila-Sandholm T. Potential of lactic acid bacteria and novel antimicrobials against Gram-negative bacteria. Trends in Food Science & Technology. 1997;8(5):146-50.
15. Anas M, Zinedine BA, Rizk HA, Ed-dine HJ, Mebrouk K. Screening of autochthonous Lactobacillus species from Algerian raw goats' milk for the production of bacteriocin-like compounds against Staphylococcus aureus. African Journal of Biotechnology. 2012;11(20):4595-607.
16. Pancheniak EdFR, Soccol CR. Biochemical characterization and identification of probiotic Lactobacillus for swine. Boletim do Centro de Pesquisa de Processamento de Alimentos. 2005;23(2).
17. Maragkoudakis PA, Zoumpopoulou G, Miaris C, Kalantzopoulos G, Pot B, Tsakalidou E. Probiotic potential of Lactobacillus strains isolated from dairy products. International Dairy Journal. 2006;16(3):189-99.
18. Jamaly N, Benjouad A, Bouksaim M. Probiotic potential of Lactobacillus strains isolated from known popular traditional Moroccan dairy products. British Microbiology Research Journal. 2011;1(4):79.
19. Bujnakova D, Kmet V. Aggregation of animal lactobacilli with O157 enterohemorrhagic Escherichia coli. Journal of Veterinary Medicine, Series B. 2002;49(3):152-4.
20. Botes M, Loos B, van Reenen CA, Dicks LM. Adhesion of the probiotic strains Enterococcus mundtii ST4SA and Lactobacillus plantarum 423 to Caco-2 cells under conditions simulating the intestinal tract, and in the presence of antibiotics and anti-inflammatory medicaments. Archives of microbiology. 2008;190(5):573-84.
21. Zhang L. Evaluation of the Potential Probiotic Properties and Immune Regulation Function of Lactobacillus Strains Isolated from Traditional Fermented Yak Milk: PhD Thesis. Gansu Agricultural University; 2011.
22. Cho J, Lee D, Yang C, Jeon J, Kim J, Han H. Microbial population dynamics of kimchi, a fermented cabbage product. FEMS microbiology letters. 2006;257(2):262-7.

Original Article :

Wet cupping (Hijama) positively and significantly impacted multiple hematological parameters

Abdulraheem Alshareef¹, Ahmad Khalaf Alsaedi¹, Ahmad Abdulaziz Alnakhli¹,
Abdulrahman Amer Albeladi¹, Raed Saad AlHejili¹, Mohammed Siddig Younis¹

1. Department of Medical Laboratories Technology, College of Applied Medical Sciences,
Taibah University, P.O. Box 41477,

Received on 20- 8-2020 accepted for publication on 28-12- 2020 dx.doi.org/10.5455/mjhs.2021.02.011

Corresponding Author:

Abdulraheem Alshareef, MSc, PhD, MBA. Department of Medical Laboratories Technology,
College of Applied Medical Sciences, Taibah University, Madinah, P.O. Box 41477, Saudi Arabia;
E-mail: amshareef@taibahu.edu.sa .

Abstract

Background and Aim:

Wet cupping, known as Hijama, is considered one of the main types of traditional (alternative) medicine around the world. The practice of cupping helps in treating many health problems and many studies have shown its effectiveness. The study target is to figure out if the hematological parameters are affected by wet cupping or not, and to determine the risk of anemia caused by wet cupping.

Methods:

The data were collected from 17 participants who participate in the study. The cupping was performed at cupping centers in Madinah, and the samples were processed in the research laboratory at Taibah University. The analysis of hematological parameters was done by comparing the samples of each participant before wet cupping, one week and two weeks after it.

Results:

The results of the study show that the wet cupping causes an increase, that were statistically significant, in many hematological parameters such as white blood cells count and hemoglobin level after performing wet cupping.

Conclusion:

Several hematological parameters were influenced after performing wet cupping while others did not. Wet cupping is generally safe, as it does not cause anemia, and it is recommended to be performed appropriately due to its health benefits.

Key words:

Wet cupping, Hijama, alternative medicine, hematological parameters, anemia.

المخلص

الخلفية والأهداف:

تعتبر الحجامه الرطبه أحد أهم أنواع الطب التقليدي (البديل) حول العالم. تساعد ممارسة الحجامه في علاج العديد من المشاكل الصحية وقد أظهرت العديد من الدراسات فعاليتها. تستهدف الدراسة معرفة تأثير الحجامه الرطبه على مؤشرات الدم ، وقياس خطر فقر الدم الناجم عن الحجامه الرطبه.

طريقة البحث:

تم جمع البيانات من ١٧ مشاركاً شاركوا في الدراسة. تم إجراء الحجامه في مراكز الحجامه بالمدينه المنوره وتمت معالجتها وفحصها في معمل الأبحاث بجامعة طيبه. تم إجراء الدراسة بمقارنة مؤشرات الدم المفحوصه من عينات كل مشارك قبل الحجامه الرطبه ، بعد أسبوع وبعد أسبوعين من الحجامه.

النتائج:

أظهرت نتائج الدراسة أن الحجامه الرطبه لها تأثير بزيادة بعض مؤشرات الدم مثل كريات الدم البيضاء وخضاب الدم (الهيموجلوبين) بعد إجراء الحجامه الرطبه.

الخلاصة:

تأثرت بعض مؤشرات الدم بعد إجراء الحجامه الرطبه والبعض الآخر لم يتأثر. الحجامه الرطبه آمنه بشكل عام ولا تسبب فقر الدم ويوصى بإجرائها بالطريقة الصحيحه نظراً لفوائدها الصحيه.

الكلمات المفتاحية:

الحجامه الرطبه، الحجامه، الطب البديل، مؤشرات الدم، فقر الدم

1.Introduction

Cupping (Arabic term: Hijama), is known as the process of applying cups on different parts of the body to draw blood by making an incision (of wet cupping) or without incision (other types of cupping)¹. It is considered as one of the traditional (alternative) medicine types around the world². Cupping has an extended history along different centuries in different cultures, from East to West. Cupping in ancient times is different from the current time in the ways of its application and the instruments used. The practice of cupping was shown to help in treating many health problems and some studies have shown their effectiveness³. Methodologies of traditional cupping have been passed along the centuries by its practitioners⁴. Dry, wet, and massage are the three known cupping types⁵. In Saudi Arabia, wet cupping is the most common type that has been used until now. The Middle East, including Saudi Arabia, uses different wet cupping techniques from the one that is used in China, Korea and Germany⁶. Middle East technique usually utilize three order of steps which are cupping, puncturing, and then cupping again after making incision by a sharp surgical blade. On the other hand, Germany, China, and Korea use two steps procedure by using an auto-lancet for the puncturing. The two

steps are puncturing and cupping^{7,8}.

Cupping cups can be placed on many places in the human body including the back, neck, area of sacral, thigh and shoulders to relieve symptoms of many health problems such as arthritis and diabetes⁹. Based on the National Institute of Health (NIH) in the United States, cupping shows its effects in various symptoms such as chemotherapy, nausea and vomiting³. Cupping is mainly suggested as a complementary therapy in some conditions such as knee pain, sports injuries and performance, muscle pain and soreness, back pain, neck and shoulder pain, headache or migraine¹⁰. Cupping usually is safe when a professional person performs it on healthy people². However, cupping is not recommended for people with some health problems due to its side effect. Also, cupping might cause pain and bruise. According to the National Center for Complementary and Integrative Health (NCCIH) in the United States, many side effects may result from cupping including hematoma (blood accumulated outside the blood vessels), persistent skin discoloration that leads to irregular patches areas where there are changes in skin color, scars (fibrous tissue that replaces normal skin after an injury), burns, bleeding which may occur with people who lacks the essential clotting factors such as factor VIII, or psoriasis (an autoimmune

disease characterized by patches of abnormal skin these skin patches are typically red), or purple on some people with darker skin, dry, itchy, and scaly¹¹. Several contraindications prevent people from doing wet cupping which includes pregnancy, swelling, dry or cracked skin, hypotension, open wounds, and high fever. Even though some people believe that wet cupping can cause anemia, cupping is safe for anemic patients and does not cause anemia according to some studies¹².

Wet cupping has been used as a treatment for many years. In 2008, one study showed a relationship between cupping and Iron deficiency¹⁰. This study contradicts newer studies that show no effect of wet cupping on hemoglobin levels^{12, 13}. Thus, there are limited studies available regarding cupping's effect on hematological parameters. Here, we asked whether the wet cupping has a significant influence on the hematological parameters or not. Our investigation will be comparing the samples of each participant before wet cupping, one-week after wet cupping and two weeks after wet cupping.

2. Materials and Methods

2.1 Study design and sampling method:

The design of this study is an experimental cohort prospective study. It is the most suitable design of the study since it re-

quires a follow up with the participant to investigate the effect of wet cupping on the blood parameters. Also, to answer the question regarding the differences of the hematological parameters among people who do cupping.

2.2 Location of the study:

The cupping was performed at cupping centers in Madinah, Saudi Arabia. The cupping centers mainly provide wet cupping therapy for individuals who ask for it for different reasons.

2.3 Procedure of the study:

The data was collected from 17 volunteers who participated in the study. The blood sample was collected in Ethylene Diamine Tetra Acetate (EDTA) tube (the sample volume is about 3ml). The sample was collected immediately from the participant before cupping, one week and two weeks after cupping to compare the hematological parameters of each participant before and after cupping. To minimize physiological variations, the collection time of venous blood was performed from 10:00 AM to 2:00 PM and after 30 minutes from eating a mild meal. The total blood cells that include Red Blood Cell (RBC), White Blood Cell (WBC) and Platelet (PLT) were measured by using the automated method, Beckman machine (Atlanta Georgia, United States), that measure the complete blood count (CBC). The other

measured parameters include hemoglobin (HB), hematocrit (HCT), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), red cell distribution width (RDW), platelet distribution width (PDW), mean platelet volume (MPV) and Plateletcrit (PCT).

2.4 Inclusion criteria:

The study focused on healthy male individuals in Madinah, who should be clear from any health concerns, and the age of volunteers ranged between 18-42.

2.5 Exclusion criteria:

We exclude all individuals who suffer from any health concerns such as hypertension or diabetes.

2.6 Ethical approval:

Ethical approval was obtained for the study from the research ethics committee of the College of Applied Medical Sciences at Taibah University via letter number SREC/AMS 2019/44/CLD dated: 18/11/2019. All participants who received wet cupping signed a form of consent indicating that their data would be used in this study and they have the right to withdraw anytime during the study and there is no personal information will be shared with others.

2.7 Cupping procedure:

The tools used in the cupping procedure including plastic cups, blades, and suction devices. The procedure of cupping usually

involves cleaning the target area with an alcohol swab and placing the cup over a specific area and start suctioning. The cup is then gently removed, and three to four fine superficial incisions were made [the size of incisions is about 0.3 cm to 0.7 cm in length and 0.2 mm in depth parallel to each other]. After creating the incisions, the cup is placed again over the same area, and the suctioning is repeated. This procedure is performed on all or most of the cupping targets at the same time. The amount of blood removed in cupping is about 50-60 ml of blood and a maximum of 100 ml.

2.8 Statistical analysis: The statistical tests such as mean, standard deviation, student's t-test (dependent t-test), and p value are performed using statistical package for social science (SPSS) program. Differences were considered significant when the $p < 0.05$.

3.Results

The age of our participants in this study was ranged from 18 to 42 years. All the participants were males. The mean values of the participants WBC, RBC, HB, HCT, MCV, MCH, MCHC, RDW, PLT, MPV, PCT, and PDW were all written in (Table 1). All the participants had 5 cups of wet cupping, in which two cups in the shoulders and three cups in the back.

Several comparisons were obtained from

the participant's results to demonstrate the variation between their blood results before wet cupping and one week after wet cupping, then before wet cupping and two weeks after wet cupping (detailed in the next sections).

Table 1. Baseline characteristics of participants before wet cupping.

Baseline characteristic	Results (\pm SD)	Range	Reference Range*
Mean age	24.17 (\pm 5.67)	18-42	18-60
Mean WBC count	6.34 (\pm 2.04)	3.4-10.6	4-11 X 10 ⁹ /L
Mean RBC count	4.91 (\pm 0.41)	3.94-5.76	4.5-6.5 X 10 ¹² /L
Mean HB level	12.82 (\pm 1.14)	10.7-14.8	13-18 g/dl
Mean HCT	40.94 (\pm 3.24)	32.3-47.4	40-52%
Mean MCV	83.71 (\pm 6.90)	64.8-93.5	80-100 fl
Mean MCH	26.25 (\pm 2.88)	19.1-30.1	26-32 pg
Mean MCHC	31.27 (\pm 1.34)	29.4-34.2	32-36 g/dl
Mean RDW	13.50 (\pm 1.63)	12.2-19	11.5-14.5%
Mean PLT	210.82 (\pm 59.39)	124-322	150-450 X 10 ⁹ /L
Mean MPV	8.82 (\pm 1.18)	6.8-11.5	9.4-12.3 fl
Mean PCT	0.19 (\pm 0.05)	0.11-0.20	\leq 0.15%
Mean PDW	16.21 (\pm 0.99)	13.1-17.5	10.0 - 17.9%

*Obtained from the World Health Organization (WHO).

3.1 Effect of wet cupping on White Blood Cells (WBCs) indices

3.1.1 Total White Blood Cells (WBCs) count:

We looked into the WBCs count. The mean before wet cupping was 6.34 (\pm 2) X 10⁹/L (Table 1). This number increased to 7.5 (\pm 1.8) X 10⁹/L after wet cupping by one week. Then, the mean decreased to 6.9 (\pm 1.6) X 10⁹/L after two weeks of wet cupping (Table 2). The result shows

that the WBCs count increased after one week of wet cupping but decreased after two weeks of wet cupping. Interestingly, a comparison of WBCs counts between before wet cupping and after one week of wet cupping showed a statistically significant difference ($p=$ 0.02). However, a comparison of WBCs counts between before wet cupping and after two weeks of wet cupping showed no statistical significance ($p=$ 0.33) (Table 2).

Table 2. Comparison between the WBCs counts before wet cupping, one week after wet cupping and two weeks after wet cupping.

Comparisons	Comparison between baseline and results one week after wet cupping	Comparison between baseline and results two weeks after wet cupping
Mean after wet cupping (\pm SD)	7.5 (\pm 1.8) X 10 ⁹ /L	6.9 (\pm 1.6) X 10 ⁹ /L
P value	0.02*	0.33

*Statistically significant at $<$ 0.05

3.2 Effect of wet cupping on Red Blood Cells (RBCs) indices:

3.2.1 Total Red Blood Cells (RBCs) count:

We moved to look at the RBCs count. The mean before wet cupping was $4.91 (\pm 0.41) \times 10^{12}/L$ (Table 1), then it decreased to $4.89 (\pm 0.5) \times 10^{12}/L$ after one week of wet cupping. Then it raised to $4.93 (\pm 0.5) \times 10^{12}/L$ after two weeks

of wet cupping (Table 3). The result shows that the RBC count decreased after performing wet cupping. However, the RBC count reversibly increased after two weeks of wet cupping. The comparison of RBCs counts between before and after wet cupping showed non-statistically significant results (Table 3).

Table 3. Comparison between the RBCs indices before wet cupping, one week after wet cupping and two weeks after wet cupping.

Comparisons	Comparison between baseline and results one week after wet cupping	Comparison between baseline and results two weeks after wet cupping
Total Red Blood Cell (RBC)		
Mean after wet cupping (\pm SD)	$4.89 (\pm 0.5) \times 10^{12}/L$	$4.93 (\pm 0.5) \times 10^{12}/L$
P value	0.84	0.87
Hemoglobin (Hb)		
Mean after wet cupping (\pm SD)	$13.74 (\pm 1) \text{ g/dl}$	$13.5 (\pm 0.94) \text{ g/dl}$
P value	0.003*	0.03*
Hematocrit (HCT)		
Mean after wet cupping (\pm SD)	$42.2 (\pm 3.17)\%$	$41.58 (\pm 2.14)\%$
P value	0.18	0.49
Mean Corpuscular volume (MCV)		
Mean after wet cupping (\pm SD)	$86.77 (\pm 6.41) \text{ fl}$	$85.29 (\pm 6.36) \text{ fl}$
P value	$< 0.001^*$	0.01^*
Mean corpuscular hemoglobin (MCH)		
Mean after wet cupping (\pm SD)	$28.31 (\pm 2.55) \text{ pg}$	$27.28 (\pm 2.61) \text{ pg}$
P value	$< 0.001^*$	$< 0.001^*$
Mean corpuscular hemoglobin concentration (MCHC)		
Mean after wet cupping (\pm SD)	$32.59 (\pm 1.18) \text{ g/dl}$	$33.17 (\pm 2.17) \text{ g/dl}$
P value	$< 0.001^*$	0.006^*
Red cell Distribution width (RDW)		
Mean after wet cupping (\pm SD)	$14.34 (\pm 1.75)\%$	$13.82 (\pm 1.98)\%$
P value	0.004^*	0.4

*Statistically significant at < 0.05

3.2.2 Hemoglobin (Hb):

We analyzed the Hb level, the mean before wet cupping was $12.82 (\pm 1.14) \text{ g/dl}$ (Table

1). In the first week after wet cupping, the Hb level showed an increase in the mean value $13.74 (\pm 1) \text{ g/dl}$. Later (i.e. after two

weeks), the Hb level showed a slight decrease of $13.5 (\pm 0.94)$ g/dl (Table 3). Interestingly, these results were statistically significant in both comparisons, ($p= 0.003$) in the first comparison between before wet cupping and one week after and ($p= 0.03$) same with the second comparison between before wet cupping and two weeks after (Table 3).

3.2.3 Hematocrit (HCT):

In the analysis of HCT, the mean before wet cupping was $40.94 (\pm 3.24)\%$ (Table 1), it increased in one week after wet cupping to $42.2 (\pm 3.17)\%$, then slightly decreased in two weeks after wet cupping $41.58 (\pm 2.14)\%$ (Table 3). We observed non-statistically significant results in both comparisons.

3.2.4 Mean corpuscular volume (MCV):

We looked at the MCV level. The mean before wet cupping was $83.71 (\pm 6.9)$ fl (Table 1), it increased in one week after wet cupping $86.77 (\pm 6.41)$ fl and decreased in two weeks after wet cupping $85.29 (\pm 6.36)$ fl (Table 3). This result shows that the MCV level increased after one week of wet cupping but decreased after two weeks of wet cupping. The results show significant differences between the groups in both comparisons; ($p< 0.001$) in the first comparison between before wet cupping and one week after and ($p= 0.01$) in the second comparison between before

wet cupping and two weeks after (Table 3).

3.2.5 Mean corpuscular hemoglobin (MCH):

We looked at the MCH level. The mean before wet cupping was $26.25 (\pm 2.88)$ pg (Table 1), it increased in one week after wet cupping $28.31 (\pm 2.55)$ pg, and decreased in two weeks after wet cupping $27.28 (\pm 2.61)$ pg (Table 3). These results show that the MCH level increased after one week of wet cupping but decreased after two weeks of wet cupping. The results show significant differences between the group in both comparisons; ($p< 0.001$) in the first comparison between before wet cupping and one week after and ($p< 0.001$) in the second comparison between before wet cupping and two weeks after (Table 3).

3.2.6 Mean corpuscular hemoglobin concentration (MCHC):

We analyzed the MCHC level, before wet cupping the mean was $31.27 (\pm 1.34)$ g/dl (Table 1), in the first week after wet cupping it showed an increase in the mean value $32.59 (\pm 1.18)$ g/dl, and then it also increased after two weeks of wet cupping $33.17 (\pm 2.17)$ g/dl. These results were statistically significant in both comparisons; ($p< 0.001$) in the first comparison between before wet cupping and one week after and ($p= 0.006$) in the second comparison between before wet cupping and two weeks after (Table 3).

3.2.7 Red cell distribution width (RDW): We investigated the RDW ratio. The mean before wet cupping was 13.5 (\pm 1.63)% (Table 1). This number increased to 14.34 (\pm 1.75)% after wet cupping by one week. Then, the mean decreased to 13.82 (\pm 1.98)% after two weeks of wet cupping. This result shows that the RDW ratio increased after one week of wet cupping and decreased after two weeks of wet cupping. Interestingly, the comparison of the RDW ratio between before wet cupping and after one week of wet cupping shows a statistically significant difference ($p=$ 0.004) (Table 3). However, a comparison of the RDW ratio between before and after two weeks of wet cupping shows non-statistical significance.

3.3 Effect of wet cupping on Platelets (PLTs) indices:

3.3.1 Platelets (PLT) count:

In the analysis of PLT, the mean before wet cupping was 210.8 (\pm 59.4) X 10⁹/L

(Table 1), it decreased after one week of wet cupping 208.1 (\pm 56.1) X 10⁹/L, and increased after two weeks of wet cupping 209.8 (\pm 51.06) X 10⁹/L (Table 4). We observed a non-statistically significant result in both comparisons.

3.3.2 Mean platelet volume (MPV):

We investigated the MPV level. The mean before wet cupping was 8.82 (\pm 1.18) fl (Table 1). This number increased to 9.94 (\pm 1.75) fl after one week of wet cupping. Then, the mean decreased to 8.74 (\pm 1.18) fl after two weeks of wet cupping (Table 4). The result shows that the MPV level increased after one week of wet cupping and decreased after two weeks of wet cupping. Comparison of MPV level between before wet cupping and after one week of wet cupping shows a statistically significant difference ($p=$ 0.03). However, a comparison of MPV level between before wet cupping and after two weeks of wet cupping shows a non-statistical significance ($p=$ 0.81).

Table 4. Comparison between the PLT indices before wet cupping, one week after wet cupping, and two weeks after wet cupping.

Comparisons	Comparison between baseline and results one week after wet cupping	Comparison between baseline and results two weeks after wet cupping
Platelets count (PLT)		
Mean after wet cupping (\pm SD)	208 (\pm 56.1) X 10 ⁹ /L	209.8 (\pm 51.06) X 10 ⁹ /L
P value	0.89	0.94
Mean Platelet Volume (MPV)		
Mean after wet cupping (\pm SD)	9.94 (\pm 1.75) fl	8.74 (\pm 1.18) fl
P value	0.03*	0.81

Comparisons	Comparison between baseline and results one week after wet cupping	Comparison between baseline and results two weeks after wet cupping
Plateletcrit (PCT)		
Mean after wet cupping (\pm SD)	0.20 (\pm 0.03)%	0.18 (\pm 0.04)%
P value	0.22	0.71
Platelet Distribution Width (PDW)		
Mean after wet cupping (\pm SD)	15.7 (\pm 1.5)%	16.14 (\pm 0.9)%
P value	0.09	0.8

*Statistically significant at < 0.05

3.3.3 Plateletcrit (PCT):

For PCT, the mean before wet cupping was 0.19 (\pm 0.05)% (Table 1), it increased after one week of wet cupping 0.20 (\pm 0.03)% and decreased after two weeks of wet cupping 0.18 (\pm 0.04)% (Table 4). In the analysis of PCT, we observed a non-statistically significant result in both comparisons.

3.3.4 Platelet distribution width (PDW):

We moved to look at the PDW ratio. The mean before wet cupping was 16.21 (\pm 0.99)% (Table 1), it decreased to 15.7 (\pm 1.5)% after one week of wet cupping. Then it raised to 16.14 (\pm 0.9)% after two weeks of wet cupping (Table 4). The comparison of PDW between before and after wet cupping showed non-statistically significant results.

4. Discussion:

In this study, we show that wet cupping has a significant impact on several hematological parameters such as WBCs, Hb, MCV, MCH, MCHC, RDW and MPV. Although other parameters were still affected by wet cupping, it was not statistically significant.

4.1 Effect of wet cupping on total WBCs count:

White Blood Cells (WBCs) play a crucial role in the immune system by protecting the body from infectious disease and foreign substances¹⁴. The results of our study show that wet cupping influences the total WBCs count after one week, where the increase was statistically significant. In contrast after two weeks, it was not statistically significant. Measuring WBCs count is considered as one way for assessing the stimulation of the immune system. It has been known that the immune system could be enhanced by wet cupping⁵. Our result confirms the previous statement in which we observed a significant increase in the WBCs count after one week from performing wet cupping. However, when we measure the WBCs count after two weeks from performing wet cupping, we did not observe this significant increase. This observation is consistent with another study that shows no significant difference between WBCs count before wet cupping and two

weeks after wet cupping¹. So, our study added additional evidence for the transient enhancement of the immune system upon wet cupping, and this observation triggers further investigation to understand the significance of this phenomenon. One of the main limitations of this study is that we did not compare the clinical conditions of participants, whether are they infected during the study duration. Besides, the variation of the results might be due to the cupping methodology that we and others applied.

4.2 Effect of wet cupping on RBCs indices:

4.2.1 Effect of wet cupping on RBCs count: Red Blood Cells (RBCs) are responsible for delivering oxygen to the cells and tissues in which oxygen is carried by the hemoglobin, which is a constituent part of RBCs¹⁵. Counting the RBCs is considered as one way of assessing anemia¹². The results of our study show that the wet cupping has no or minimal effect on the total RBCs count after one and two weeks of wet cupping. There were inconsistent results about the effect of wet cupping on RBCs count. Our results are consistent with the studies that show a minimal difference in the total RBCs count when it is measured before and after the wet cupping^{11, 16}. On the other hand, there is one study that shows a statistically significant decrease ($p=0.04$ in a cohort of 48 participants) of the total RBCs count when it is measured after two

weeks of the wet cupping¹. It is essential to mention that the decreased RBCs count reported in our study was not clinically significant (i.e. it did not cause anemia).

One of the main arguments against wet cupping is the possibility of wet cupping causing anemia. Our results showed that RBCs count is not significantly decreased after the wet cupping procedure. This is also observed in many other studies^{1, 12}. It is important to mention that these results are based on following standard wet cupping protocols that prohibit frequent wet cupping procedures and a high number of incisions^{6, 17-20}.

4.2.2 Effect of wet cupping on Hb level:

Hemoglobin (Hb) is an RBCs that contained a protein, that has a function in oxygen delivery²¹⁻²³. Measuring Hb level is considered as one way of assessing polycythemia (the increase in RBCs hematocrit or hemoglobin level when measuring in CBC as compared to reference range)²⁴. The results of our study show that wet cupping has a significant effect on Hb level after one and two weeks. There were inconsistent results on the impact of wet cupping on the Hb level. For instance, some studies show that there is a minimal difference in the Hb level when it is measured before and after the wet cupping^{12, 17}. Other studies, which are consistent with our results, showed that there was a sta-

tistically significant difference in the Hb level when it is measured before and after wet cupping^{1,5}. Again, we did not observe anemia upon wet cupping. Therefore, our study is confirming the safety of wet cupping as it will not cause anemia if it is performed properly.

4.2.3 Effect of wet cupping on HCT level:

The term Hematocrit (HCT) is known as the measuring of the volume of packed RBCs relative to whole blood. It is also known as packed cell volume (PCV). It is a simple test used to recognize a condition such as anemia and polycythemia. This test is also used for monitoring drug response¹⁸. The results of our study show that the wet cupping has no or minimal effect on the HCT level after one and two weeks of wet cupping. Our results are consistent with previous reports that show no significant difference in hematocrit level when it is measured before and after wet cupping^{16, 17}.

4.2.4 Effect of wet cupping on MCV:

Mean Corpuscular Volume (MCV) is a laboratory measurement that determines the average size and volume of RBCs. It is useful and helpful in determining the cause of anemia¹⁹. The results of our study show that the wet cupping has a noticeable effect on the MCV level after one and two weeks of wet cupping. There were inconsistent results on the impact of wet cupping on the

MCV level. These reports show that there is a minimal difference in the MCV level before and after the wet cupping^{1,12}. On the other hand, our result was consistent with one study that showed a significant difference in MCV level when measured before and after wet cupping²⁵.

4.2.5 Effect of wet cupping on MCH:

Mean Corpuscular Hemoglobin (MCH) is the average amount of hemoglobin per single RBC in a blood sample. It is a useful tool that helps in determining hypochromic anemia²⁰. The results of our study show that the wet cupping has a significant effect on MCH level after one and two weeks of wet cupping. There were inconsistent results about the effect of wet cupping on the MCH level show that there is a minimal difference^{1,12}. There is a study, which is consistent with our results, show that there is a significant difference in MCH level when it is measured before and after the wet cupping²⁵.

4.2.6 Effect of wet cupping on MCHC:

Mean Corpuscular Hemoglobin concentration (MCHC) is known as the measuring concentration of hemoglobin in a specific blood sample. It is a useful tool in determining iron deficiency²⁶. The results of our study show that the wet cupping has a significant effect on the MCHC level after one and two weeks of wet cupping. There were inconsistent results on the impact of

wet cupping on the MCHC level showed that there is a minimal difference¹. Some studies, which are consistent with our results show that there was a significant difference in the MCHC level when it is measured before and after wet cupping^{17,25}.

4.2.7 Effect of wet cupping on RDW:

Red Cell Distribution Width (RDW) is a simple and cheap parameter that shows the degree of heterogeneity of erythrocyte volume. It is useful in the differential diagnosis of anemia^{8, 27}. The results of our study show that the wet cupping influences RDW after one week, where the increase was statistically significant. However, RDW is not statistically significantly different after two weeks.

4.3 Effect of wet cupping on PLT indices:

4.3.1 Effect of wet cupping on PLT count:

Platelets (PLTs) also called thrombocytes are tiny cells that are important for normal blood clotting²¹. Measuring PLT count is considered an essential way in the assessment of bleeding disorder, or excessive clotting disorder²². The results of our study show that wet cupping has no or minimal effect on the total PLT count after one week and after two weeks of wet cupping. There was an inconsistent study about the impact of wet cupping on PLT count¹. There is a study, which is consistent with our result, show that there was minimal difference in the total PLT count when it measured be-

fore and after wet cupping¹⁶.

4.3.2 Effect of wet cupping on MPV:

Mean Platelet Volume (MPV) is a laboratory test associated with platelet function and activity; it is considered an important indicator for the thromboembolic disease²³. The results of our study show that the wet cupping influences the MPV after one week, where the increase was statistically significant. On the other hand, the MPV was not statistically significant after two weeks. Our result is aligned with the previous statement in which we observed a significant increase in the MPV after one week. However, when we measure MPV after two weeks from performing the wet cupping, we did not observe a significant increase.

4.3.3 Effect of wet cupping on PCT:

Plateletcrit (PCT) Is the measurement of total platelet mass²⁴. The results of our study showed that wet cupping has no or minimal effect on PCT after one and two weeks of wet cupping.

4.3.4 Effect of wet cupping on PDW:

Platelet distribution width (PDW) is the calculation of platelet anisocytosis that is measured from the distribution of person platelet volume²⁵. The results of our study show that wet cupping has no or minimal effect on PDW after one and two weeks of wet cupping.

5. Conclusion:

Wet cupping has a significant effect on hematological parameters, and it is also safe when it is performed by trained people in the right way. Based on our findings, we are suggesting studying the effect of wet cupping on hematological parameters in a larger cohort. Furthermore, it is worthwhile to study the significance of the transient elevation of WBCs count and its correlation with different WBC cells as well as other immunological biomarkers.

Acknowledgment

We would like to thank all participants. We would also like to thank participating Cupping Centers for their collaboration and for providing an extra discount to the participants in this study.

References:

1. Mahdavi MRV, Ghazanfari T, Aghajani M, Danyali F, Naseri M. Evaluation of the effects of traditional cupping on the biochemical, hematological and immunological factors of human venous blood. A compendium of essays on alternative therapy Croatia: In Tech. 2012;6.
2. Aleyeidi NA, Aseri KS, Matbouli SM, Sulaiamani AA, Kobeisy SA. Effects of wet-cupping on blood pressure in hypertensive patients: a randomized controlled trial. *Journal of integrative medicine*. 2015;13(6):391-9.

3. Ullah K, Younis A, Wali M. An investigation into the effect of cupping therapy as a treatment for anterior knee pain and its potential role in health promotion. *Internet J Altern Med*. 2007;4(1):1-9.

4. Qureshi NA, Ali GI, Abushanab TS, El-Olemy AT, Alqaed MS, El-Subai IS, et al. History of cupping (Hijama): a narrative review of literature. *J Integr Med*. 2017;15(3):172-81.

5. Al-Kazazz FF, Abdulsattar SA, Mohammed K. Study effect of wet cupping on hematological parameters and inflammatory proteins of healthy Iraqi men. *Am J Phytomed Clin Ther*. 2014:1-6.

6. Khalil MK, Al-Eidi S, Al-Qaed M, Al-Sanad S. Cupping therapy in Saudi Arabia: from control to integration. *Integrative medicine research*. 2018;7(3):214-8.

7. Mehta P, Dhapte V. Cupping therapy: A prudent remedy for a plethora of medical ailments. *Journal of traditional and complementary medicine*. 2015;5(3):127-34.

8. Akhtar J, Siddiqui MK. Utility of cupping therapy Hijamat in Unani medicine. 2008.

9. Ahmedi M, Siddiqui MR. The value of wet cupping as a therapy in modern medicine-An Islamic Perspective. 2014.

10. Lee HJ, Park NH, Yun HJ, Kim S, Jo DY. Cupping therapy-induced iron deficiency anemia in a healthy man. *The Amer-*

- ican journal of medicine. 2008;121(8):e5-e6.
11. Al-Rubaye KQA. The clinical and histological skin changes after the cupping therapy (Al-Hijamah). *J Turk Acad Dermatol*. 2012;6(1):1261a1.
12. Mourad SA, Al-Jaouni SK. The effect of wet cupping on blood haemoglobin level. *Alternative & Integrative Medicine*. 2016:1-6.
13. AL-Shamma YM. Al-Hijamah cupping therapy. *Kufa Medical Journal*. 2009;12(1):49-56.
14. AL-Dulaimi K, Banks J, Chandran V, Tomeo-Reyes I, Nguyen Thanh K. Classification of white blood cell types from microscope images: Techniques and challenges. *Microscopy Science: Last Approaches on Educational Programs and Applied Research*. 8: Formatex Research Center; 2018.
15. Hegel GWF, Schopenhauer A, Kuhn TS. *Circulatory Impairment in Myalgic Encephalomyelitis: A Preliminary Thesis*. 2016.
16. Jahromi SK, Jelodar G, Mallahi AM. Effect of Wet cupping on Human Venous Blood factors in Golestan Province. *Bull Env Pharmacol Life Sci*. 2016;5:25-7.
17. Hekmatpou D, Moeini L, Haji-Nadali S. The effectiveness of wet cupping vs. venesection on arterial O₂ saturation level of cigarette smokers: A randomized controlled clinical trial. *Pakistan journal of medical sciences*. 2013;29(6):1349.
18. Zhang X, Tian R, Lam WC, Duan Y, Liu F, Zhao C, et al. Standards for reporting interventions in clinical trials of cupping (STRICTOC): extending the CONSORT statement. *Chinese Medicine*. 2020;15(1):10.
19. Cao H, Li X, Liu J. An Updated Review of the Efficacy of Cupping Therapy. *PLOS ONE*. 2012;7(2):e31793.
20. Al-Bedah AMN, Elsubai IS, Qureshi NA, Aboushanab TS, Ali GIM, El-Olemy AT, et al. The medical perspective of cupping therapy: Effects and mechanisms of action. *Journal of Traditional and Complementary Medicine*. 2019;9(2):90-7.
21. Chandrashekar V. Plateletcrit as a screening tool for detection of platelet quantitative disorders. *Journal of Hematology*. 2013;2(1):22-6.
22. Smith GS, Walter GL, Walker RM. *Clinical pathology in non-clinical toxicology testing*. Haschek and Rousseaux's *Handbook of Toxicologic Pathology*: Elsevier; 2013. p. 565-94.
23. Billett, Henny H. *Hemoglobin and hematocrit*. *Clinical Methods: The History, Physical, and Laboratory Examinations*. 3rd edition. 1990.

24. Ward AA, Foltz EL, Knopp LM. "Polycythemia" Associated with Cerebellar Hemangioblastoma. 1956;13(3):248.
25. Soleimani R, Saghebi SA, Taghipour A, Vakilzadeh AK, Afshari JT. Evaluation of Changes in Health and Complete Blood Count after Wet Cupping. Journal of Biochemical Technology. J Biochem Tech 2019;(2):162.
26. Kong W, Zheng J, Chen L, Zuo X, Wang H, Wang X, et al. Mean corpuscular hemoglobin concentration correlates with prognosis of resected hepatocellular carcinoma. Biomarkers in medicine. 2020;14(4):259-70.
27. Salvagno GL, Sanchis-Gomar F, Picanza A, Lippi G. Red blood cell distribution width: A simple parameter with multiple clinical applications. Critical reviews in clinical laboratory sciences. 2015;52(2):86-105.

Review Article :

Lumbar Segmental Instability Classification: Functional, Structural and Multiple Instability

Faisal M. Alyazedi

Department of Physical Therapy, Prince Sultan Military College of Health Sciences,
Dhahran, Kingdom of Saudi Arabia. E.mail: falyazedi@psmchs.edu.sa

Received on 7- 10 -2020 accepted for publication on 7-12- 2020 dx.doi.org/10.5455/mjhs.2021.02.012

Corresponding Author:

Faisal Mohammed Alyazedi

Department of Physical Therapy, Prince Sultan Military College of Health Sciences,
Dhahran, Kingdom of Saudi Arabia. E-mail: falyazedi@psmchs.edu.sa

Abstract

Low back pain (LBP) is a widespread condition. One of the common cause of LBP is lumbar segmental instability (LSI). The understanding of LSI can be improved by dividing cases into three subcategories: functional instability; if neuromuscular system is dysfunctional, structural instability; if osseoligamentous structure is disrupted, and multiple instability; if both subcategories are existed. Elucidating distinctions between sub-classifications might improve common understanding regarding LSI subcategories among physical therapists, radiologists and spinal physicians. The purpose of this review is to highlight the distinctions among the three LSI subcategories, which includes their definitions, scientific evidence, and clinical tests. This review will help to improve understanding of LSI and guide clinical diagnostic decisions. Additionally, this review might help in future research on LSI into three distinct and clinically meaningful sub-classifications.

Keywords:

Low back pain, Lumbar segmental instability, Classification, Functional instability, Structural instability, Multiple instability.

المخلص

آلام أسفل الظهر (LBP) هي حالة منتشرة. أحد الأسباب الشائعة لـ LBP هو عدم استقرار أو ثبات الفقرات القطنية (LSI). يمكن تحسين فهم LSI عن طريق تقسيم الحالات المرضية إلى ثلاث فئات فرعية: عدم استقرار الفقرات وظيفياً؛ إذا قلّة كفاءة النظام (العصبي-العضلي). عدم استقرار الفقرات بنائياً؛ إذا قلّة كفاءة النظام (الهيكلية-الرباطية). عدم الاستقرار المضاعف؛ إذا تأثر كلا النظامين في آن واحد. قد يؤدي إيضاح الفروق بين التصنيفات الفرعية إلى تحسين الفهم المشترك فيما يتعلق بفئات LSI الفرعية بين أخصائيي العلاج الطبيعي وأطباء الأشعة وأطباء العمود الفقري. الغرض من هذه المراجعة هو تسليط الضوء على الفوارق بين فئات LSI الفرعية الثلاثة، والتي تشمل تعريفاتها، والأدلة العلمية، والاختبارات السريرية. تساعد هذه المراجعة في تحسين فهم LSI وتوجيه قرارات التشخيص السريري. علاوة على ذلك، قد تساعد هذه المراجعة في توجيه الأبحاث المستقبلية حول LSI إلى ثلاثة تصنيفات فرعية مميزة وذات مغزى سريري.

الكلمات المفتاحية :

آلام أسفل الظهر، عدم استقرار الفقرات القطنية، التصنيف، عدم الاستقرار الوظيفي، عدم الاستقرار الهيكلية الرباطية، عدم الاستقرار المضاعف.

INTRODUCTION:

Lumbar segmental instability (LSI) is believed to be a main cause of the high recurrence rates of low back pain (LBP)¹. However, concept of LSI is different among different specialties². For example, spinal surgeons view LSI as segmental movement that exceeds normal segmental range of motion (ROM), especially at end-ROM². In contrast, physiotherapists view LSI as neuromuscular control error across motion segments, especially at mid-ROM³. Both types lead to excessive tissue elongation/compression and thus irritation/injury of the soft tissues of motion segment⁴. Despite unique features, both can exist separately or jointly (multiple instability).

The main aim of this review is to highlight distinctions among LSI sub-classifications: Functional, structural, and multiple instability. Elucidating distinctions between sub-classifications might improve common understanding regarding LSI subcategories among physical therapists, radiologists and spinal physicians⁵. Additionally, this review might help in future research on LSI into three distinct and clinically meaningful sub-classifications.

Lumbar segmental instability:

In normal tasks of daily living, e.g. bending forward, each spinal segment slide forward and rotate². Therefore, if one seg-

ment suddenly moves beyond its normal range, spinal structures may sustain overstretch/compression injuries/irritation^{3,4}. Instability is defined as loss of segmental stiffness or abnormal response to applied loads characterized by movement of motion segments beyond normal constraints⁶. Panjabi proposed a biomechanical model of spinal stabilization system involving three anatomical subsystems: passive, active and neural control subsystems⁴ (Figure-1).

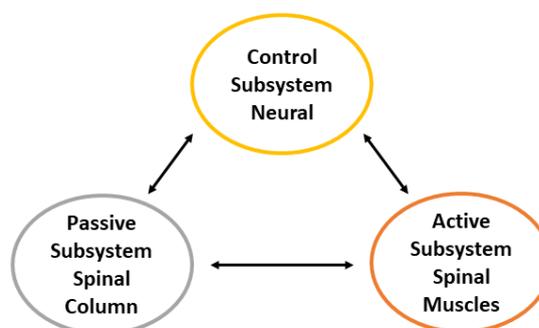


Figure 1. the spinal stability system consists of three subsystems: passive spinal column, active spinal muscles and neural control unit

However, the main function of the neuromuscular control subsystem is to orchestrate adequate and timely orders to ensure appropriate muscular recruitment⁷. This leads LSI classification into: 1) functional instability, if active(neuromuscular) system is dysfunctional; 2) structural instability, if passive (osseoligamentous) system is disrupted; and 3) multiple instability, if both systems are affected (Figure-2).

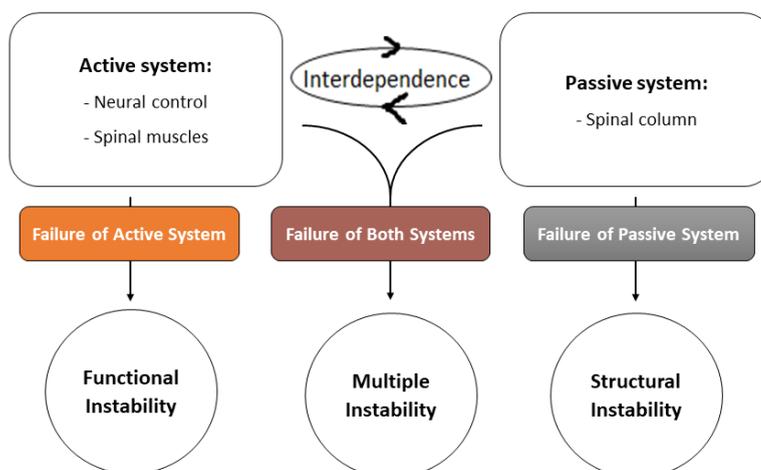


Figure 2. Relationship between the binary stabilization system and the SLI classification

LSI patients have LBP during spinal movement, positioning/sustained postures⁸. The patient report “giving-way”/“slipping” sensation⁹. Symptoms decrease with rest and bracing¹⁰.

Functional (patho-mechanical) instability:

Functional instability refers to “a significant decrease in capacity of active system to maintain the intervertebral neutral zones within physiological limits[expansion of neutral zone] so that there is no neurological dysfunction, no major deformity and no incapacitating pain”¹¹. (Figure-3)

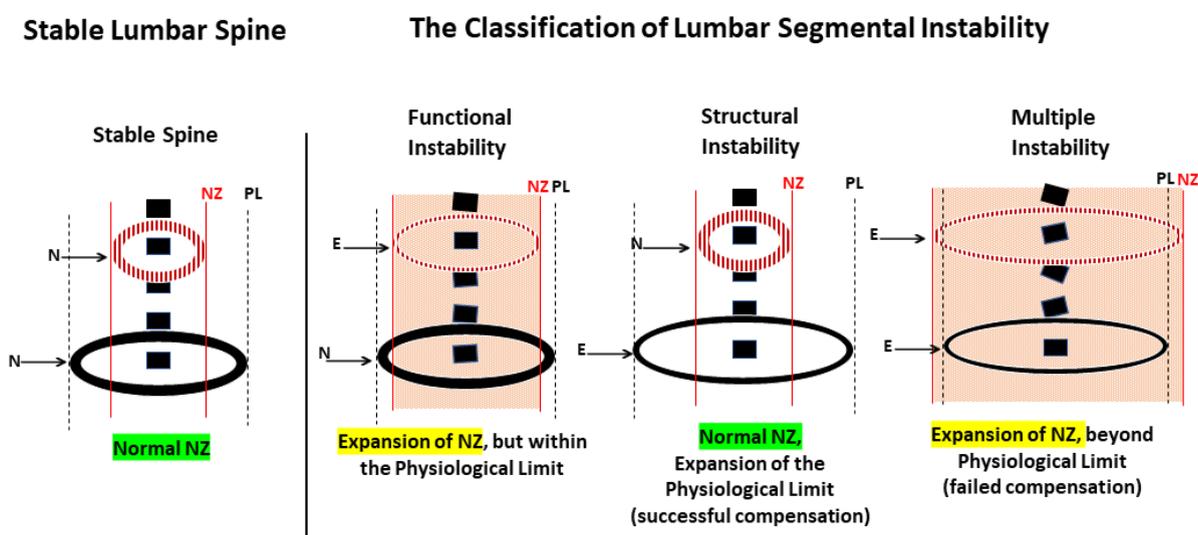


Figure 3: Theoretical interaction between the active system (red circles) and passive system (black circles) and their effects on the size of the neutral zone (NZ) in the stable lumbar spine and instability subcategories. NZ: neutral zone; PL: physiological limit; N: normal; E: expansion.

If spinal segment is unable to support load and maintain a normal pattern of displacement, it is considered unstable, which may generate LBP¹².

Evidence of Functional Instability:

Studies have reported abnormal increase in lumbar segmental translation in patients with recurrent LBP^{13,14}. Other studies have reported muscular deficits at pain level or increased fatty tissue infiltration leading to acute¹⁵, chronic and recurrent LBP¹⁶. Wallwork et al.¹⁷ reported an association in chronic LBP patients between lumbar multifidus muscle(LMM) atrophy and reduced voluntary isometric muscle contraction. Furthermore, Tsao et al. found an association between recurrent LBP and adaptive motor cortex remapping favouring superficial fascicles of the longissimus erector spinae at expense of the deep fibres of the LMM¹⁸. Lastly, LBP patients demonstrated reduced proprioception, impaired postural control and impaired ability to react to perturbations¹⁹. All this evidence may indicate a deficit of the active system, which may increase the risk of lumbar spine buckling injuries as a result of delayed and inefficient spinal muscular recruitment.

Functional Instability Tests:

Hicks et al. proposed four predictors that, together, form the clinical prediction rule

(CPR) for determining which LBP patients will respond to stabilization exercise²⁰. CPR involves four variables²¹: age <40 years, positive result for Prone Instability Test (PIT), presence of aberrant lumbar movement during trunk motion testing and a mean straight leg raise (SLR) >91°. If CPR is positive (three of four variables are present), likelihood of stabilization success increases from 33% to 67%. CPR was validated in two treatment-based classification studies^{22,23} and reliability ranges from substantial to excellent²¹. Another CPR validity study, Rabin et al.²⁴ proposed a modified CPR that involves only two items (the presence of aberrant movement and a positive PIT) and had an improved predictive validity for identifying individuals most likely to succeed with stabilization exercise, but this requires further validation.

Structural (Radiographic/Patho-anatomical) Instability:

Structural/radiographic instability refers to “disruption of passive stabilizers and decreased structural integrity”²⁵ due to progressive degenerative changes⁴. The main feature of segmental osseoligamentous structures is passive stability at physiological end-ROM. (Figure-3)

Evidence of Structural Instability:

Various imaging techniques such as radi-

ography, CT, and MRI are used to visualize structural abnormalities. Carragee et al. found that about 90% of 200 asymptomatic subjects had radiographic signs of abnormality, despite not having LBP. Among asymptomatic subjects, 36% had a herniated disc, 21% had spinal stenosis and >90% had a degenerated disc²⁶. More pertinently, LSI radiographic studies have reported high false-positive rates for individuals without LBP².

As the majority of people with static radiographic signs are asymptomatic, it is important to realize that these signs might indicate a previous period of degenerative instability that resulted in re-stabilization⁹. Thus, static radiographic signs of degenerative instability are part of normal ag-

ing and their usefulness depends on establishing a cause-and-effect relationship between them and clinical presentation among LSI patients².

Structural Instability Tests:

Widely used assessment method is flexion-extension/dynamic radiography, which was first described by Knuttson to identify and quantify abnormal anterior-to-posterior translation of the motion segments at end-ROM²⁷. Common criteria for structural instability diagnosis is 3 mm or 9% of vertebral body width on flexion-extension radiograph or 9° of sagittal plane rotation between the L1–L5 motion segments. There are a number of clinical tests that are reported to predict dynamic radiograph findings²⁸ (Table 1).

Table 1: Clinical tests predicting dynamic radiograph findings

Author	Test	Reliability	Sensitivity (95% CI)	Specificity (95% CI)	+LR (95% CI)	-LR (95% CI)
Kasai et al. ^[29]	PLET	k=0.46 to 0.76	84 (68, 93)	90 (82, 96)	8.8 (4.5, 17.3)	0.2 (0.1, 0.4)
Esmailiejah et al. ^[30]	PLET	-	78.8	94.7	19.44 (2.80, 135)	0.29 (0.15, 0.55)
Abbott et al. ^[31]	PPIVM (flexion)	-	5 (1, 22)	99.5 (97, 100)	8.7 (0.6, 134.7)	1.0 (0.9, 1.1)
	PPIVM (extension)	-	16 (6, 38)	98 (94, 99)	7.1 (1.7, 29.2)	0.9 (0.7, 1.1)
Fritz et al. ^[13]	Lack of intervertebral hypomobility	k=-0.2 to 0.3	43 (0.27, 0.61)	95 (0.77, 0.99)	9.0 (1.3, 63.9)	0.60 (0.43, 0.84)

k=kappa coefficients; +LR=positive likelihood ratio; -LR=negative likelihood ratio; PPIVM=Passive Physiological Intervertebral Movements; PLET=Passive lumbar extension test.

Multiple (pathomechanical/pathoanatomical) Instability:

Multiple instability is defined as “expan-

sion of the neutral region that cannot be held at physiological limits when a problem occurs in subsystems that provide sta-

bility in the spine”³² (Figure-3).

Clinically, multiple instability can be defined as; an expansion of intervertebral motion of the lumbar spine beyond physiological limits that causes chronic intractable LBP (with or without sciatica) due to suboptimal generation of stiffness by both active and passive systems”.

Evidence of Multiple Instability:

Panjabi hypothesized that sub-failure ligament injuries due to single or cumulative micro-traumas generates corrupted signals to the neuromuscular control unit, which in turn produces a corrupted muscular response. The persistently inaccurate muscular response produces higher stresses and strains on the spinal components, leading to further sub-failure¹⁶.

Accumulated evidence links spinal osseoligamentous injuries or degeneration to neuromuscular control impairments that indicate multiple instability. For example, experimentally induced intervertebral disk injury causes focal atrophy, as indicated by decreased LMM cross-sectional area at the relevant level in a porcine³³ model and in patients with disk herniation^{34,35}. Furthermore, spinal degeneration conditions are associated with decreased density of the paraspinal muscles³⁶. More recent, 22 consecutive patients undergoing surgery due to chronic degenerative lumbar spine

pathology were found to have high levels of LMM degeneration³⁷. This further confirms relationship between degenerative osseoligamentous structures and dysfunction of active subsystem in LBP patients.

Multiple Instability Tests:

To categorize a case of LSI as multiple instability, both functional and radiographic instability tests have to be positive.

Conservative treatment of lumbar segmental instability:

In functional instability, the neutral zone (NZ) expansion can overstretch and/or compress spinal structures beyond their normal NZ limits. However, the expansion does not pass the physiological limits. Therefore, although the flexion-extension radiography results are negative, patient signs and symptoms can indicate functional instability (false-negative). Therefore, historically, functional instability diagnosis has been considered as a diagnosis of exclusion²⁸. In contrast, multiple instability affects both the active and passive systems, so the expansion of the NZ passes the physiological limits, which can be observed on flexion-extension radiographs. Contrary, structural instability is a potential rather than an actual instability sub-classification that represents disruption and deterioration of the passive stabilizers, which might be masked (successful com-

pensation) primarily by the active system. However, if the compensation fails, the segmental motions will exceed the physiological limits, causing multiple instability. Based on this model, we can predict that functional and multiple instabilities are reversible (Figure 4).

Conservative Treatment of Lumbar Segmental Instability

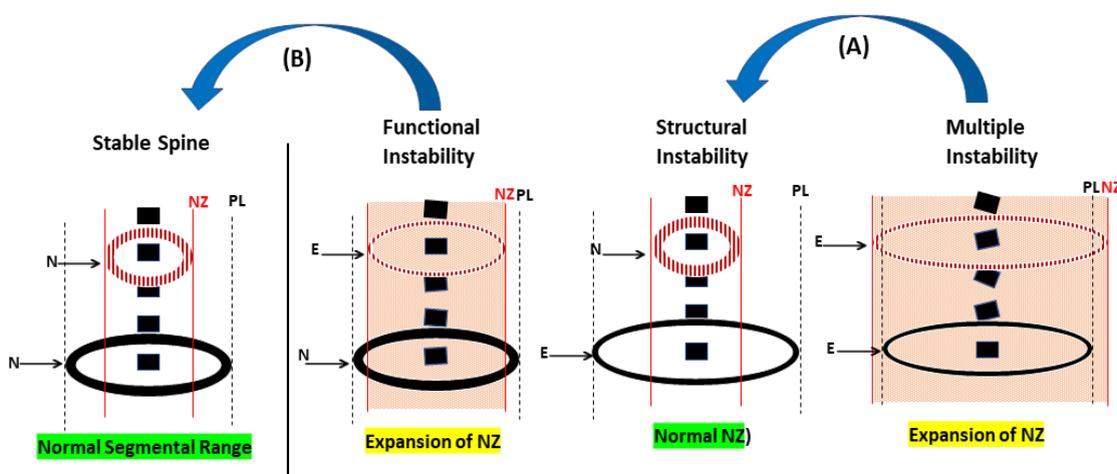


Figure 4: The arrows indicate the translation of patient classification from: (A) the expansion of NZ classifications (multiple instability) to potentially normal NZ classification (structural instability) and (B) the expansion of NZ classifications (functional instability) to normal NZ classification (healthy stable spine).

CONCLUSIONS:

In this review, we proposed clinical LSI classification system involving functional, structural and multiple instability that are based on reformulation of Panjabi's theory. Two clinical instability sub classifications are caused by expansion of NZ: functional and multiple instability, primarily due to active stabilization system dysfunction. As stabilization exercises can restore functionality of active system, which subsequently restores the normal NZ, multiple instability can be reversed to produce structural instability and functional instability can be reversed to produce a stable

spine.

SOURCE OF FUNDING

NIL

CONFLICT OF INTEREST

NIL

KEY POINTS:

- The understanding of clinical concept of LSI can be improved by dividing LSI individuals into three subcategories: functional, structural and multiple instability.
- Active (neuromuscular) system dysfunctionality may cause LBP due to expansion of NZ.

- The improvement of patients' outcome due to stabilization exercises can be attributed to restoration of active system functionality, thus, restoration of normal NZ.
- Because active stabilization system is trainable, multiple instability and functional instability can be reversed to produce structural instability and stable spine, respectively.

REFERENCES:

1. Hides JA, Jull GA, Richardson CA. Long-term effects of specific stabilizing exercises for first-episode low back pain. *Spine*. 2001; 26 (11):243-8.
2. Leone A, Guglielmi G, Cassar-Pullicino VN, et al. Lumbar intervertebral instability: a review. *Radiology*. 2007;245 (1):62-77.
3. McGill SM. Low back stability: from formal description to issues for performance and rehabilitation. *Exercise and sport sciences reviews*. 2001; 29 (1):26-31.
4. Panjabi MM. The stabilizing system of the spine. Part I. Function, dysfunction, adaptation, and enhancement. *Journal of spinal disorders*. 1992; 5:383-83.
5. Kaiser MG, Eck JC, Groff MW, et al. Guideline update for the performance of fusion procedures for degenerative disease of the lumbar spine. Part 1: introduction and methodology. *Journal of Neurosur-*

- gery: Spine*. 2014;21 (1):2-6.
6. Frymoyer J, Selby D. Segmental instability. Rationale for treatment. *Spine*. 1985;10(3):280-86.
7. Cleland J, Schulte C, Durall C. The role of therapeutic exercise in treating instability-related lumbar spine pain: a systematic review. *Journal of back and musculoskeletal rehabilitation*. 2002;16 (2):105-15.
8. Paris SV. Physical signs of instability. *Spine*. 1985;10 (3):277-79.
9. Kirkaldy-Willis W, Farfan H. Instability of the lumbar spine. *Clinical Orthopaedics and Related Research* 1982;165:110-23.
10. MacDonald DA, Moseley GL, Hodges PW. The lumbar multifidus: does the evidence support clinical beliefs? *Manual therapy*. 2006;11 (4):254-63.
11. Panjabi MM. The stabilizing system of the spine. Part II. Neutral zone and instability hypothesis. *Journal of spinal disorders*. 1992;5:390-390.
12. Demoulin C, Distree V, Tomasella M, et al. Lumbar functional instability: a critical appraisal of the literature. *Annales de readaptation et de medecine physique : revue scientifique de la Societe francaise de reeducation fonctionnelle de readaptation et de medecine physique*. 2007;50 (8):677-84.
13. Fritz JM, Piva SR, Childs JD. Accuracy of the clinical examination to predict radiographic instability of the lumbar spine.

- European spine journal : official publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society. 2005; 14 (8):743-50.
14. Sihvonen T, Lindgren KA, Airaksinen O, et al. Movement disturbances of the lumbar spine and abnormal back muscle electromyographic findings in recurrent low back pain. *Spine*. 1997;22 (3):289-95.
15. Hides JA, Stokes MJ, Saide M, et al. Evidence of lumbar multifidus muscle wasting ipsilateral to symptoms in patients with acute/subacute low back pain. *Spine*. 1994; 15 (19):165-72.
16. Panjabi MM. A hypothesis of chronic back pain: ligament subfailure injuries lead to muscle control dysfunction. *European spine journal : official publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society*. 2006; 15 (5):668-76.
17. Wallwork TL, Stanton WR, Freke M, et al. The effect of chronic low back pain on size and contraction of the lumbar multifidus muscle. *Manual therapy*. 2009;14 (5):496-500.
18. Tsao H, Danneels LA, Hodges PW. ISSLS prize winner: smudging the motor brain in young adults with recurrent low back pain. *Spine*. 2011;36 (21):1721-27.
19. Radebold A, Cholewicki J, Polzhofer GK, et al. Impaired postural control of the lumbar spine is associated with delayed muscle response times in patients with chronic idiopathic low back pain. *Spine*. 2001;26 (7):724-30.
20. Hicks GE, Fritz JM, Delitto A, et al. Preliminary development of a clinical prediction rule for determining which patients with low back pain will respond to a stabilization exercise program. *Archives of physical medicine and rehabilitation*. 2005;86 (9):1753-62.
21. Alyazedi FM, Lohman EB, Wesley Swen R, et al. The inter-rater reliability of clinical tests that best predict the subclassification of lumbar segmental instability: structural, functional and combined instability. *The Journal of manual & manipulative therapy*. 2015; 23 (4):197-204.
22. Brennan GP, Fritz JM, Hunter SJ, et al. Identifying subgroups of patients with acute/subacute “nonspecific” low back pain: results of a randomized clinical trial. *Spine*. 2006;15:31:6:623-31.
23. Ganesh GS, Sahu PK, Das SP, et al. A subgroup analysis to compare patients with acute low back pain classified as per treatment-based classification. *Physiotherapy research international : the journal for researchers and clinicians in physical therapy*. 2019;24 (1):1747.

24. Rabin A, Shashua A, Pizem K, et al. A clinical prediction rule to identify patients with low back pain who are likely to experience short-term success following lumbar stabilization exercises: a randomized controlled validation study. *Journal of orthopaedic & sports physical therapy*. 2014;44 (1):6-13.
25. Beazell JR, Mullins M, Grindstaff TL. Lumbar instability: an evolving and challenging concept. *The Journal of manual & manipulative therapy*. 2010;18 (1):9-14.
26. Carragee E, Alamin T, Cheng I, et al. Are first-time episodes of serious LBP associated with new MRI findings? *The spine journal : official journal of the North American Spine Society*. 2006; 6 (6):624-35.
27. Knutsson F. The instability associated with disk degeneration in the lumbar spine. *Acta Radiologica*. 1944;25 (5):593-609.
28. Alqarni AM, Schneiders AG, Hendrick PA. Clinical tests to diagnose lumbar segmental instability: a systematic review. *Journal of orthopaedic & sports physical therapy*. 2011;41 (3):130-40.
29. Kasai Y, Morishita K, Kawakita E, et al. A New Evaluation Method for Lumbar Spinal Instability: Passive Lumbar Extension Test. *Physical therapy*. 2006;86 (12):1661-67.
30. Esmailiejah AA, Abbasian M, Bidar R, et al. Diagnostic efficacy of clinical tests for lumbar spinal instability. *Surgical neurology international*. 2018;9 (2):15-22.
31. Abbott JH, McCane B, Herbison P, et al. Lumbar segmental instability: a criterion-related validity study of manual therapy assessment. *BMC musculoskeletal disorders*. 2005;6 (1):56-60.
32. Ve Deformite LSİ. Lumbar Segmental Instability and Deformity. *Turkish Neurosurgery*. 2014;24 (1):20-28.
33. Hodges P, Holm AK, Hansson T, et al. Rapid atrophy of the lumbar multifidus follows experimental disc or nerve root injury. *Spine*. 2006;1 (31):2926-33.
34. Yoshihara K, Nakayama Y, Fujii N, et al. Atrophy of the multifidus muscle in patients with lumbar disk herniation: histochemical and electromyographic study. *Orthopedics*. 2003; 26 (5):493-95.
35. Yoshihara K, Shirai Y, Nakayama Y, et al. Histochemical changes in the multifidus muscle in patients with lumbar intervertebral disc herniation. *Spine*. 2001;15 (26):622-26.
36. Kalichman L, Hodges P, Li L, et al. Changes in paraspinal muscles and their association with low back pain and spinal degeneration: CT study. *European spine journal : official publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Socie-*

ty. 2010;19 (7):1136-44.

37. Shahidi B, Hubbard JC, Gibbons MC, et al. Lumbar multifidus muscle degenerates in individuals with chronic degenerative lumbar spine pathology. *Journal of Orthopaedic Research*. 2017;35 (12):2700-706.

Case Report :

Third (Intermediate) head of gastrocnemius muscle; a case report and literature review

Mohammed Abdelsalam Ahmed Abdelmotalab

Assistant Professor of Human&Clinical Anatomy; Anatomy Department,
Faculty of Medicine, International University of Africa, Sudan.

Received on 28- 7-2020 accepted for publication on 22-12- 2020 dx.doi.org/10.5455/mjhs.2021.02.013

Corresponding Author:

Dr. Mohammed Abdelsalam Ahmed Abdelmotalab

E-mail : Salam_ahamed@yahoo.com, Phone: +00249129168727

Abstract

Anatomical variations of limb musculature are common. During the routine dissection for teaching musculoskeletal course for second year students of Medicine, a third (Intermediate) head of the gastrocnemius muscle was detected in a 70-year-old female cadaver in left lower limb. It was originated from the posterior surface of the distal end of the femur by small tendon and extended as long muscular belly. Throughout its course, this belly crosses superficial to the popliteal fossa beneath the skin on its way to join the medial side of the lateral head of gastrocnemius muscle. Furthermore, the intermediate head takes its innervation from the nerve to the lateral head of gastrocnemius that passes on its deeper aspect. No such variation was found in the right lower limb. Knowledge of these variants is very important in clinical practice.

Keywords:

Gastrocnemius, Dissection, Variation, intermediate head and Cadaver.

الملخص

تعتبر الاختلافات التشريحية لعضلات الأطراف شائعة. أثناء التشريح الروتيني لتدريس مقرر العضلات والعظام للسنة الثانية لطلاب الطب، تم اكتشاف رأس ثالث (متوسط) لعضلة الساق في جثة أنثى تبلغ من العمر ٧٠ عاماً في الطرف السفلي الأيسر. نشأ من أسطح الخلفي للنهاية البعيدة لعظم الفخذ بواسطة وتر صغير ويمتد مثل البطن العضلي الطويل. خلال مساره يتقاطع هذا البطن سطحياً مع الحفرة المأبضية تحت الجلد في طريقه للانضمام إلى الجانب الإنسي للرأس الجانبي لعضلة الساق. علاوة على ذلك، يأخذ الرأس الوسيط تعصيبه من العصب إلى الرأس الجانبي لعضلة الساق الذي يمر على جانبه الأعمق. لم يتم العثور على مثل هذا الاختلاف في الطرف السفلي الأيمن. معرفة هذه المتغيرات مهمة جداً في الممارسة السريرية.

Introduction:

The gastrocnemius muscle is the superficial muscle of the back of the leg. It was a powerful planter flexor of the ankle joint¹. The gastrocnemius muscle proximally originated by two heads, the medial head

arose from the popliteal surface of the femur superior to the medial condyle and the lateral head arose from lateral aspect of lateral condyle of the femur. Distally it attaches to the posterior surface of calcaneum via Achilles tendon¹. The gastrocne-

mius muscle take origin from both diaphysis and shaft the lateral head arises by a tendon from the lateral surface of lateral condyle and by few fleshy fibers from the lateral supracondylar ridge. The medial head arises by tendon from the medial supracondylar and by fibrous from the popliteal surface of the femur ².

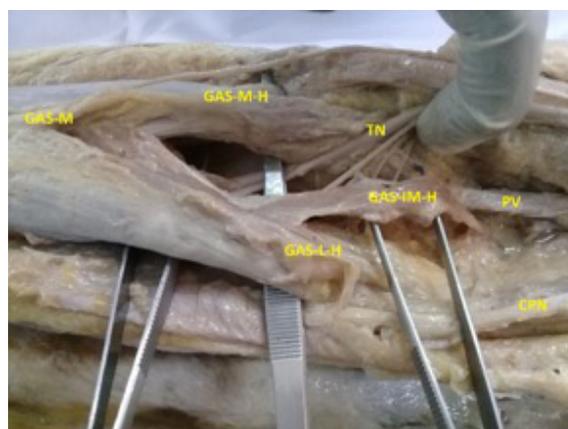
In a case report the gastrocnemius muscle was observed with three heads. Accessory third head was fused with the medial head with sural nerve entrapped between them [3]. Amuscular belly was noted in the middle of the popliteal fossa. It was arising by two tendons from the biceps femoris long head and semitendinosus muscle. It has a tendon courses between the two heads of gastrocnemius muscle and runs on superficial to the tendocalcaneus ⁴.

Case report:

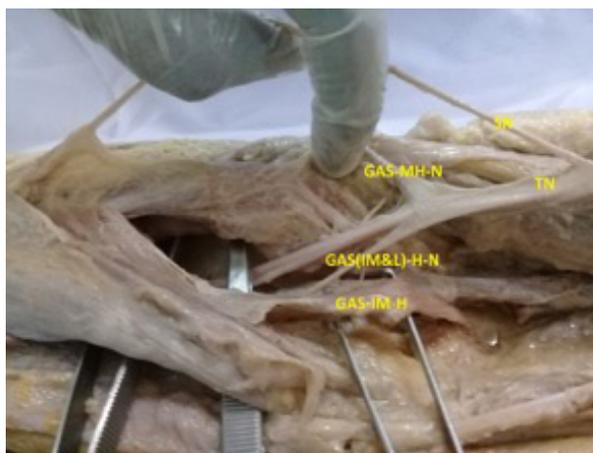
During the routine dissection for second year medical students at the department of Anatomy of Riyadh International College of Medicine for the academic year 2018-2019. A third (Intermediate) head of the gastrocnemius muscle was detected in a 70-year-old female cadaver in left lower limb. The contents of popliteal fossa and the gastrocnemius muscle heads were carefully dissected and cleaned. An intermediate head of the gastrocnemius was observed, it had its origin from the posterior

surface of the distal end of the femur by small tendon about 1 cm just lateral to the popliteal vessels. Further, when followed distally it was extended as long muscle belly running beneath the skin of the popliteal fossa with the tibial nerve and popliteal vessels deeperto it. The intermediate head finally joins the lateral head of gastrocnemius on its medial aspect near its junction with medial head. The intermediate head measured 5.48 cm long. The tibial nerve gives a common branch which passes on the deeper aspect to the intermediate and lateral heads. Then the intermediate and lateral heads were joining the medial head where they constitute gastrocnemius muscle, which was the normal in morphology as demonstrated in Figures 1&2.No other variation or variant was encountered.

"Fig. 1."Showing the third head (intermediate) (GAS-IM-H) of the gastrocnemius muscle(GAS-M) joining the lateral head (GAS-L-H). Also shown in the figure are medial head of gastrocnemius (GAS-M-H), popliteal vein (PV), tibial nerve (TN), and common peroneal nerve (CPN)



“Fig. 2.” Showing the nerve supply to the (GAS-IM&L-H) third head (Intermediate) (GAS-IM-H) and lateral head (GAS-L-H), medial head of gastrocnemius (GAS-M-H) and tibial nerve (TN) and (SN)sural nerve



Discussion:

Variations of muscles have been usually benign; it occurs due to genetic factors or embryological errors⁵. Anomaly of the gastrocnemius muscle of origins and accessory heads are usually encountered at the popliteal fossa⁶. Additional slips of the gastrocnemius muscle may have different sites of origin⁷. A study of thirty west Nigerian cadavers, the gastrocnemius muscle were found attached by four heads representing 51.7%, followed by two-headed gastrocnemius muscle representing 35% and lastly three-headed muscle in about 13.3% of investigated limbs⁸.

Srinivasa et al reported accessory muscular belly about 4.8 cm long was in the popliteal region. It has a separate branch of the tibial nerve; the belly extends to fuse with the medial head of the gastrocnemius muscle with the popliteal vessels entrapped

between them⁹. A north Indian 70-year-old male cadaver showed additional head for gastrocnemius muscle, it was originating from the supracondylar ridge and lateral condyle of the femur. The three heads united together to form the tendocalcaneus¹⁰. Yildirim et al describes the third additional head as gastrocnemius tertius which was found on two sides, his case presented also an unilateral accessory soleus muscle. The medial head of the gastrocnemius muscle receives the junction of right gastrocnemius tertius¹¹.

In a 54-year-old female the left lower extremity showed a muscular belly representing the third head of the gastrocnemius muscle. This belly was coming proximally from the popliteal surface of the femur shaft, at the lower part of the popliteal fossa, it fused heads of the gastrocnemius muscle¹². In comparison to previous literature to the current case, the intermediate head of the gastrocnemius muscle measured about 4.48 cm in length, it was arising from the posterior surface of the lower end of the femur and extended straightly to merge with the lateral head near its fusion with the medial head.

20 out of 1,039 investigated knees demonstrated a third head arising from the back of the distal end of the femur and finally fused with the medial aspect of the lateral head of the gastrocnemius. One case

of a third head of the gastrocnemius was seen which joined the medial head of the gastrocnemius. Regarding the relation between the third and the popliteal vessels in 20 presented cases the popliteal vessel gained a lateral position¹³.

In accordance with this case observation there is similarity in the origin, course and termination of the third head of the gastrocnemius muscle of the previous study. Rajan et al named the caput tertium for gastrocnemius third head, it joins the medial head of the gastrocnemius. The third and medial heads seemed to constrict the popliteal vessels¹³. In contrast to the present case the popliteal vessels were crossing medially to the intermediate head, so they were appearing not at danger to be entrapped.

Conclusion:

A third (Intermediate) head of the gastrocnemius muscle was observed in left lower limb of a female cadaver. Knowledge about such a variant muscle in the popliteal region should be considered in the diagnosis and management of various procedures in the fields of surgery, radiology and physiotherapy.

Conflict of Interests:

None.

Acknowledgments:

We are thankful to Riyadh International

College directors for their technical support.

Reference:

1. Keith L. Moore, Arthur F. Dalley, A. M. R. Agur. Clinically Oriented Anatomy. 7th, Year 2014, University of Toronto, Ontario, Canada. Wolters Kluwer Health/Lippincott Williams & Wilkins. Lower limb, Chapter number 5, pp:535-584.
2. McMinn RMH. Last's Anatomy (Editors McMinn RMH), 9th, Revised 9th edition, Year 2019, Regional and Applied Anatomy, Churchill Livingstone, Singapore. Lower limb, Chapter 3 pp:240-248.
3. Guru A, Kumar N, Shetty S.D and Nayak S.B. Presence of third head of gastrocnemius and entrapment of the sural nerve. Int J Anat Var. 2013; 6: 194–196.
4. Gupta RK, Bhagwat SS. An anomalous muscle in the region of the popliteal fossa: A case report. J Anat Soc Ind 2006; 55(2): 65-68.
5. Rajakumari Rajendiran and Anuradha Murugesan. Unilateral tensor fascia suralis: a case report. Brunei Darussalam Journal of Health 2016; 6(2): 94-98.
6. Kumar and Ashwani. Morphological Analysis of Proximal Gastrocnemius Muscle – A Study in Thirty Adult Human Cadavers. International Journal of Anatomy, Radiology and Surgery 2016;5(2):41-43.
7. Hyounghin Hahn, Jae-Chan Shim, Ki

- Hwan Kim, Kyoung Eun Lee, Dae Hyun Hwang, MD, Ghi Jai Lee, Ho Kyun Kim. MRI Findings of Accessory Popliteus Muscle: A Case Report. *J Korean Soc Radiol* 2019;80(3):574-578.
8. Ashaolu JO, Oni-Orisan OP, Ukwenya VO, Alamu O, Adeyemi DO. Variability of the morphology of gastrocnemius muscle in an African population. *Anatomy Journal of Africa* 2014;3(3):400-404.
9. Srinivasa Rao S, Bhagath Kumar P, Sathesha Nayak B, Kumar MR Bhat. Popliteal Vessels Entrapment by a Variant Accessory Belly of Medial Head of Gastrocnemius. *AnatomPhysiol* 2013, 3(1):116.
10. Kaur R, Sharma A and Kumar MS. A case report of a variant head of gastrocnemius. *Int J Anat Res* 2018;6(3.1):5420-23.
11. Yildirim FB, Sarikcioglu L, Nakajima K. The co-existence of the gastrocnemius tertius and accessory soleus muscles. *J Korean Med Sci* 2011;26(10):1378-1381.
12. Mitesh R. Dave, Vaishali Kiran Yagain & Samir Anadkat. Unilateral third/accessory head of the gastrocnemius muscle: a case report. *Int. J. Morphol* 2012;30(3):1061-1064.
13. Koplak MC, Grooff P, Piraino D, Recht M. Third head of the gastrocnemius: an MR imaging study based on 1,039 consecutive knee examinations. *Skeletal Radiol* 2009;38(4):349-354.
14. Rajan Kumar Singla, Rimpi Gupta. Caput Tertium gastrocnemius: A case report. *Journal of Clinical and Diagnostic Research* 2012;6(6):1059-1061.

GUIDELINES FOR MANUSCRIPT PREPARATION

A. TYPES OF MANUSCRIPTS

I. ORIGINAL MANUSCRIPTS

Manuscripts submitted in this category are expected to be concise, well organized, and clearly written. The maximum length is 5000 words, including the abstract, references, tables, and figure legends. The maximum length is 5000 words, including the abstract, references, tables, and figure legends.

- The structured abstract must not exceed 250 words.
- The title must not exceed 130 characters.
- A maximum of 4 tables and 4 figures is allowed.
- References should not exceed a maximum of 100.
- The abstract must be organized as follows:
- Background & Aims
- Methods
- Results
- Conclusions
- Do not use abbreviations, footnotes or references in the abstract.
- An electronic word count of the abstract must be included.
- Three to ten key words at the end of the abstract must be provided.

The manuscript must be arranged as follows:

- Title page
- Abstract
- Introduction
- Materials and methods (or Patients and methods)
- Results
- Discussion
- Acknowledgements
- References
- Tables
- Figure legends
- Figures

Acceptance of original manuscripts will be based upon originality and importance of the investigation. These manuscripts are reviewed by the Editors and, in the majority of cases, by two experts in the field. Manuscripts requiring extensive revision will be at a disadvantage for publication and will be rejected. Authors shall be responsible for the quality of language and style and are strongly advised against submitting a manuscript which is not written in grammatically correct English. The Editors reserve the right to reject poorly written manuscripts even if their scientific content is qualitatively suitable for publication. Manuscripts are submitted with the understanding that they are original contributions and do not contain data that have been published elsewhere or are under consideration by another journal.

II. REVIEW ARTICLES

Review articles on selected clinical and basic topics of interest for the readers of the Majmaah Journal of Health Science will be solicited by the Editors. Review articles are expected to be clear, concise and updated.

- The maximum length is 5000 words, excluding the summary, references, tables, and figures.
- References should not exceed a maximum of 150.
- The inclusion of a maximum of 4 high-quality tables and 4 colored figures to summarize critical points is highly desirable.
- Review articles must be accompanied by a title page and a summary.

- Reviews should include at least one Key Point Box, with a maximum of 5 bullet points, that briefly summarizes the content of the review.

Review articles are reviewed by the Editors and may be sent to outside expert reviewers before a final decision for publication is made. Revisions may be required.

III. EDITORIALS

This section consists of invited brief editorial comments on articles published in the Majmaah Journal of Health Science

The length of an editorial should not exceed 1500 words, excluding references.

- A maximum of 1 table or 1 figure is allowed.
- References should not exceed a maximum of 20.
- A title page must be provided.

IV. CASE REPORTS

Case reports would be only accepted if they represent an outstanding contribution to the Etiology, pathogenesis or treatment of a specific condition.

- The maximum length is 3000 words, including the summary and references.
- A maximum of 2 tables and 2 figures is allowed.
- References should not exceed a maximum of 15.
- A title page must be provided.

V. LETTERS TO THE EDITOR

Letters to the Editor will be considered for publication if they are related to articles published in recent issues of Majmaah Journal of Health Science. Occasionally, Letters to the Editor that refer to articles not published in Majmaah Journal of Health Science will be considered.

The length of a Letter to the Editor should not exceed 800 words.

- A maximum of 1 table or 1 figure is allowed.
- References should not exceed a maximum of 10.
- No more than 4 Authors may appear in the author list.

VI. COMMENTARIES

International commentaries will be solicited by the Editors only.

- Commentary articles should not exceed a maximum of 800 words, excluding tables or figures.
- A maximum of 1 table or 1 figure is allowed.
- References should not exceed a maximum of 10.
- A title page must be provided.

B. MANUSCRIPT SUBMISSION

ORGANIZATION OF THE MANUSCRIPT

- The submitted manuscript must be typed double-spaced throughout and numbered (including references, tables and figure legends). Preferably using a "standard" font (we prefer Times/Arial 12).
- For mathematical symbols, Greek letters, and other special characters, use normal text. The references must be in accordance with the Vancouver reference style (see References).
- Approved nomenclature for gene and protein names and symbols should be used, including appropriate use of italics (all gene symbols and loci, should be in italics) and capitalization as it applies for each organism's standard nomenclature format, in text, tables, and figures.
- Full gene names are generally not in italics and Greek symbols are not used. Proteins should not be italicized.
- Improperly prepared manuscripts will not be entered into the peer review process and will be sent back to the author for correction.

TITLE PAGE MUST CONTAIN:

- A title of no more than 130 characters.

- Running title (not to exceed 60 characters)
- Names of the Authors as it should be published (first name, middle initial, last name)
- Affiliations of all authors and their institutions, departments, or organizations (use the following symbols in this order to designate authors' affiliations: *, †, ‡, §, ¶, ||, #, **, ††, ‡‡, §§, ¶¶, || ||, ##).
- Name, address, telephone and fax numbers, and electronic mail address of the corresponding Author.
- Electronic word count.
- Number of figures and tables.
- List of abbreviations in the order of appearance.
- Conflict of interest.
- Financial support.

Animal trials: Manuscripts reporting experiments using animals must include a statement giving assurance that all animals received human care and that study protocols comply with the institution's guidelines. Statistical methods used should be outlined.

Human trials: Manuscripts reporting data from research conducted on humans must include a statement of assurance in the methods section of the manuscript reading that:

1. Informed consent was obtained from each patient included in the study and
2. The study protocol conforms to the ethical guidelines of the 1975 declaration of helsinki as reflected in a priori approval by the institution's human research committee.

Randomized controlled trials: Any paper that is a randomized control trial should adhere to the guidelines that can be found at the following web-site: www.consort-statement.org. The checklist should be printed out and faxed to the Editorial office at the time of submission. The trial registration number must be included on the title page of the manuscript reporting a registered clinical trial. Failure to do so will prevent entry to the peer review process.

Drugs and chemicals: Drugs and chemicals should be used by generic name. If trademarks are mentioned, the manufacturer's name and city should be given. All funding sources supporting the work, either public or private, especially those from pharmaceutical companies, must be provided.

Genetic Sequence data: In papers reporting a novel DNA or amino sequence, verification that the data have been or will be submitted either to Gen-Bank or EMBL is required. Please provide this verification and the accession number in the covering letter.

REFERENCES

References must be in accordance with the Journal of Hepatology reference style. References are ordered as they appear in the text and citation numbers for references are placed between "brackets" (" []") in the text as well as in the reference list.

Authors should be listed surname first, followed by the initials of given names (e.g. Bolognesi M). If there are more than six authors, the names of the first six authors followed by et al. should appear.

Titles of all cited articles are required. Titles of articles cited in reference list should be in upright, not italic text; the first word of the title is capitalized, the title written exactly as it appears in the work cited, ending with a full stop. Journal titles are abbreviated according to common usage, followed by Journal years, semicolon (;) before volume and colon (:) before full page range (see examples below).

All articles in the list of references should be cited in the text and, conversely, all references cited in the text must be included in the list.

Personal communications and unpublished data should be cited directly in the text by the first Author, without being numbered. Please make sure you have the latest, updated version of your reference management software to make sure you have the correct reference format for Majmaah Journal of Health Science.

An example of how references should look within the text:

"HVPG was measured by hepatic vein catheterization using a balloon catheter according to a procedure described elsewhere [14, 15] and used as an index of portal hypertension [16]."

An example of how the reference list should look:

[14] Merkel C, Bolognesi M, Bellon S, Zuin R, Noventa F, Finucci G, et al. Prognostic usefulness of hepatic vein catheterization in patients with cirrhosis and esophageal varices. *Gastroenterology* 1992;102:973-979.

[15] Groszmann RJ, Wongcharatrawee S. The hepatic venous pressure gradient: anything worth doing should be done right. *Hepatology* 2004;39:280-282.

FIGURES

A maximum of 4 figures is allowed

(This can be modified if needed by Editorial board).

- Figures will be often, but not always, re-designed by graphic designers. By signing and transferring the Copyright Agreement to MJHS, the author gives permission to the graphic designers to alter the visual aspect of any figures, tables, or graphs. The scientific content of figures will not be altered. Please provide this information with your covering letter.
- All graphics submitted to Majmaah Journal of Health Science should be sent at their actual size, which is 100% of their print dimension and in portrait orientation.
- Two standard widths are used and figures should fit in one (8.5 x 23.5 cm) or two (17.5 x 23.5 cm) columns
- Figures should be supplied in the following preferred file formats: PDF (*.pdf), Power Point (*.ppt), Adobe Illustrator (*.ai, *.eps), Photoshop (*.psd) files in grayscales or in RGB color mode. It is highly recommended that figures not be sent in JPG (*.jpg) format.
- Photographs (scans, immunofluorescences, EM, and histology images) should be submitted as: 1. TIFF (*.tif) with a resolution of at least 300 pixels per inch, or
- Illustrator compatible EPS files with RGB color management (*.eps),
- Photoshop (*.psd) or PDF (*.pdf) files (grayscales or RGB) at the appropriate resolution, which is:
 1. 300 dpi for color figures
 2. 600 dpi for black and white figures
 3. 1200 dpi for line-art figures
- For all photomicrographs, where possible, a scale should appear on the photograph. Photographs of identifiable patients should be accompanied by written permission to publish from patient(s).
- Furthermore, panel lettering should be in Arial bold 14 pt, capitalized and no full stop (A, B) while lettering in figures (axes, conditions), should be in Arial 8 pt, lower case type with the first letter capitalized and no full stop. No type should be smaller than 6 pt.

TABLES

A maximum of 4 tables is allowed

(This can be modified if needed by Editorial board)

- Tables should be provided as Word files (*.doc) or Illustrator/InDesign (*.ai, *.eps, *.indd) compatible files. No TIFF and JPG files are acceptable for table submission.
- When submitting tables in Microsoft Word table function, no tab, space or colors should be used. Tables should contain a maximum of 10 columns.
- Tables submitted in landscape orientation will not be accepted. Tables should include a title, table legend, and if necessary footnotes.
- Include tables in the submitted manuscript as a separate section.

FIGURE LEGENDS

- Figure legends should be listed one after the other, as part of the text document, separate from the figure files.
- Please do not write a legend below each figure. Each figure legend should have a brief title that describes the entire figure without citing specific panels, followed by a description of each panel, and the symbols used.
- Enough information should be provided in the figure legend text to permit interpretation of figures without reference to the text; but should not contain any details of methods, or exceed 100 words.
- The abbreviated word for figure "Fig." should be typed and bolded, followed by the figure number and a period

(i.e. "Fig. 1."). Every figure legend should have a Title written in bold.

- If a figure contains multiple sections (i.e. A, B, C, D) the letter for these subsections should be in capital letters. Within the figure legend text the capital letters should be surrounded by parenthesis [i.e. (A)(B)(C)(D)].
- Figures should be numbered according to the order of citation.

Supplementary material: Supplementary material, not for review, is acceptable. Supplementary material can be submitted as (*.mov), (*.avi), (*.mpeg), or (*.gif) files. Please note that the size limit for these items is 10 MB per file.

ENGLISH

Authors may be asked to contact professionals regarding the correction of the English content of manuscripts either before or after acceptance. This expense will be the responsibility of the Authors.

C. REVIEW PROCESS

Authors should be aware that manuscripts will be screened upon submission. Only the manuscripts which fully comply with the submission requirements outlined and in which the level of English is of an acceptable standard will enter the peer review process.

First submission

Once successful submission of a manuscript has taken place, an acknowledgement will be sent by e-mail to the Corresponding Author on the manuscript. All subsequent correspondence will be with the designated Corresponding Author. The number of the manuscript should be used by the Authors in all communications with the Editorial Office. All the manuscripts will be reviewed by the Editors and, and in some cases, by other expert reviewers. After review, the corresponding Author will be notified by letter of the decision taken by the Editor(s). This letter will be accompanied in most, but not all, cases by the comments of the reviewers. This letter will be sent via e-mail.

Resubmission of manuscripts

In some cases, Authors will be invited to submit a revised version of the manuscript for further review. This invitation does not imply, in any case, that the revised version will be accepted for publication. In general, revised manuscripts must be received in the Editorial Office within four months of the date of the first decision. Authors should submit the resubmitted manuscript with all changes underlined. The resubmitted manuscript should be accompanied by a cover letter stating that the manuscript has been revised according to the comments made by the Editor and the Reviewers. Figures and tables must be uploaded. Please ensure that a separate point by point response to the reviewers is included with the covering letter. Please do not send revised manuscripts to the Editorial Office via e-mail. Revised manuscripts should be mailed to site of Majmaah Journal of Health Sciences at mjhs@mu.edu.sa

PROOFS

Proofs will be made available to the author(s) to be checked. It is the responsibility of the author(s) to make sure that the quality and accuracy of the manuscript, figures, and tables in the proofs is correct. Authors should return their proofs within 48 hours, by fax or e-mail if the corrections are minor, to expedite publication. Further changes or additions to the edited manuscript after these corrections cannot be accepted.

COVER ILLUSTRATIONS

Cover illustrations will be chosen by the Editors. Authors are highly encouraged to submit high quality color figures and images suitable for publication on the cover at the time of submission of the manuscript.

REPRINTS

Reprints must be ordered in advance. An order form indicating the cost of the reprints is sent from the Publisher with page proofs. Reprint orders, payments, and inquiries must be forwarded to the Publisher, not to the Editorial Office.

ADVERTISEMENTS

Information about advertisements in Majmaah Journal of Health Science can be obtained from the Publisher.

Copyright assignments, financial disclosures, and Institutional Review Board/Animal Care Committee Approval. Upon article acceptance, the corresponding author will be contacted and asked to submit the above forms. It is the author's responsibility to make sure these forms are signed and duly returned to the editorial office via fax. If these forms are

not received the manuscript will NOT be published.

Drug Declaration/Conflict of Interest Form

This form should be printed out and the suitable statement chosen among the listed ones (A-G). It should then be signed by the corresponding author and faxed to the Editorial Office at +41 22 510 24 00. If this form is not received the paper will NOT be published.

Methodological & Statistical instructions for Authors submitting manuscripts to the Majmaah Journal of Health Science

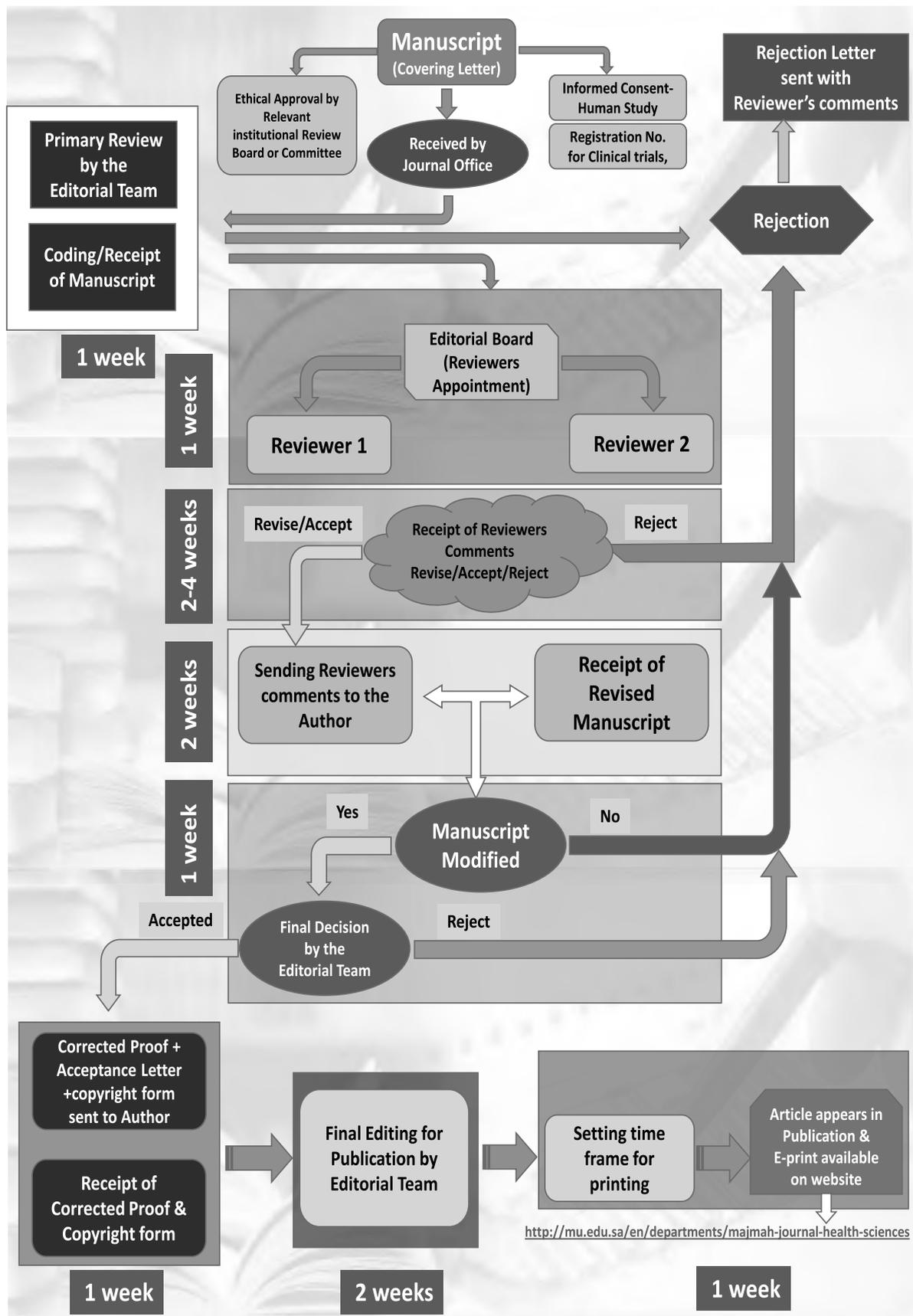
The manuscripts should include a complete and detailed description of what was done. This includes a description of the design, measurement and collection of data, the study objective and major hypotheses, type and source of subjects, inclusion and exclusion criteria and measures of outcome, number of subjects studied and why this number was chosen. Any deviation from the study protocol should be stated. The baseline characteristics of any compared groups should be described in detail and -if necessary -adjusted for in the analysis of the outcome.

For randomized clinical trials the following should also be clearly documented: treatments, sample size estimation, method of random allocation and measures taken for maintaining its concealment including blinding, numbers treated, followed-up, being withdrawn, dropping out, and having side effects (numbers and type). The statistical methods used should be relevant and clearly stated. Special or complex statistical methods should be explained and referenced.

Complex analyses should be performed with the assistance of a qualified statistician. Unqualified use of such analyses is strongly discouraged. The underlying assumptions of the statistical methods used should be tested to ensure that the assumptions are fulfilled.

For small data sets and if variable distributions are non-normal, distribution free (non-parametric) statistical methods should be used. The actual p values - whether significant or not - should always be presented (not NS). Confidence intervals convey more information than p values and should be presented whenever possible. Continuous variables can always be summarized using the median and range which are therefore preferred. Only in the infrequent case of a Normal distribution are the mean and standard deviation (SD) useful. Complex analyses (including Cox and logistic regression analysis) should be presented in sufficient detail: i.e. variable scoring, regression coefficients, standard errors and any constants. Odds-ratios or relative risks are not sufficient documentation of such analyses. The handling of any missing values in the data should be clearly specified. The number of statistical tests performed should be kept at a minimum to reduce spurious positive results. Explorative (hypothesis generating) analyses without confirmation using independent data are discouraged. Figures showing individual observations e.g. scatter plots are encouraged. Histograms may also be useful. Tables should indicate the number of observations on which each result is being based





MJHS

مجلة الجامعة للعلوم الصحية

MAJMAAH JOURNAL OF HEALTH SCIENCES
A JOURNAL PUBLISHED BY MAJMAAH UNIVERSITY

Editor in Chief

Dr. Khaled M. Al-Abdulwahab

Members

Prof. S.Karthiga Kannan

Dr. Abdul Aziz Bin Abdulla Al Dukhyil

Dr.Elsadig Yousif Mohamed

Dr. Mohamed Sherif Sirajudeen

Dr. Shaik Abdul Rahim

Dr. Khalid El Tohami Medani

MJHS Office

MAJMAAH JOURNAL OF HEALTH SCIENCES
Basic & Health Sciences Research Centre
Deanship of Research, Majmaah University
Ministry of Education,
Kingdom of Saudi Arabia
Post Box 66, Al Majmaah 11952
E-Mail: info@mjhs-mu.org

Website: <http://mjhs-mu.org>

INVITATION TO PUBLISH

Dear Authors,

Majmaah Journal of Health Sciences is accepting original articles, review articles and letters to editors for publishing in forthcoming issue. Kindly go through the guidelines for submission and submit your manuscripts online at mjhs-mu.org



Copyrights© 2015 by Majmaah University. All right reserved.

Reproduction without permission is prohibited. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording or any information and retrieval system without permission in writing from the publisher.

All articles published, including editorial, letters and book reviews, represent the opinion of the authors and do not reflect the official policy of the publisher or the institution with which the author is affiliated, unless it is clearly specified.