RESEARCH ARTICLE

Characteristics of back pain in young adults and their relationship with dehydration: a cross sectional study [version 1; peer review: awaiting peer review]

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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 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 disability. Out of several causative reasons for LBP, some predominant ones are bad posture, obesity, and low physical activity. 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 LBP, which results in reduced productivity and absence from the workplace. This is the reason why back pain has now emerged as a socioeconomic burden for both the individual and society as a whole.

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. 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 linked. 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 muscle. 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 control.

Water is a vital component for life, constituting 75% of the body weight of infants and 55% of the elderly. Body fluid and electrolyte homeostasis is dependent on the balance between water intake and output, and around 5–10% is renewed daily. Moreover, it is essential to maintain an adequate fluid balance, in order to carry out our vital bodily functions. Regulation of water balance is mainly by passing it through urine, as described by Engell D et al. 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 balance. The pace of modern life has generally led to it becoming more difficult to fulfill body water demands, which leads to dehydration. Clinically the term dehydration denotes body water loss, either without salt or along with it. 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 subjects. 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 loss.

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 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 collected.

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 rpm 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 436, 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. 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 healthcare 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 intensity. Participants filled the pro formas 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 data). 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 participants visiting a healthcare professional to consult about back pain more than once a week, with a duration usually (in 61.5%) felt an association between dehydration and back pain (Table 2).

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

| Gender       | Frequency | Percentage (%) |
|--------------|-----------|----------------|
| Female       | 223       | 52.3           |
| Male         | 203       | 47.7           |

| Age groups   | Frequency | Percentage (%) |
|--------------|-----------|----------------|
| 21–30 Years  | 250       | 58.7           |
| 31–39 Years  | 176       | 41.3           |

| Height (Mean=5.51±0.39) | Frequency | Percentage (%) |
|--------------------------|-----------|----------------|
| ≤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) | Frequency | Percentage (%) |
|---------------------------|-----------|----------------|
| ≤80 kg                    | 373       | 87.6           |
| 81–99 kg                  | 43        | 10.1           |
| ≥100 kg                   | 10        | 2.3            |

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 recommendation. 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 daily.

Dehydration has emerged as a separate risk factor for back pain and as mentioned above, disc degeneration may be the mechanism behind it. 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 experience. 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 adulthood.

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. While grading the severity
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. Moreover, female dominance is noted in this case overall. 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. Moreover, being
Table 3. Activities of patients with back pain (n=361).

| Activity                                      | 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.

| Attitude                                        | 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           |
female has been identified as an independent predisposing factor for dehydration\textsuperscript{3}.

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. \url{https://doi.org/10.6084/m9.figshare.11786457.v4}\textsuperscript{3}

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. \url{https://doi.org/10.6084/m9.figshare.11786457.v4}\textsuperscript{3}

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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