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Study on the occurrence and factors contributing to lower back pain in Taif region adolescents, KSA

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Abstract

This study aimed to validate variables impacting the prevalence of low back pain (LBP) in adolescents, focusing on gender, age, exercise, sedentary activities, and dietary factors. A cross-sectional study with random sampling was conducted among adolescents aged 9 to 19 years, using a modified questionnaire based on the Oswestry and Roland-Morris LBP and Disability questionnaires. The response rate was 81.9%, with the highest LBP prevalence (87.5%) in 18-year-olds. Overall, 93.5% of participants reported experiencing back pain, particularly among those not actively involved in sports; notably, 63% led a sedentary life style. Of the subjects, 23.5% reported sleeping 6-8 hours, 29.5% went to the gym 2-3 days a week, and 30.6% consumed over 3 liters of water daily. Additionally, 45.2% maintained a diet rich in fruits and vegetables, while 26.1% consumed high-protein foods. A good breakfast routine was linked to significantly reduced LBP. Males (59.2%) reported higher LBP frequency than females. For relief, 48.8% of males sought medical help or took medication, while 34.4% relied on self-healing methods. The study underscored the associations between various factors and LBP in adolescents and school-age children.

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INTRODUCTION

Globally, LBP is considered a crucial and prominent cause of debility, having increased by 64% between 1990 and 2017, preventing many people from engaging in jobs and performing everyday activities. Besides skin, bone, and joint disorders, it is said to be the 3rd most common reason for visiting a physician. According to an estimate, more than 264 million individuals lost working days in a year, or about two working days for every full-time worker in America alone. Another estimate suggests that 80% of people will experience LBP at some point in their lives, across all age groups, from adolescents to adults. Each year, approximately $50 billion is spent due to LBP, and this figure may rise to over $100 billion. Extended

periods of television watching, obesity, a positive family history of LBP, a sedentary lifestyle, psychosocial difficulties, and sports participation have been reported as possible risk factors for juvenile LBP [1]. The incidence of LBP in individuals with a positive family history of LBP is around two times higher than in those without. More notably, it is reported that individuals with childhood LBP are at higher risk of experiencing LBP in adulthood. Ironically, standard diagnosis and management protocols for children with LBP have not yet been well developed or documented. The annual incidence of LBP symptoms in European adolescents is 24%. This condition is increasingly common among adolescents and adults alike, potentially affecting 70-80% of individuals under 20.A well-conducted epidemiological study was carried out at the Hospital of King Abdul-Aziz University, Jeddah, KSA, using a 1.5-T MRI system to scan all patients. The results showed that 17 out of 625 patients (2.7%) had a diagnosis of a treatable cause of low LBP or sciatica other than disc disease [4]. Although many studies have been conducted in Saudi Arabia, no single study has targeted the age group from 9 to 19 years. We have chosen this age bracket to correlate various parameters with age-related factors. Thus, the primary objective of the present study is to validate the prevalence of LBP and determine appropriate therapies for relieving LBP in adolescents, considering gender, age, exercise practices, sedentary activities, and daily nutritional consumption.

Materials and Methods

The present epidemiological research was conducted from November 2018 to March 2019, following the principles of a cross-sectional and random sampling study in primary and secondary schools in the Taif region, KSA. The study was approved by the College of Pharmacy research committee.

All school children aged 9 to 19 years attending primary and secondary schools in the city of Taif (a total of six schools, including 3 boys' and 3 girls' schools) were included in the study. This selection was based on the availability of access to government-based schools according to the norms of the Ministry of Education, Kingdom of Saudi Arabia. A modified questionnaire was prepared with the help of the Oswestry and Roland-Morris LBP and Disability questionnaires [6]. Data collection began in November 2018 using random sampling. Teachers assisted by sending one student at a time to complete the questionnaire. Before completing the questionnaire, each student was given a clear explanation of the objectives and then participated in a structured interview with the researcher, lasting approximately twenty minutes per student.

The researchers followed a standardized protocol for data collection and procedures. Initially, a pretest was conducted with 30 subjects to check the reliability and validity of the questionnaire. The entire process was free from bias; however, minor technical errors among the measuring team were not quantified. To ensure quality control, 10% of the school children's samples were measured in duplicate. Schools were informed and agreements were made for their participation in the research, with students attending a brief lecture and receiving a consent form. Parental consent was required for students under 18 years old.

A probability random sampling design was chosen for the study. To determine the number of adolescents in Taif city, we visited primary and secondary schools, taking into account different shifts and grade levels. Afterwards, schools were randomly selected using a strategy that accounted for the proportionality of the regions. An illustration is provided as **Figure 1**.

Inclusion Criteria

- Age: 9 to 19 years
- Non-specific LBP
- Sub-acute LBP
- Recurrent LBP (LBP ranging from 2 to 12 weeks) or LBP for 2 weeks in the past year
- Chronic non-specific LBP (≥ 12 weeks)

Exclusion Criteria

- Under age 9 and above age 19 years
- Spinal/manipulative therapy
- Treatment from therapists for LBP
- Metabolic or mentally challenged
- Benign joint hypermobility syndrome

Variables

- Age

- Gender
- Active life sport
- Non-active hours
- Active time
- Sleep duration
- Exercise days
- Backpack weight
- Lifetime back pain frequency
- Back pain consistency
- Back pain occasion
- Back pain relief
- Daily water consumption
- Diet
- Breakfast routine

the questionnaire, 19 (6.4%) refused or submitted an incomplete questionnaire, 14 (4.8%) were excluded due to parental consent issues, 3 (1%) were excluded after being found to have permanent postural disability, 9 (3%) were dropped due to being under the age limit, and 8 (2.7%) were excluded for being over the age limit of 19. Thus, a final total of 240 schoolchildren responded to the questionnaire, comprising 125 males (52.1%) and 115 females (47.9%).

The age group ranging from 9 to 11 years reported no LBP, while an increase in LBP occurrence was observed in the 12 to 19 age range, with maximum responses of 84.2%, 87.5%, and 85.7% at the ages of 17, 18, and 19 years, respectively. A total of 93.5% of adolescents reported suffering from back pain without active life sports, whereas only 40.2% reported developing LBP while engaging in active life sports. On the other hand, 63% of adolescents who spent 8 or more hours in sedentary activities

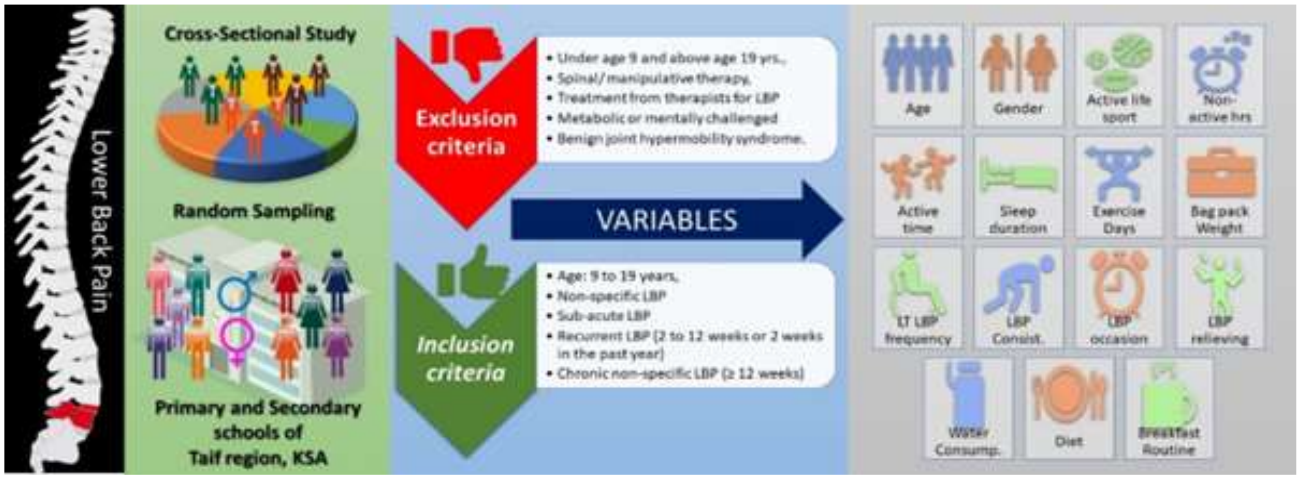

Figure 1 Methodology followed, in a nutshell

Plan for Data Analysis & Interpretation

Data were entered twice into IBM SPSS Statistics software (version 23) for analysis using descriptive methods of distribution, as well as absolute and relative frequencies for categorical variables. The study employed the chi-square test for bivariate analysis and hierarchical analysis for multivariate binary logistic regression. Adjusted odds ratios were calculated using a 5% significance level and a 95% confidence interval.

Results

A total of 293 schoolchildren were enrolled in the study. Of these, 240 individuals (81.9%) completed

such as watching television, playing video games, and using mobile devices experienced LBP. Subjects who slept for 6-8 hours (23.5%) reported less LBP compared to those who slept for less or more than 8 hours. Notably, candidates who attended the gym or exercised 2-3 days a week reported a lower occurrence of LBP (29.5%) compared to those who exercised every day (30.8%), more than 3 days a week (38.7%), or were not interested in gym or exercise (65.1%).

Students who carried backpacks weighing 10 kg or more had aggravated LBP (33.3%). All the results are shown in **Table 1**, along with Chi-square and significance values.

Table 1 Gender-based distribution of absolute and relative frequencies of age range, sports practice, sedentary activities, and weight load, with Chi Square (χ2) and p values, in relation to LBP

Variables	Response	Gender				LBP				Chi Square (χ2) and p values depends on LBP occurrence (Y/N)
		Male (n = 125)		Female (n = 115)		Yes		No		
		f_i	n_i	f_i	n_i	f_i	n_i	f_i	n_i	
Age (years old)	9	0	0	1	12	0	0.0	1	100.0	χ2 = 6.458 p = 0.03
	10	3	3.8	3	3.5	0	0.0	6	100.0	
	11	2	2.5	3	3.5	0	0.0	5	100.0	
	12	7	8.8	2	2.3	3	33.3	6	66.7	
	13	10	12.5	7	8.0	7	41.2	10	58.8	
	14	12	15	16	18.4	14	50.0	14	50.0	
	15	14	17.5	27	31.0	23	56.1	18	43.9	
	16	29	36.3	28	32.2	35	61.4	22	38.6	
	17	23	28.8	15	17.3	32	84.2	6	15.8	
	18	15	18.8	9	10.4	21	87.5	3	12.5	
	19	10	12.5	4	4.6	12	85.7	2	14.3	
Active Life in sports	No	38	30.4	70	60.9	101	93.5	7	6.5	χ2 = 6.660 p = 0.01
	Yes	87	69.6	45	39.1	53	40.2	79	59.8	
Non-Active Hrs.	2-4 Hrs.	3	2.4	1	0.8	1	25.0	3	75.0	χ2 = 5.900 p = 0.04
	4-6 Hrs.	21	16.8	23	20	12	27.3	32	72.7	
	6-8 Hrs.	34	27.2	12	10.4	28	60.9	18	39.1	
	>8 Hrs.	67	53.6	79	68.7	92	63.0	54	37.0	
Time spend in sleeping	2-4 Hrs.	34	27.2	18	15.7	18	34.6	34	65.4	χ2 = 11.030 p = 0.01
	4-6 Hrs.	51	40.8	61	53	45	40.2	67	59.8	
	6-8 Hrs.	24	19.2	27	23.4	12	23.5	39	76.5	
	>8 Hrs.	16	12.8	9	7.8	18	72.0	7	28.0	
weightlifting exercises or gym in a week	Everyday.	9	7.2	4	3.5	4	30.8	9	69.2	χ2 =0.037 p = 0.45
	>3 Days	25	20	6	5.2	12	38.7	19	61.3	
	2-3 Days.	32	25.6	12	10.4	13	29.5	31	70.5	
	NI	59	47.2	93	80.9	99	65.1	53	34.9	
Bag pack weight carrying to school	3-5 Kg	42	33.6	34	29.6	4	5.3	72	94.7	χ2 = 0.311 p = 0.63
	>10 Kg	20	16	31	26	17	33.3	34	66.7	
	5-10 Kg	54	43.2	47	40.9	2	2.0	99	98.0	
	No bag	9	7.2	3	2.6	1	8.3	11	91.7	

Adequate water consumption also showed a significant reduction in LBP, with only 30.6% reporting LBP among those consuming more than 3 liters of water daily, compared to 48.4% of those consuming less than 1 liter, 48.5% of those consuming 1-2 liters, and 28.4% of those consuming 2-3 liters. In terms of diet, subjects who consumed processed foods (77.6%) showed a higher occurrence of LBP compared to those consuming chocolate and sugar (75%) and vegetables and fruits (45.2%). High protein consumption was associated with a lower occurrence of LBP (26.1%). A breakfast routine also showed a non-significant reduction in LBP, with 23.5% reporting LBP among those who ate breakfast daily, compared to 80.6% among those

Table 2 Gender-based distribution of water consumption and diet frequencies in relation to LBP using Chi Square (χ2) and p-values

Variables	Response	Gender				LBP				Chi Square (χ2) and p values depends on LBP occurrence (Y/N)
		Male (n = 125)		Female (n = 115)		Yes		No		
		f_i	n_i	f_i	n_i	f_i	n_i	f_i	n_i	
Daily Water Consumption	Less than 1 Liter	34	27.2	30	26.1	31	48.4	33	51.6	χ2 = 7.628 p = 0.002
	2-3 Liters	42	33.6	32	27.8	21	28.4	53	71.6	
	1-2 Liters	31	24.8	35	30.4	32	48.5	34	51.5	
	>3 Liters	18	14.4	18	15.7	11	30.6	25	69.4	
Diet	Protein	27	21.6	19	16.5	12	26.1	34	73.9	χ2 = 1.357 p = 0.6
	Chocolate and sugars	55	44.0	41	35.7	72	75.0	24	25.0	
	Processed or instant Food	29	23.2	38	33.0	52	77.6	15	22.4	
	Vegetables and fruits	14	11.2	17	14.8	14	45.2	17	54.8	
Breakfast Routine	Mostly daily	23	18.4	45	39.1	16	23.5	52	76.5	χ2 = 0.352 p = 0.7
	Mostly skipped	54	43.2	13	11.3	54	80.6	13	19.4	
	Sometimes	32	25.6	48	41.7	42	52.5	38	47.5	
	I don't like breakfast	16	12.8	9	7.8	21	84.0	4	16.0	

who mostly skipped breakfast, 52.5% who ate breakfast sometimes, and 84% who did not like breakfast. All statistical parameters are illustrated in **Table 2**.

Lifetime LBP frequency was higher in males compared to females. Only a few males reported no pain (5.6%), while they reported pain 1-2 times (59.2%), 2-5 times (20.8%), or more than 5 times (14.4%). In contrast, more females reported no pain (42.6%), with 32.2% experiencing pain 1-2 times, 20% experiencing pain 2-5 times, and 5.2% experiencing pain more than 5 times. LBP consistency over days was also higher in males, with 49.6% reporting pain for 2-3 days, 23.2% for 3-5 days, and 21.6% for more than 5 days. Among females, 36.5% reported pain for 2-3 days, 16.5% for 3-5 days, and 4.3% for more than 5 days. In LBP-specific scenarios, 68% of males reported pain while lifting weights or playing, compared to45.2% of females. For LBP treatment, 48.8% of males consulted a physician or took medication, compared to only 8.7% of females. More females (30.4%) opted for exercise to relieve LBP compared to males (11.2%). Additionally, 34.4% of males relied on self-healing compared to 18.3% of females. All data and statistical parameters are illustrated in **Table 3**.

For the age range of 9-14 years, the odds ratio at 95% CI was adjusted to 1, while for ages 14-19, it was adjusted to 1.2, ranging from 1.04 to 1.15, with all results found to be significant ($p<0.03$). For males, the odds ratio at 95% CI was adjusted to 1, whereas for females, it was adjusted to 1.32, ranging from 1.11 to 1.36, with significant values ($p<0.03$). The odds ratio for lifetime back pain frequency at 95% CI was adjusted to 1.31, ranging from 0.86 to 1.96, with significant values ($p<0.002$). For relieving LBP through therapy, the odds ratio

Table 3 Distribution of absolute (fi) and relative frequencies (ni) of occurrence, consistency, number of times of backpain in reference to gender with Chi Square (χ2) and p values

Variables	Response	Gender				Chi Square (χ2) and p values
		Male (n = 125)		Female (n = 115)		
		f_i	n_i	f_i	n_i	
Lifetime LBP Frequency	Never	7	5.6	49	42.6	χ2 = 6.763 p = 0.03
	2-5 times	26	20.8	23	20.0	
	1-2 times	74	59.2	37	32.2	
	>5 times	18	14.4	6	5.2	
LBP consistency	Never	7	5.6	49	42.6	χ2 = 10.40 p = 0.01
	3-5 days	29	23.2	19	16.5	
	2-3 days	62	49.6	42	36.5	
	>5 days	27	21.6	5	4.3	
LBP occasion	Never	7	5.6	49	42.6	χ2 = 8.833 p = 0.002
	Sleeping	21	16.8	11	9.6	
	Playing/Lifting Weight	85	68.0	52	45.2	
	Sitting	12	9.6	3	2.6	
Relieve LBP Therapy	Never	7	5.6	49	42.6	χ2 = 7.680 p = 0.02
	Physician/ Medication	61	48.8	10	8.7	
	Exercise	14	11.2	35	30.4	
	Self-healing	43	34.4	21	18.3	

Table 4 Odd ratio or 95% confidence Interval of Variables with their categories

Variables	Categories	p value	Adjusted OR / CI 95%
Age range	9 -14 years	0.03	1.00
	14- 19 years		1.12 (1.04 – 1.15)
Gender	Male	0.03	1.00
	Female		1.32 (1.11 – 1.36)
LBP Frequency		0.03	1.00
LBP consistency		0.01	1.00
LBP occasion		0.002	1.31 (0.86 – 1.96)
Relieve LBP Therapy		0.02	1.51 (1.02 – 2.26)

at 95% CI was adjusted to 1.51, ranging from 1.02 to 2.26, with significant values (p<0.02) (**Table 4**).

Discussion

The affliction of LBP affects 70–80% of the adult population at least once in their life and is usually not presented as an isolated event. LBP and its consequences in adult life are influenced by a range of genetic and environmental factors. Both shared and non-shared aspects of exposure contribute to reported occurrences of LBP. Adolescents who experience LBP are more likely to have long-term pain in adulthood, as studies show that those who had LBP at 14 are more prone to future pain compared to those without early life episodes [8].

Over the last twenty years, various factors such as socioeconomic status, genetics, daily activities, and psychosocial conditions have been linked to lower back pain in adolescents. Age is considered of prime importance in this study, as associated factors of LBP and its occurrence have shown variation across age groups. In this study, the age group of 17-19 years has reported increased LBP with the maximum response of 84.2%-87.5%. This particular age range was found to be more affected

due to various hormonal changes, psychological changes, and muscle and bone development. Hormonal development occurs during puberty, and research has shown a strong correlation between sex hormone secretion and each stage of puberty in both boys and girls [9]. Hormones play a key role in pain perception, as confirmed by a study based on hormone replacement therapy, which suggests a role in the development of LBP in postmenopausal women. Pain perception varies between males and females during their reproductive years. In summary, it can be concluded that the hormonal changes occurring during puberty have a definite role in our perception of pain.

It is important to prioritize physical activity for preventing and managing mild LBP. The simplified aspect of the study overlooks the U-shaped curve relationship between activity level and LBP risk. In the present study, 93.5% of adolescents reported having back pain with no active life in sports, whereas only 40.2% reported LBP despite having active life sports. Another aspect shows that 63% of adolescents spending 8 hours or more in non-activity, such as sedentary lifestyles with television, video games, and mobiles, reported LBP. A sedentary lifestyle is a major cause of back pain, as the immobility of joints leads to poor posture, which negatively impacts spine health [10].Subjects getting 6-8 hours of sleep (23.5%) reported less LBP compared to those sleeping more than 8 hours. Sleep enhances bone formation and recovery of the spine and synovial fluid [12]. Candidates going to the gym or exercising 2-3 days a week reported less LBP occurrence (29.5%) compared to those going every day (30.8%). This can be attributed to more exertion on the back by daily gym activity. On the other hand, the occurrence of LBP increased to 65.1% for subjects not going to the gym at all. Thus, it can be concluded that doing weight exercises for 2-3 days is better than a more rigorous or less strenuous regime [14]. In youngsters, going to the gym and performing muscle training without adequate supervision may be a primary cause of LBP.

Backpack weight is also one of the major factors correlated with LBP, as carrying too much unbalanced weight causes intense LBP [15]. There is significant variation in the average backpack load across studies, with the majority indicating that students exceed the recommended limits. The use of heavy and unstable backpacks has been suggested as a significant cause of high rates of lower back pain in school-age children, with mild lower back pain reported in 65% of youngsters. The logic of unnecessary school bag load leading to LBP is accepted by many health associations. Many health organizations recommend limiting the bag load to 10-15% of the child's body weight [16]. In the present study, subjects going to school with a backpack of 10 kg or more reported aggravated LBP by 33.3%.

Approximately 80% of body fluid is water, which is a necessary constituent of cerebrospinal fluid (CSF) and synovial fluid. Dehydration is a significant factor in causing herniated discs, as it leads to a decrease in disc water content, which is associated with spinal disc degeneration. Disc degeneration results in fissures forming in its fibrous outer ring, leading to the leakage of cerebrospinal fluid. As the inner core weakens and shrinks, it becomes more stressed, ultimately leading to disc bulging or herniation. The common advice from health professionals is to drink a minimum of eight 8-ounce glasses of water a day. An individual's water requirements primarily rely on factors such as gender, weight, environment, and activity level [17]. In the present study, appropriate water consumption also showed a significant reduction in LBP to 30.6% (>3 liters).

High LBP occurrence was observed in subjects consuming processed food (77.6%), possibly due to increased salt content and added MSG, leading to symptoms like pressure, burning, numbness, or mild pain known as Chinese Restaurant Syndrome. Candidates with an average consumption of chocolate and sugar (75%) and less protein intake have shown LBP, which may be due to obesity or similar problems. On the other hand, 45.2% of candidates consuming vegetables and fruits reported lesser LBP.

In general, healthy conditions and an adequate intake of vegetables and fruits help maintain appropriate levels of essential micronutrients, such as vitamin K. Low consumption of the required nutrients increases the risk of fractures and lower bone mass.Advanced Glycation End-products (AGEs) are proteins or lipids (fat-like substances) with an outer coating of sugars, which eventually damage their function. Research has proved that a diet high in heat-processed foods,

including fried and heavily processed foods, plays a role in AGE formation. The enhanced development of AGEs over time causes the breakdown of tissues in the body, leading to increased inflammation, subsequent disc degeneration, and other degenerative diseases, including Alzheimer's, atherosclerosis, and diabetes [18]. A high-protein diet has been associated with low LBP occurrence (26.1%), possibly due to the near-accurate composition of protein assimilation inside the body. Research suggests that diets rich in protein and low in carbohydrates tend to yield greater effectiveness, especially for short-term weight loss. Diets containing protein levels exceeding 1.4 g·kg−1·d−1 and carbohydrate intake below 150 g/d have been observed to promote weight and fat reduction while minimizing the loss of lean mass, in contrast to carbohydrate-based diets [19].

Although protein diets appear beneficial during periods of short-term weight loss, long-term compliance and the effect on body weight are still controversial. Breakfast routine also showed a non-significantly reduced LBP (23.5%) among those who mostly eat breakfast, compared to those who mostly skipped (80.6%), sometimes ate (52.5%), or didn't like (84%) breakfast. Early breakfast rejuvenates and repairs the body by increasing anabolic activity. The vertebral discs are maintained and repaired by the nutrients provided by breakfast. This explains why candidates who skipped breakfast had increased LBP compared to those who did not [20].The evident constraint of the present study was the cross-sectional nature of the data collected. The differences in age and gender were assumed, but other factors like genetics, environment, and activity level could also impact the result. A key limitation in past studies on treatable lower back pain is the subjective nature of mild to moderate pain and the necessity to depend on participant recollection. To address this impact, the questionnaire's reliability and validity were evaluated before the study. Furthermore, given the subjective nature of pain, the sole valid method of pain assessment is personal recollection.

Conclusion

The results obtained from the study revealed a prevalence of symptoms reported in LBP, predominantly among male adolescents aged 12-19 years, with more intensified responses in the age group of 16-19 years, particularly in those who were not involved in active sports and had a sedentary lifestyle. Adolescents who had appropriate sleep of 6-8 hours, exercised 2-3 days a week, carried a low-weight backpack, consumed adequate water, vegetables, fruits, and a high-protein diet, and had regular breakfast showed lesser frequency and intensity of back pain. Males were found to be more prone to LBP in comparison to females. In the Taif region, KSA, the most common method for treating back pain was self-healing, with conservative management through medications being used in some cases. Females were found to practice physiotherapy exercises more consistently than males. The utilization of such data, including its derived forms, can have a significant influence on understanding variable relationships and provide valuable components for implementing measures aimed at enhancing the well-being of adolescents and promoting a healthy lifestyle.

Recommendations

Study results gained by the present study can be applied to other geographical regions in Saudi Arabia to target the same or different age groups. Results obtained in the study also can improve the measures aimed for the care of back pain in school kids and adolescents. In the future, further study can be done in correlation to present variables with different psychological and physical variables.

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Ethical Approval

The study was approved by the College of Pharmacy research committee (No. 2017/TU/ Pharmacy/04).

Author Contribution

Author made substantial contributions to the conception, design, acquisition, analysis, or interpretation of data for the work. He was involved in drafting the manuscript or revising it critically for important intellectual content. Authors gave final approval of the version to be published and agreed to be accountable for all aspects of the work, ensuring its accuracy and integrity.

Conflict of Interest

The authors declare no conflict of interest, financial or otherwise.

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