GEORGIAN MEDICAL NEWS

GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE
www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman (Кириллица)**, для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman (Cyrillic)**, print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf

In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

**Articles that Fail to Meet the Aforementioned
Requirements are not Assigned to be Reviewed.**

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგ-ლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**,ხოლო ქართულენოვან ტექსტში საჭიროა გამოიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიისა და რეზიუმების (ინგლისურ,რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენ-ტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ,რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი,მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემა-ჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები,ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტო-სურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი,ანათლების შედგების ან იმპრეგნაციის მეთოდი და აღნიშნოთ სუ-რათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხო-ური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამული, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი,წელი,ჟურნალის №,პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანე-ლის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა,მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა,რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შე-ჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

Содержание:

PREVALENCE OF LEFT/RIGHT CONFUSION AMONG MEDICAL STUDENTS IN MUTAH UNIVERSITY- JORDAN

Sherif W. Mansour[1]*, Nesrin R. Mwafi[1], Nafe' M. AL-Tawarah[2], Bayan Masoud[3], Hamzah A. Abu-Tapanjeh[3], Ibraheem M. Alkhawaldeh[3], Mohammad S. Qawaqzeh[3], Raghad Amro[3] and Sulieman B. Mazahreh[3]

[1]Department of Biochemistry, Physiology and Molecular Biology, Faculty of Medicine, Mutah University, Jordan.

[2]Department of Medical Laboratory Sciences, Faculty of Allied Medical Sciences, Mutah university, Jordan.

[3]Medical student, Faculty of Medicine, Mutah University, Jordan.

Abstract.

Background: The ability to distinguish left from right has been shown to vary substantially within healthy individuals, yet its characteristics and mechanisms are poorly understood.

Aim: The study was designed in an effort to spot the extents of left-right confusion (LRC) among medical students in Mutah university and to investigate the relationship between LRC and multiple health and socioeconomic variables.

Methods: Analytic cross section study was performed. Database gathered by google sheet in order to introduce them to software (starting form 12th - October / 2021 ended in 15/1/2022). Before analysis, survey was checked for missing data, statistically analysed by SPSS version 25.

Results: The prevalence in our sample was slightly lower than the prevalence reported in prior research, which was 14.7%, and this may be attributed to medical students' greater level of education and overall understanding when compared to the general population.

Conclusions: It was found that there is a statistically significant link between gender, communication issues, and ADHD. The challenge now is where we go from here; since the relationship we discovered between ADHD and left-right confusion is novel, we need to carry further research to establish this unique association more solidly.

Key words. Left right confusion, Al-Karak, prevalence, Mutah university, Medical student, Gender.

Introduction.

The ability to distinguish between left and right, known as left–right discrimination (LRD) is critical in everyday life. It is important to be able to distinguish left from right while following directions to an unknown location or operating on a patient's knee. It is acceptable to presume that most people have acquired such a necessary skill during childhood, but recent research indicated that it differs significantly within healthy individuals and this phenomenon of confusing left and right is widely spread [1]. Surprisingly little is known about the features of this phenomenon and the underlying process involved in differentiating between left and right. There are just a few papers on this sort of spatial processing accessible.

There are two types of LRD: egocentric and allocentric [2]. The ability to distinguish left from right from one's own perspective with usual orientations is known as egocentric LRD. Allocentric LRD is claimed to be an association of egocentric LRD with mental rotation and is employed for uncommon orientations or for other people's bodies. The Bergen Left–Right Discrimination Test (BLRDT) was utilized in this study to investigate allocentric LRD [3]. Different measures can be used to examine left–right discrimination. Older research frequently relied solely on self-report questionnaires (questions on subjective LRD performance in daily life) [4]. In recent research, behavioral tasks such as Bergen left-right discrimination test (BLRDT) have been utilized instead of self-report, or self-report questionnaires have been combined with behavioral tasks [5]. Several characteristics, including sex, handedness, and education, were identified as contributors explaining LRD variability in those investigations.

After evaluating his own very selective issues in this area, Wolf (1973) was the first to quantify left-right confusion [6]. According to a brief survey of 790 doctors and their spouses, 17.5 percent of women and 8.8 percent of men had "often" difficulty distinguishing between the left and right sides [6]. Then, in their study, Harris and Gitterman (1978) incorporated both gender and hand variables [7]. The researchers discovered that 44.7 percent of women and 15.8 percent of men have trouble rapidly recognizing the left and right sides among 364 university professors. They also discovered that the difficulty was greater for left-handers, particularly women [7]. These gender and handedness effects have been confirmed in successive studies [8] but the effect of gender has been shown to be age-modulated and sex difference has either not been found or not been reported in older adults in the study by Often and Hugdahl with a wider age range [3].

Women are more prone to left–right confusion compared with men and showing elevated rates either in accuracy or response speed [5,9,10]. On the other hands, women's reported performance is inconsistently correlated with their actual behavioural task performance [11] despite some studies reported a moderate correlation [12,13] and others reported no correlation [5,14]. Women's lower self-report ratings may be due to their compliance with sex stereotypes [5]. When behavioral tasks involve analyses, some research reveal sex differences [3,15]. However, other investigators have found no such differences [16]. As a result, the impact of gender on left–right discrimination remains an open question, with one possible explanation being that sex interacts with other variables like handedness.

Regarding handedness, it has been found that right-handers reported fewer difficulties compared to left-handers in LRD [4]. Moreover, left-handed men performed better than right-handed men on the BLRDT [17]. However, other studies found no noticeable effect of handedness [18]. It should be emphasized that left-hander's ratio did not reached greater than 15% in any reported study. Furthermore, most researches are

based exclusively on self-reports which have been shown to be inaccurate [5]. In the study that used an approximately balanced sample of left and right-handed persons, it was discovered that left-handers (41%) have the advantage both in detecting left hands and validating "left" propositions [11]. Additionally, Vingerhoets and Sarrechia (2009) found that handedness had no effect on performance on its own, but that greater manual preference strength and asymmetry were associated to higher performance [19].

Since the dawn of this issue, it was suggested that LRD is a developmental skill [9]. It wasn't until 2002, when Ofte and Hugdahl found the cognitive abilities component that it became well known. they stated that LRD performance is lowest (12%) among children under the age of eight. Performance was better (40%) in adolescents (12–13 years old) and older adults. Young adults (18–22) outperformed all other categories (60 %) by a substantial margin [3]. Furthermore, LRD performance in older individuals appears to follow the same downward pattern as spatial cognitive ability declined in elderly people [20]. As a result, it has been discovered that a student's academic curriculum has an impact on their left–right discriminating performance with medical students outperforming law and psychology students [21]. The fact that medical students are better at LRD and have better spatial abilities supports the theory that LRD and spatial cognitive ability are linked. Furthermore, medical students aspiring to be surgeons scored higher on the LRD than those aspiring to be general practitioners or medical physicians [22]. It was suggested that this improvement was due to future surgeons' more frequent use of spatial abilities than other medical students. Studies proposed that one component of LRD is visuo-spatial ability [23,24] but research failed to show a link between LRD and performance on a Mental Rotations Test or a navigation task in a 3D virtual maze [5,15]. Therefore, the nature of the visuo-spatial skills associated with good performance in LRD remains unknown. Additionally, as an attribution of words to RLD concept, regardless of sex, a negative association of LRD response time with visuo-spatial and verbal long-term memory was discovered, offering fresh insights into the link between cognitive skills and LRD performance [25]. Recent insights into the suggested cognitive mechanisms underlying right-left confusion were discussed by Tagami and Imaizumiin in their recently published paper. The authors proposed that it could be classified into visuo- verbal and verbo-visual processes and mental rotation based on a self-reported measure although their psychometric and behavioral indices might be distinct as they cross react with other factors such as cortical lateralization, handedness, and sex [23]. These relations need to be studied broader alongside the whole aspect of the mechanism of right-left confusion including visuo-verbal and verbo-visual processes and mental rotation [26]. From the previous point, we hypothesized that the disorders affect these pathways might affect the LRC rate and Attention-deficit/hyperactivity disorder (ADHD) was chosen with a number of diseases. Studies showed that ADHD is associated with weaker function and structure of prefrontal cortex (PFC) circuits, especially in the right hemisphere and it affects sound intensity response, showed a significant effect of handedness, and seems

to cause Atypical left-right balance of visuo-motor awareness in adult ADHD (combined type). These things seem to affect LRD also as mentioned in previous literature [27,28].

Furthermore, given the lack of consensus on what processes may drive LRC, recent research sought to include a question on strategy usage. An informal pilot questionnaire demonstrated that people may utilize numerous similar ways to pick between left and right. Such approaches may aid in determining if LRD is based on body position, verbal labelling, or basic perception. Furthermore, they investigated if certain techniques are associated to subjective LRD; they investigated whether specific methods were linked to greater or poorer performance evaluations. Including strategy use as an extra issue was beneficial; there was a distinct separation between those who used their body, notably their hands, to decide on left and right and those who did not [1]. The great majority of individuals who did not utilize their body said that they did not apply any overt method and "simply knew" left from right. The use of hands to differentiate left from right underlines the relevance of spatial body characteristics in LRD. However, this impact appears to be restricted to 42.9% of individuals. Those who did not use their hand evaluated their LRD skill significantly higher than those who did. It is probable that LRI is more internalized and automatic for those persons, and that relying on hand cues is more common in those who are inherently less clear about left and right [1].

In addition to the relationship between verbal labelling or lower level perception with LRD, there could be an association between horizontal body-centered orientation and LRD in the context of using the body in navigating left-right decisions. Gold et al. (1995) proposed that LRD is a defect in horizontal body-centered orientation and the authors offer a model in which such body-centered spatial orientation is represented by horizontal, vertical, and radial representation systems which explains the selectivity of the left–right identification (LRI) problem [29]. The evidence that LRD comes from a defect in body or its internal characteristics and not from external are rapidly increasing as it confirmed by Vingerhoets and Sarrechia (2009) who documented that body symmetry is linked to the ability to distinguish between left and right [19]. They discovered that having a stronger physiological asymmetry as evaluated by handedness, grip strength, and tactile sensitivity, is connected to having less left-right issues [19]. Moreover, recent research stated that the process appears to rely on a stored body representation rather than bottom-up sensory information and so as a result, even when this is not explicitly part of the job, they believe a top-down body representation is the main process in identifying left and right. In addition, the performance is enhanced when there is an external stimulus, in particular with a hand-related strategy [1].

Right-left confusion in medical practice may lead to iatrogenic mishaps and thus can be of serious concern with respect to the patient care. Hence, the purpose of this study was to assess the right-left discrimination (RLD) ability among medical students with the intention to investigate and introduce a new aspects that have never been studied before including life style factors, various disorders, childhood experiences and role of individual

differences and personality traits to unravel the relationships with RLC. Moreover, we explored whether such interactions could also affect performances in left–right discrimination using objective and subjective tests, and in the first place to assess the prevalence among this interesting and highly educated population and make a solid ground for further research.

Aims.

1. To determine medical students' self-awareness and ability to discriminate right from left; to identify characteristics associated with this ability and to identify any techniques and strategies used to aid discrimination.
2. To identify the prevalence of RLC among medical students in Mutah university.
3. To detect the relation between RLC and sociodemographic, and medical characteristics of the medical students.
4. To investigate the correlation between RLC and lifestyle factors and chronic intake of certain medications.
5. To find a correlation between RLC and various disorders) learning disabilities, ADHD, chronic diseases).

Subjects and Methods.

The cross-sectional study was conducted at Mutah University in Al-Karak governorate in southern Jordan, from October 2022 to March 2023. After approval from the institutional ethics review committee, the sample was raised from among Jordanian undergraduate medical students aged 17 years and above. A total of 636 medical students enrolled at Mutah university (female (N=358, 56.3%) and male (N=278, 43.7%) were recruited to participate in the current study using online-Google form self-questionnaire. The participants were categorized into 6 groups as follows: first year medical students (N= 179, 28.1%), second year medical students (N= 121, 19.0%), third year medical students (N= 132, 20.75 %), fourth year medical students (N= 57, 8.96%) , fifth year medical students (N= 92, 14.4%) and sixth year medical students (N= 55, 8.64%) . The age of the participants ranges between (17 – 24) years old with the mean age was (20.08) years old for female and (20.28) years old for male. The students further classified into 61 left-handed, 551 right-handed and 24 right/left-handed. After taking informed consent, data was collected using the online-self questionnaire and analysed using SPSS software (version 25). The p-values were considered statistically significant at *p < 0.05.

Results.

Our sample size was 636 medical students, with a mean age of 20.17 years old. Table (1) categorized the sample according to gender, study level and residence district. On the other hand, Table 2 shows the frequencies of each response option per question. It was found that 428 students (67.3%) answered very fast compared to 12 students (1.9%) who needed more than 4 second to answer. However, data showed that approximately one third of the students required 2-4 second (30.8%) as a response time.

Table 1. Shows a gender split of participants. 56.3% were female (358/636) and 43.7% were male (278/636). Students in the basic years (first to third) participated at a higher rate than students in the clinical years (fourth to sixth) and most participants were first year medical students.

Table 1. Shows a gender split of participants.

Sample size	636 participants out of 2519 students (25%)
Gender	**Females**: 358 participants (56.3%) **Males**: 278 participants (43.7%)
Year of study	**Basic years** 67.9% **Clinical years** 32.1%
Area of living	**Amman** 31.1% **Karak** 30.3% **Irbid** 11% **Other governorates** 27.6%

Table 2. Shows the frequencies of each response option per question.

			Left-right confusion		Total
			Yes	No	
Time needed to distinguish	Very fast (less than 2 sec.)	Count	13	415	428
		% Within have confusion	21.3%	72.2%	67.3%
	Average (2-4 sec.)	Count	41	155	196
		% Within have confusion	67.2%	27.0%	30.8%
	Slow (more than 4 sec.)	Count	7	5	12
		% Within have confusion	11.5%	0.9%	1.9%
Total		Count	61	575	636
		% Within have confusion	100%	100%	100.00%
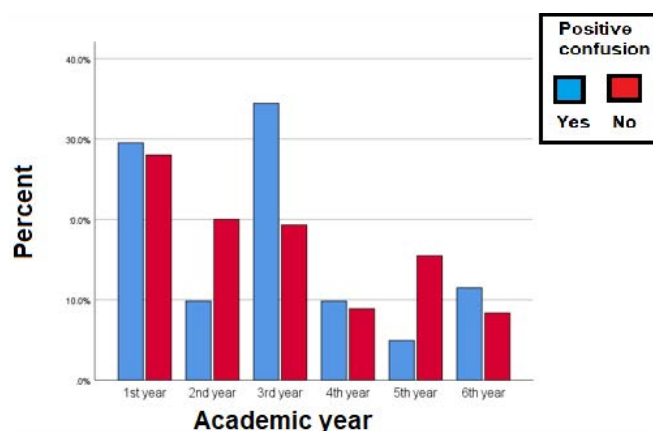
Figure 1. Shows the percentage of medical years and LRC.
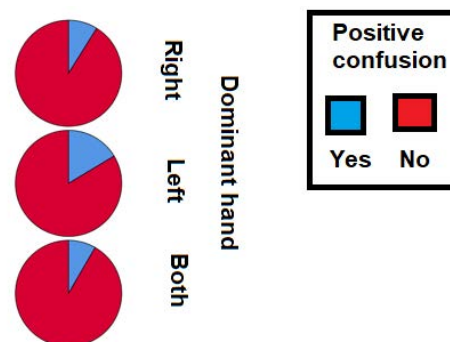
Figure 2. Shows that 86.6% of our sample is right-handed and 8.9% of them reported having confusion, while 9.6% of participants are left-handed and 16.4% of them have Left-right confusion, even the prevalence is higher among left-handed individuals, but the increase was statistically insignificant.

The methods used by the participants to distinguish between left and right varied. The most common method was raising the dominant hand (46.8%), while 37.4% of participants know without any method and 9% move their eye towards the direction as depicted in Figure 3.
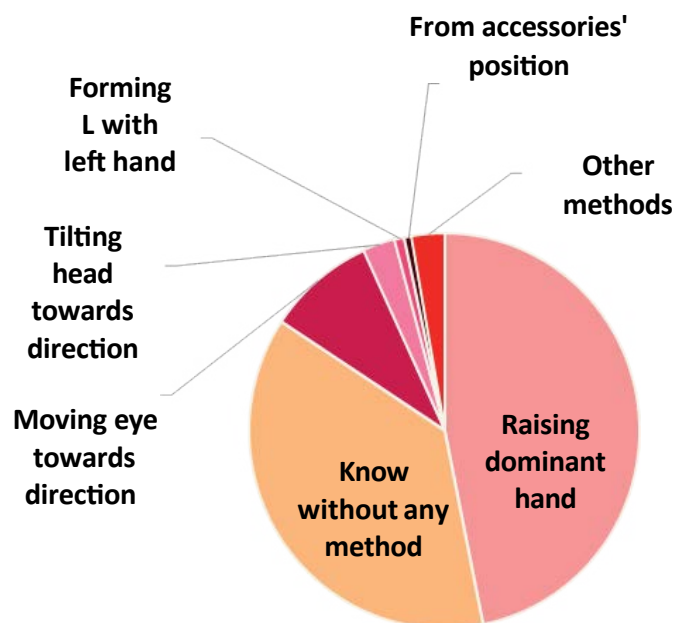

Figure 3: Methods for left-right differentiation.

Figure 2 Shows that 86.6% of our sample is right-handed and 8.9% of them reported having confusion, while 9.6% of participants are left-handed and 16.4% of them have Left-right confusion, even the prevalence is higher among left-handed individuals, but the increase was statistically insignificant.

In the present study it was found that (6.6%) of participants with confusion are taking insulin (anti-diabetic drug) (p value<0.001), and (6.6%) of them take hypnotics (p value=0.048), so there is a highly significant association between drugs and left right confusion. However, we did not find any relation between LRC and smoking (Figure 1). Moreover, 34.4% of LRC participants reported having difficulty communicating with others (p value 0.001), and the person having anxiety when asked to distinguish between right and left the rate of LRC increased (95.1). It was also found that there is a significant association between being diagnosed with ADHD and having left-right confusion, as the prevalence of ADHD in the whole sample was 1.7% while the percentage among students who have confusion was 8.2%, the (p-value <0.001) which is highly significant.

Furthermore, 27.9% of participants who have LRC were academically affected by having LRC, especially regarding anatomy and radiology courses as these subjects require the allocentric type of discrimination which is a harder skill.

Discussion.

Overall, our findings mostly align with previous literature regarding LRC with some novel findings that can be further investigated in the future. Firstly, concerning gender, we found a significant association between the female gender and LRC which is in accordance with multiple studies [11,14,30]. As

for handedness, our study found that Left-handed students experience LRC more than right-handed individuals, which does not align with the study on medical students in Ireland [28]. However, the relation that the current study found between LRC, and left-handedness was statistically insignificant and the total number of left-handed students in our sample was not high enough to suggest a strong link between the two factors. However, the absence of the link between handedness and LRC is supported by previous literature [13,16,18,22].

Most importantly, a statistically significant finding was found between students formally diagnosed with ADHD and LRC. After an extensive literature search, we can confidently say that this link is novel and has not been explored in any other study concerning LRC. Nevertheless, there are a few factors that must be accounted for to establish the link more strongly between LRC and ADHD, the first being that our study relied on a self-reporting questionnaire, so future research investigating this link should rely more on an objective measure of LRC like the Bergen left-right discrimination test (BLRDT) [12]. Moreover, the number of formally diagnosed ADHD patients in our sample is low, so a larger sample of ADHD patients is needed to investigate the link in a better way.

As it pertains to the population of the study being medical students, we tried to investigate existence of relation between LRC and the desired future specialty, and unlike previous studies investigating this link [22,31,32], our study showed an insignificant association between LRC and the future desired specialty. Furthermore, since medical school involves the skill of left-right discrimination, one of the items on the questionnaire explored the academic effect of having LRC on the students, and a significant number of students reported being negatively impacted by LRC on studying subjects like anatomy and radiology. Interestingly, these two subjects mostly require allocentric left-right discrimination which is harder to master [22] so the negative effect of LRC on students' performance in anatomy and radiology is justifiable. Altogether, with the help of the large sample size that participated in the study, we were able to effectively reach the aim of the study of finding the prevalence of LRC and its associated factors. We hope our study opens the door for future studies using more objective measurements and focused investigations.

Conclusion.

The prevalence in our sample was slightly lower than the prevalence reported in prior research, which was 14.7%, and this may be attributed to medical students' greater level of education and overall understanding when compared to the general population. In addition to that, we discovered a statistically significant link between gender, communication issues, and ADHD. The challenge now is where we go from here; since the relationship we discovered between ADHD and left-right confusion is novel, we need to carry further research to establish this unique association more solidly.

Acknowledgement

References.

1. van der Ham IJ, Dijkerman HC, van Stralen HE. Distinguishing left from right: A large-scale investigation of left–right confusion in healthy individuals. Quarterly Journal of Experimental Psychology. 2021;74:497-509.

2. Auer T, Schwarcz A, Aradi M, et al. Right–left discrimination is related to the right hemisphere. Laterality: Asymmetries of Body, Brain and Cognition. 2008;13:427-38.

3. Ofte SH, Hugdahl K. Right-left discrimination in male and female, young and old subjects. J Clin Exp Neuropsychol. 2002;24:82-92.

4. Hannay HJ, Ciaccia PJ, Kerr JW, et al. Self-report of right-left confusion in college men and women. Percept Mot Skills. 1990;70:451-7.

5. Jordan, K, Wustenberg T, Jaspers-Feyer F, et al. Sex differences in left/right confusion. Cortex. 2006;42:69-78.

6. Wolf SM. Difficulties in Right-Left Discrimination in a Normal Population. Arch Neurol. 1973;29:128-9.

7. Harris LJ, Gitterman SR. University Professors' Self-Descriptions of Left-Right Confusability: Sex and Handedness Differences. Perceptual 2nd Motor Skills. 1978;47:819-23.

8. Williams RJ, Standen K, Ricciardelli LA. Sex Differences in Self-Reported Right-Left Confusion by Adults: A Role for Social Desirability? Soc Behav Personal an Int J. 1993;21:327-32.

9. Elkind D. Children's discovery of the conservation of mass, weight, and volume: Piaget replication study. II. J Genet Psychol. 1961;98:219-27.

10. Gormley G, Brydges R. Difficulty with right-left discrimination: A clinical problem? CMAJ. 2016;188:98-9.

11. Constant M, Mellet E. The Impact of Handedness, Sex, and Cognitive Abilities on Left–Right Discrimination: A Behavioral Study. Front Psychol. 2018;9:405.

12. Thomas MS, Kini S, Mala K. Factors affecting the right and left discrimination ability among dental students. J. Educ. Ethics Dent. 2013;3:66-70.

13. McKinley J, Dempster M, Gormley GJ. 'Sorry, I meant the patient's left side': impact of distraction on left-right discrimination. Med. Educ. 2015;49:427-35.

14. Hirnstein M, Ocklenburg S, Schneider D, et al. Sex differences in left-right confusion depend on hemispheric asymmetry. Cortex. 2009;45:891-9.

15. Ocklenburg S, Hirnstein M, Ohmann H, et al. Mental rotation does not account for sex differences in left–right confusion. Brain and Cognition. 2011;76:166-71.

16. Grewe P, Ohmann HA, Markowitsch HJ, et al. The Bergen Left-Right Discrimination Test: practice effects, reliable change indices, and strategic performance in the standard and alternate form with inverted stimuli. Cogn Process. 2014;15:159-72.

17. Ofte SH. Right–left discrimination: Effects of handedness and educational background. Scand J Psychol. 2002;43:213-9.

18. Jaspers-Fayer F, Peters M. Hand preference, magical thinking and left-right confusion Laterality. 2005;10:183-91.

19. Vingerhoets G, Sarrechia I. Individual differences in degree of handedness and somesthetic asymmetry predict individual differences in left-right confusion. Behav Brain Res. 2009;204:212-6.

20. Techentin C, Voyer D, Voyer SD. Spatial abilities and aging: a meta-analysis. Exp Aging Res. 2014;40:395-425.

21. Ofte SH. Right-left discrimination: effects of handedness and educational background. Scand J Psychol. 2002;43:213-9

22. Gormley GJ, Dempster M, Best R. Right-left discrimination among medical students: questionnaire and psychometric study. BMJ. 2008;337:a2826.

23. Tagami U, Imaizumi S. Visual and Verbal Processes in Right-Left Confusion: Psychometric and Experimental Approaches. Front Psychol. 2021;12:753532.

24. Benton AL. Right-left discrimination. Pediatr Clin North Am. 1968;15:747-58.

25. Constant, M, Mellet, E. The impact of handedness, sex, and cognitive abilities on left–right discrimination: A behavioral study. Frontiers in psychology. 2018;9:405.

26. Tagami U, Imaizumi S. Visual and Verbal Processes in Right-Left Confusion: Psychometric and Experimental Approaches. Front Psychol. 2021;12:753532.

27. Braun CM, Delisle J, Suffren S, et al. Atypical left-right balance of visuomotor awareness in adult ADHD (combined type) on a test of executive function. Laterality. 2013;18:385-406.

28. Simões EN, Carvalho ALN, Schmidt SL. What does handedness reveal about ADHD? An analysis based on CPT performance. Res Dev Disabil. 2017;65:46-56.

29. Gold M, Adair JC, Jacobs DH, et al. Right-Left Confusion in Gerstmann' S Syndrome: A Model of Body Centered Spatial Orientation. Cortex. 1995;31:267-283.

30. Wolf SM, Angeles L. Right-Left Discrimination in a Normal Population. Arch Neurol. 1973;29:128-9.

31. Callahan D, Virgilio C, Tillou A, et al. Medical student hand preference, perceived dexterity, and impact of handedness on training. J Surg Res. 2016;204:114-7.

32. Bruce AN, Battista A, Plankey MW, et al. Perceptions of gender-based discrimination during surgical training and practice. Med Educ. 2015;20:25923.