RESEARCH ARTICLE

Characteristics of back pain in young adults and their relationship with dehydration: a cross sectional study [version 1; peer review: 1 approved with reservations, 1 not approved]

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Abstract

Background: Low back pain (LBP) is one of the major factors impairing the quality of life and is the most frequent cause of disability. Inadequate water intake is believed to be the predisposing factor for LBP particularly in the younger population. It is commonly seen that the incidence of LBP has been on the rise in people between 20-40 years of age. Thus, the basic aim of this study is to find a potential relationship between dehydration and LBP among young adults.

Methods: This cross-sectional study was conducted from the medical students and practicing doctors of 21-39 years from March-May 2019. Characteristics of pain along with the daily activities of patients were assessed. The severity was assessed by using the Graded Chronic pain scale (GCPS).

Results: Out of a total of 426 participants, 84.74% had LBP. Of these, 44.3% complained of having it more than once a week, with duration usually between 1-7 days. More than half of the patients had their routines disturbed because of this pain. Most of the participants complained of an episodic increase in summers. The majority (75.9%, n=274) drank 5-9 glasses of water a day, 64.5% of them were of opinion that their daily water consumption was enough, while 61.5% felt an association between dehydration and LBP. According to the GCPS, one-third of the population had chronic pain of grade I and the other third had grade IV.

Conclusion: It can be concluded that with the increase in the pace of life many individuals who belong to the above mentioned age group have a reduced intake of water, and due to a probable relationship between LBP and dehydration, this might be a reason of the

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Any reports and responses or comments on the article can be found at the end of the article.

increasing propensity of LBP in them. There is a need for further work in this regard.

Keywords

Back pain, Dehydration, Orthopedics, young adults

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Introduction

Low back pain (LBP) is a severely debilitating condition which not only impairs quality of life but also affects the productivity of an individual. In a study published by the World Health Organization (WHO), LBP was recognized as the leading cause of disability¹. Out of several causative reasons for LBP, some predominant ones are bad posture, obesity, and low physical activity². Back pain is emerging as a common complaint among the young population. A study conducted in Finland suggested it as a frequent problem in adults who are in their 30s, increasing in severity with age, evolving as a non-specific and radiating LBP³, which results in reduced productivity and absence from the workplace⁴. This is the reason why back pain has now emerged as a socioeconomic burden for both the individual and society as a whole⁵.

It is believed that inadequate water intake is a predisposing factor for many acute medical conditions and a potential association with some chronic conditions exists. Even a short duration of fluid restriction can lead to loss of body mass, reduced levels of alertness and concentration, tiredness, headaches, and back pain^{6,7}. Secondly, a potential relationship is believed to exist between dehydration and LBP, and this hypothesis is somewhat supported by a study conducted on the hydration of nucleus pulposus and its relation to intervertebral disc derangement. It states that the proper functioning of an intervertebral disc depends upon the nucleus pulposus. Around 80–88% of the nucleus pulposus is composed of water in early life, which gradually decreases with age. The study also reveals that dehydration and degeneration of nucleus pulposus are linked⁸. Suitable intake of water and maintaining adequate fluid intake is necessary as dehydration can affect the body's working capacity in many ways, one of which is by the reduction of optimum blood flow to the body's core muscle⁷. Also relevant is the role of adequate hydration on postural control, which has a pivotal role in our daily life, especially in our biomechanical wellness, which can become a cause of musculoskeletal problems including LBP if not functioning properly. A study published in the International Journal of Neuroscience suggested that adequate fluid intake may help in maintaining posture by preserving the muscles responsible for postural control⁹.

Water is a vital component for life, constituting 75% of the body weight of infants and 55% of the elderly¹⁰. Body fluid and electrolyte homeostasis is dependent on the balance between water intake and output, and around 5–10% is renewed daily¹¹. Moreover, it is essential to maintain an adequate fluid balance, in order to carry out our vital bodily functions¹². Regulation of water balance is mainly by passing it through urine, as described by Engell D *et al.*¹³. Daily fluid consumption of a human body mostly exceeds its daily requirement and this may change in accordance with the level of physical exertion, climate, and several other factors that affect the water balance¹⁴. The pace of modern life has generally led to it becoming more difficult to fulfill body water demands, which leads to dehydration¹⁵. Clinically the term dehydration denotes body water loss, either without salt or along with it¹⁵. It is observed that reduced thirst, reduced water intake, and thermal dehydration are the major predisposing factors for dehydration and the situation becomes worse when these factors are combined with reduced renal

water-conservation capacity, especially in older subjects¹⁶. This point was further emphasized in a study by Armstrong *et al.*, where it was concluded that around 1–2% of pre-exercise body mass is lost, even after a small amount of body water loss¹⁷.

Individuals of 20–40 years of age can be rightly termed as the workforce of our society. They are active in sports, aerobics, workouts, as well as other forms of physical activities, which makes them vulnerable to dehydration. Thus, the basic point on which this study is hinged upon is to establish if there is a potential relationship between dehydration and LBP among the individuals aged 20–40 in the general population; evidence of which may aid in alleviating the socioeconomic burden caused by LBP and improve quality of life.

Methods

This cross-sectional study was conducted at a medical college and a tertiary care hospital from March to May 2019. Proformas were distributed during lectures and workshops. The sample size was calculated using OpenEpi software version 3.01. Considering an estimated prevalence of LBP in young adults as 42.4%, confidence level of 95%, and a design effect of 1, the minimum sample size was kept as 376 and in the assigned time period of three months, a total sample of 426 was collected¹⁸.

Inclusion criteria was male and female medical students and young practicing doctors of 21–39 years of age. Those with a Vitamin D deficiency or a joint disease (if disclosed in history) were excluded. For vitamin D deficiency, the participants were sent to the institutional laboratory where blood samples (3–5 mL) were collected by an experienced phlebotomist in gel tubes. The serum was centrifuged at 3000 bpm for five minutes and stored at -80°C for subsequent analysis. Serum vitamin D levels were measured by commercially available enzyme linked immunosorbent assay (ELISA) kits (kit cat#KAP197 by DIA source immunoassays S.A. Belgium). Only ten patients had vitamin D deficiency (considered deficient when it was <12 ng/mL) out of 436¹⁹, which lead to the final sample size of 426. Data was collected through a pre-designed proformas in English made by reviewing similar studies from the literature and a short pilot study conducted over two weeks, with 50 participants^{20–25}. Variables included sociodemographics (age, gender, height, and weight), those related to pain (frequency, duration in the last six months, effect on sleep and routine activities, measures to relieve pain and visits to a health-care professional, and seasonal changes in pain), daily activities (driving, riding, consumption after strenuous activity, duration load of routine work, regular outdoor sports, and weight lifting or aerobic activities, and daily glasses of water drank). Patients' opinion about their daily consumption of water and the relation of back pain with dehydration was also enquired. The severity of pain was assessed by using the Graded Chronic pain scale (GCPS). It is a seven-item instrument designed to evaluate the severity of chronic pain based on its intensity and disability, with three subscales i.e. characteristic pain intensity score (calculated by combining the current pain intensities, with the worst and average pain status in the last six months), disability score (mean score of the interference of daily living by the pain), and disability points (calculated by combining the number of disability days and

the disability score). Based on these scores a combined score of pain and disability is computed, categorizing patients into five categories as Grade 0, no pain; grade I, low intensity and low disability; grade II, low disability and high intensity; grade III, high disability and moderate limiting intensity; and grade V, high disability with severely limiting intensity²². Participants filled the proformas themselves during their lectures and workshops (with proper guidance of investigators) and weight and height were measured by the principal investigator using a scale and measuring tape. They were informed that all information was to be kept confidential. Questionnaires were given an identification number. The data collection procedure was supervised by the principal investigator. Data were entered and analyzed using SPSS v. 22 (IBM Corp., Armonk, NY, US). Frequency and percentages were calculated for all variables, while the mean and standard deviation for continuous variables.

Results

Out of a total of 426 participants, 361 (84.74%) had back pain at least once in the last six months. The proportion of males and females was almost equal and the majority (41.3%, n=176) were in the age group of 21–30 years as shown in Table 1 (See underlying data²⁶). Height and weight distribution can also be seen in the table.

Most of the individuals (44.3%, n=160) complained of having back pain more than once a week, with a duration usually (in 68.1%) between 1–7 days. Of these, 59.0% (n=213) of the participants had their sleep affected by the pain, and 59.6% (n=215) were unable to do their routine activities because of this pain. Early measures to reduce pain included medicine (61.77%, n=223) and rest (43.76%, n=158), and more than half of those having back pain used pain killers regularly. The frequency of participants visiting a healthcare professional to consult about

this pain is fairly equal to those not doing so. Some seasonal variation in the pain was reported, with most complaining of an episodic increase in summers (36.8%, n=133), while many reported of the pain remaining the same in intensity throughout (36.0%, n=130) (Table 2; see underlying data²⁶).

The authors also asked about the daily activities of the participants: 57.1% (n=206) reported daily driving; 10.8% (n=39) daily riding; 13.3% (n=48) playing outdoor sports regularly; 4.4% (n=16) regular weight lifting; and 21.6% (n=78) performing regular aerobic exercises. Further data on participant activities are presented in Table 3 (See underlying data²⁶). When asked about their daily water consumption, most (75.9%, n=274) drank 5–9 glasses (of 250 ml) of water a day.

The majority (64.5%) of the participants were of the opinion that their daily water consumption was adequate, and most (61.5%) felt an association between dehydration and back pain (Table 4).

We applied the graded chronic pain scale to assess the severity of back pain where around one-third of the population had chronic pain of grade I and the other third had that of grade IV (Figure 1).

Discussion

The effects of dehydration appear in many aspects of our lives. The National Academies of Sciences, Engineering, and Medicine of the United States of America has recommended a daily water intake of ≥ 3.7 liters for males and ≥ 2.7 liters for females. If we break it down into the number of glasses, it can be appreciated that our participants fall a bit short according to that recommendation¹⁴. Considering the capacity of each glass of about 250 mL, most of the individuals with back pain in our study reported drinking 1.3–2.3 liters (5–9 glasses) of water daily. This is similar to the results by Lindeman RD *et al.*, in which the majority (71%) of the participants were found to be drinking at least six glasses of water daily²⁵.

Dehydration has emerged as a separate risk factor for back pain and as mentioned above, disc degeneration may be the mechanism behind it⁶. Interestingly back pain is a problem that was encountered more than once a week (44.3%) in our participants, the majority of whom were aged 21 to 30 years (58.7%), this data mirrors another study that states that back pain is common in the adolescent population, it is recurrent, increases with age and usually does not diminish with time. Most of the time it is regarded as a usual life experience²⁷. One possible reason may relate to the conclusions of Salminen JJ *et al.*, they found a high risk (Relative risk: 16, Confidence interval: 95%) of recurrent back pain in individuals with disc degeneration compared to the ones without it, and this degeneration of the disc starts at around the age of 20, increasing through young adulthood²⁸.

We have presented the results in accordance with the standard guidelines, with back pain of more than 30 days in the last 12 months labeled as chronic LBP, and pain up to seven days labeled as mild or no back pain^{23,24}. While grading the severity

Table 1. Sociodemographic characteristics of participants (n=426).

	Frequency	Percentage (%)
Gender		
Female	223	52.3
Male	203	47.7
Age groups		
21–30 Years	250	58.7
31–39 Years	176	41.3
Height (Mean=5.51±0.39)		
≤5.0 ft	68	16.0
5.1–5.9 ft	267	62.7
≥6.0 ft	91	21.4
Weight (Mean=68.17±13.67)		
≤80 kg	373	87.6
81–99 kg	43	10.1
≥100 kg	10	2.3

Table 2. Characteristics of back pain (n=361).

	Frequency	Percentage (%)
Frequency		
Once a week	58	16.1
More than once a week	160	44.3
Once a month	37	10.2
Occasional	106	29.4
Duration in the last six months		
0 days	29	7.8
1–7 days	246	68.1
8–30 days	31	8.6
More than 30 days, but not every day	41	11.4
Every Day	15	4.2
Problem falling asleep due to this pain		
No	148	41.0
Yes	213	59.0
Negative effect on routine activities		
No	146	40.4
Yes	215	59.6
Measures to relieve pain (Multiple choice)		
Take Medicine	223	61.77
Have Massage	103	28.53
Rest	158	43.76
Exercise	22	6.09
Herbal Treatment	7	1.93
None	20	5.54
Regular medication usage		
No	174	48.2
Yes	187	51.8
Seasonal changes in pain		
Episodes increase in summers	133	36.8
Episodes decrease in summers	1	0.3
Episodes increase in winters	94	26.0
Episodes decrease in winters	3	0.8
Remains the same throughout the year	130	36.0
Visit to a doctor or physiotherapist for this pain		
No	159	44.4
Yes	199	55.6

of chronic back pain we found that around one-third of the population had chronic pain of grade I (35%) and the other third had that of grade IV (32%).

In previous studies, the frequency of lower back pain was between 13–35% in males, and 17–38% in females^{29–32}.

Moreover, female dominance is noted in this case overall^{33,34}. Similarly, in this study, a slight female preponderance was noted. As explained in the literature, one cause of this might be a lower pain threshold in females, a better ability to perceive and discriminate the pain stimulus, poor tolerance to pain (as compared to males), or earlier onset of puberty^{35–37}. Moreover, being

Table 3. Activities of patients with back pain (n=361).

	Frequency	Percentage (%)
Driving		
No	155	42.9
Yes	206	57.1
Riding		
No	322	89.2
Yes	39	10.8
Consumption after strenuous physical work or workout		
Plain Water	276	76.5
Any meal	36	10.0
Tea	21	5.8
Fresh juice	14	3.9
Caffeinated beverage	7	1.9
Protein shake	7	1.9
Duration of routine work		
<8 hours	223	61.8
8–12 hours	104	28.8
>12 hours	34	9.4
Routine workload		
Light	170	47.1
Moderate	156	43.2
Strenuous	35	9.7
Playing outdoor sports regularly		
No	313	86.7
Yes	48	13.3
Regular weight lifting		
No	345	95.6
Yes	16	4.4
Regular aerobic activities		
No	283	78.4
Yes	78	21.6
Daily glasses of water		
≤4	47	13.0
5–9	274	75.9
≥10	40	11.1

Table 4. Attitude of participants about dehydration.

	Frequency	Percentage (%)
Do you feel your daily consumption of water is enough?		
No	128	35.5
Yes	233	64.5
Do you feel that there is an association between back pain and dehydration?		
No	139	38.5
Yes	222	61.5

Figure 1. Severity of chronic pain according to the graded chronic pain scale.

female has been identified as an independent predisposing factor for dehydration³⁸.

We have assessed the effects of back pain only in young adults and the difference in their daily activities. Further assessment should be performed in other age groups to evaluate the potential relationship of these activities with dehydration. Moreover, a comparative study across age groups, would allow the effect of aging to be determined. Our results cannot be generalized being collected from a single medical school and affiliated hospital, and from a single age group. We were also limited by the study design as the participants were not followed up to evaluate this back pain, especially the causes and outcomes.

Conclusion

In light of the results of the study, it can be concluded that with the increase in the pace of life many of the individuals who belong to the abovementioned age group have a reduced intake of water, and due to a probable relationship between LBP and dehydration, this might be a reason for the increasing propensity of LBP among them. There is an underlying need for further work in this regard.

Ethical approval and consent to participate

The study was assessed and approved by the Institutional Review Board of Department of orthopedic surgery,

Dow University of Health Sciences and Dr. Ruth Pfau Civil Hospital (Ortho/015/2019) Karachi, Pakistan. Written informed consent was obtained from all participants prior to participation.

Data availability

Underlying data

Figshare: Characteristics of back pain in young adults and their relationship with dehydration. <https://doi.org/10.6084/m9.figshare.11786457.v4>²⁶

This project contains the following underlying data:

- Untitled1.sav (Participant responses to study questionnaire)

Extended data

Figshare: Characteristics of back pain in young adults and their relationship with dehydration. <https://doi.org/10.6084/m9.figshare.11786457.v4>²⁶

This project contains the following extended data:

- Questionnaire Final.docx (Study questionnaire)

Data are available under the terms of the [Creative Commons Attribution 4.0 International license](#) (CC-BY 4.0).

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Aminu A. Ibrahim

¹ Department of Physiotherapy, Faculty of Allied Health Sciences, College of Health Sciences, Bayero University Kano, Kano, Nigeria

² Department of Physiotherapy, Muhammad Abdullahi Wase Teaching Hospital, Hospital Management Board, Kano, Nigeria

Thank you for giving me the opportunity to review this manuscript. The manuscript is very interesting for aiming to explore the potential relationship between dehydration and low back pain among young adults. The reviewer appreciates the excellent work of the authors. The manuscript is well-written and clear. The background, objectives, design, methods, statistics, and discussion are clearly explained and justified. However, I have some observations/corrections as appended below.

Abstract:

- Conclusion: "... who belong to the above mentioned age group...."
Please mention the age group.

Introduction:

- "A study published in the International Journal of Neuroscience suggested that...."
Correct as: "A previous research suggested that...."

Methods:

- "... tertiary care hospital from from March to May 2019."
"from" is replicated, delete one.
- "Proformas were distributed during lectures and workshops."
Delete the sentence. It is a replica in the subsequent paragraph.
- "Considering an estimated prevalence of LBP in young adults as 42.4%, confidence level of

95%, and a design effect of 1, the minimum sample size was kept as 376 and in the assigned time period of three months, a total sample of 426 was collected¹⁸."

Reference "18" was not placed correctly. Consider correcting as:

"Considering an estimated prevalence of LBP in young adults as 42.4%¹⁸, confidence level of 95%, and a design effect of 1, the minimum sample size was kept as 376 and in the assigned period of three months, a total sample of 426 was collected."

- "...enzyme linked immunosorbent assay (ELISA)...."
Correct as: "enzyme-linked immunosorbent assay (ELISA)".

Results:

- "The authors also asked about the daily activities of the participants: 57.1% (n=206) reported..."
Correct as: "Regarding the daily activities of the participants: 57.1% (n=206) reported..."
- "We applied the graded chronic pain scale to assess the severity of back pain where around one-third of the population...."
Correct as: "Assessment of severity of back pain with graded chronic pain scale revealed that around one-third of the population...."

Discussion:

- "...according to that recommendation¹⁴."
Correct as:according to this recommendation¹⁴.
- "One possible reason may relate to the conclusions of Salminen JJ et al., they found a high risk (Relative risk: 16, Confidence interval: 95%) of recurrent back pain in individuals with disc degeneration compared to the ones without it, and this degeneration of the disc starts at around the age of 20, increasing through young adulthood²⁸."

The above paragraph is not very clear. Please consider revising. Saminen JJ et al., should be written as "Salminen et al.,"

- "...between 13–35% in males, and...."
Delete the comma (,) after males.
-comparative study across age groups, would....
Delete the comma (,) after groups.
- The discussion regarding your findings of the relationship between back pain and dehydration is scanty. I would like the author to discuss more on this.

Conclusions:

- The subheading "Conclusion" should be written as "Conclusions". Correct also for the abstract.
- "...abovementioned age group..."
As mentioned earlier, write the age group.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

No source data required

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Musculoskeletal physiotherapy, Low back pain, Knee pain, Motor control exercise, Patient education, Questionnaire translation and validation, Cross-cultural adaptation

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 14 Feb 2022

Muniba Mehmood, Dr. Ruth K. M. Pfau Civil Hospital, Karachi, Pakistan

Thank you so much for giving us your valuable time and reviewing our manuscript. Following are the responses to your comments and a newer version has been uploaded after making changes according to your suggestions.

Abstract:

- Conclusion: "... who belong to the above mentioned age group...."
Please mention the age group.

DONE

Introduction:

- "A study published in the International Journal of Neuroscience suggested that...."
Correct as: "A previous research suggested that...."

DONE

Methods:

- ".... tertiary care hospital from from March to May 2019."
"from" is replicated, delete one.

DONE

- "Proformas were distributed during lectures and workshops."
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DONE

- "....enzyme linked immunosorbent assay (ELISA)...."
Correct as: "enzyme-linked immunosorbent assay (ELISA)".

DONE

Results:

- "The authors also asked about the daily activities of the participants: 57.1% (n=206) reported..."
Correct as: "Regarding the daily activities of the participants: 57.1% (n=206) reported..."

DONE

- "We applied the graded chronic pain scale to assess the severity of back pain where around one-third of the population...."
Correct as: "Assessment of severity of back pain with graded chronic pain scale revealed that around one-third of the population...."

DONE

Discussion:

- "....according to that recommendation¹⁴."
Correct as:according to this recommendation¹⁴.

DONE

- "One possible reason may relate to the conclusions of Salminen JJ et al., they found a

high risk (Relative risk: 16, Confidence interval: 95%) of recurrent back pain in individuals with disc degeneration compared to the ones without it, and this degeneration of the disc starts at around the age of 20, increasing through young adulthood²⁸."

The above paragraph is not very clear. Please consider revising. Saminen JJ et al., should be written as "Salminen et al.,"

DONE

- "....between 13–35% in males, and...."
Delete the comma (,) after males.

DONE

-comparative study across age groups, would....
Delete the comma (,) after groups.

DONE

- The discussion regarding your findings of the relationship between back pain and dehydration is scanty. I would like the author to discuss more on this.

A PARAGRAPH HAS BEEN ADDED

Conclusions:

- The subheading "Conclusion" should be written as "Conclusions". Correct also for the abstract.

DONE

- "...abovementioned age group..."
As mentioned earlier, write the age group.

DONE

Competing Interests: None

Reviewer Report 07 September 2020

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Rodrigo Dalke Meucci

Faculdade de Medicina, Universidade Federal do Rio Grande, Rio Grande, Brazil

General comment:

- The objective of the manuscript was to establish whether there was a potential relationship

between dehydration and low back pain among individuals aged 20 to 40 years in the general population. Unfortunately, the methods are not adequate to answer such a relevant scientific question.

Specific comments:

- The exposure (dehydration), is inaccurate. The authors did not assess whether the respondents' water consumption was adequate. Instead, they report only about the subjects' self-perceived water intake.
- Medical students and young doctors are a specific group that do not represent the general population.
- The authors did not apply an adequate data analysis and the results are poorly described. There is not even a p-value or a confidence interval.
- The authors did not mention adjustment for confounding factors.

Is the work clearly and accurately presented and does it cite the current literature?

No

Is the study design appropriate and is the work technically sound?

No

Are sufficient details of methods and analysis provided to allow replication by others?

No

If applicable, is the statistical analysis and its interpretation appropriate?

No

Are all the source data underlying the results available to ensure full reproducibility?

No source data required

Are the conclusions drawn adequately supported by the results?

No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Epidemiology (musculoskeletal disorders)

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

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