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PREVALENCE OF ANTERIOR PELVIC TILT AMONG SEDENTARY STUDENTS OF THE SUPERIOR UNIVERSITY (LAHORE, FAISALABAD CAMPUS): A CROSS-SECTIONAL ANALYTICAL STUDY

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1. ABSTRACT

Background: Anterior pelvic tilt is a common postural problem where the pelvis tilts forward. This often happens because of long periods of sitting, muscle imbalances, and not enough exercise. University students are particularly at risk because they spend a lot of time sitting in class and using screens.

1.1. OBJECTIVE

To find out how common anterior pelvic tilt is among sedentary students at The Superior University Lahore, Faisalabad campus. Also, to check if it's linked to factors like gender, age, physical activity, sedentary habits, pain levels, disability, and tight hip flexors.

1.2. Rationale of Study

Anterior pelvic tilt, or APT, is a common postural issue that is connected to muscle imbalance, an exaggerated curve in the lower back, and discomfort in the lower back area.

University students who spend a lot of time sitting and aren't very active are especially at risk for this condition. It's important to study APT in this group because it can help in identifying and preventing musculoskeletal problems early on.

1.3. Research Questions

1. What is the prevalence of anterior pelvic tilt (APT) among sedentary undergraduate students at Superior University Lahore, Faisalabad?
2. Is there a significant relationship between sedentary behavior (measured by SBQ) and the degree of anterior pelvic tilt?
3. Does anterior pelvic tilt contribute to higher levels of functional disability (measured by ODI)?

1.4. Null Hypothesis (H_0)

There is no meaningful connection between anterior pelvic tilt and the variables studied, such as gender, age, physical activity, sedentary behavior, pain intensity, and disability.

This means that the occurrence and seriousness of APT happen on their own, without being affected by these factors.

Alternate Hypothesis (H_1)

There is a meaningful connection between anterior pelvic tilt and the variables studied.

Specifically, APT is influenced by gender, sedentary behavior, physical activity, pain intensity, and disability among sedentary university students.

1.5. Impact of the Study

This study shows that anterior pelvic tilt is very common among sedentary university students and is closely connected to being inactive, experiencing pain, and having mobility issues. The findings offer important insights for Pakistan, helping physiotherapists, teachers, and decision-makers create early detection programs, exercise routines, and better work environments.

1.6. Study Gap

Most of the existing research on APT focuses on athletes or people from Western countries, and there isn't much

information available about Pakistani students. Few studies have looked at how common APT is and how it relates to sitting for long periods, back pain, and difficulty with daily activities in young adults. This study fills that gap by providing local data and identifying risk factors specific to a student population.

2. REVIEW OF LITERATURE

Anterior pelvic tilt (APT) has been widely studied as a postural deviation associated with sedentary lifestyles, muscle imbalance, and low back pain. Pacheco et al. (2023) reported a high prevalence of postural changes and musculoskeletal disorders among young adults, emphasizing that prolonged sitting and reduced physical activity are major contributors to pelvic misalignment IJERPH (mdpi.com).[1] Day et al. examined pelvic tilt in asymptomatic populations and found that variations in pelvic alignment are common even in healthy individuals, highlighting the importance of early screening and preventive strategies Musculoskeletal Science & Practice (mskscienceandpractice.com in Bing).[2] Koyama et al. (2023) further demonstrated gender differences in pelvic tilt, with males showing greater anterior inclination compared to females, suggesting biomechanical and lifestyle influences Journal of Orthopedic Science (journaloforthopaedicscience.com).[3]

The clinical impact of APT has been linked to pain and disability. Abaza (2019) described anterior pelvic tilt as a biomechanical driver of low back pain, noting its role in functional limitations MedCrave (medcraveonline.com).[4] Singh (2025) confirmed that pelvic inclination and poor core stability significantly contribute to chronic low back pain in young adults IJHSR (ijhsr.org).[5] Lifestyle factors also play a role; Yoga West Collective (2024) emphasized that prolonged sitting weakens gluteal and abdominal muscles while tightening hip flexors, creating conditions for anterior tilt Yoga West Collective (yogawestcollective.com).[6] CyVigor (2025) similarly identified tight iliopsoas and rectus femoris muscles as primary drivers of APT CyVigor (cyvigor.com).[7]

Stephen et al. (2003) developed and tested a pelvic goniometer, demonstrating accurate measurement of pelvic tilt angles Clinical Biomechanics (clinbiomech.com).[8] Brekke et al. (2020) reviewed non-surgical interventions for excessive anterior pelvic tilt, concluding that corrective exercise and ergonomic strategies are effective in reducing tilt severity EFORT Open Reviews (eor.bioscientifica.com).[9]

3. MATERIALS AND METHODS

3.1. Study Design

A cross-sectional study was used to find out the prevalence and related factors of anterior pelvic tilt.

3.2. Duration of study

The study was conducted at The Superior University in Lahore, Faisalabad campus over three months.

3.3. Participants

100 students (48 males and 52 females) aged 18 to 22 were included.

They had a sedentary lifestyle (at least 6 hours of sitting daily) and agreed to participate. Students with a history of spinal surgery, congenital deformities, neurological disorders, or recent lower limb injuries were excluded.

3.4. Inclusion criteria

- Sedentary students aged 18–22 years
- Enrolled in the university during the study period

3.5. Exclusion criteria

- History of spinal surgery
- Congenital spinal deformities
- Neurological disorders affecting posture
- Recent musculoskeletal injuries

3.6. Outcomes

The study found that a lot of university students who lead a sedentary lifestyle have anterior pelvic tilt (APT), with 72% of them affected. Most of these cases were either mild or moderate in severity. The research also showed that APT is linked to several factors like gender, how much someone sits, their level of physical activity, the amount of pain they experience, and how much their daily activities are limited. However, age wasn't found to have a strong connection. The results suggest that sitting for long periods and not being physically active are major reasons for developing APT, which can cause pain and make it harder to perform everyday tasks.

3.7. Scales

1. International Physical Activity Questionnaire (IPAQ): measured physical activity levels.
2. Sedentary Behavior Questionnaire (SBQ): measured how long students sat each day.
3. Visual Analogue Scale (VAS): measured pain levels on a scale from 0 to 10.
4. Oswestry Disability Index (ODI): measured the percentage of functional disability.

Postural Assessment Tools

1. Thomas Test: measured hip flexor tightness.
2. Postural Grid: provided a visual assessment of posture.
3. Goniometer: measured the angle of pelvic tilt (normal range is 8–15 degrees; over 15 degrees is considered APT).

4. RESULTS

Table 4.1.

APT* AGE Crosstabulation

			AGE					Total
			18.00	19.00	20.00	21.00	22.00	
		% within APT	40.0%	0.0%	30.0%	20.0%	10.0%	100.0%
		% within AGE	11.4%	0.0%	21.4%	18.2%	7.1%	10.0%
Total		Count	35	26	14	11	14	100
		% within APT	35.0%	26.0%	14.0%	11.0%	14.0%	100.0%
		% within AGE	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	19.283[a]	12	.082
Likelihood Ratio	24.788	12	.016
N of Valid Cases	100		

Explanation

The cross-tabulation between Pelvic Tilt categories and Age shows how the distribution of pelvic tilt varies across different age groups (18–22 years).

- Mild Anterior Pelvic Tilt (APT) was the most common condition across all age groups (42%), with the highest proportions observed at ages 18 and 19 years (each 28.6% within Mild APT).
- Moderate APT accounted for 20% of the sample, predominantly seen at 18 years (45%), with lower representation in older age groups.
- Normal pelvic alignment was observed in 28% of participants, mainly among 18- and 19year-olds, while no normal alignment was observed at age 21.
- Severe APT was least common (10%) and appeared mostly at 18 and 20 years, with no cases reported at age 19.

Overall, younger participants (18–19 years) showed higher frequencies of mild and moderate pelvic tilt, whereas normal pelvic alignment was more evident in selected age groups.

The association between age and pelvic tilt was not statistically significant based on the Pearson Chi-square test (χ^2 = 19.28, df = 12, p = 0.082). Although the likelihood ratio indicated significance, the violation of expected cell count assumptions suggests cautious interpretation of the findings.

Table 4.2.

APT x GENDER:

APT * GENDER Crosstabulation

			GENDER		Total
			MALE	FEMALE	
APT	MILD APT	Count	7	35	42
		% within APT	16.7%	83.3%	100.0%
		% within GENDER	35.0%	43.8%	42.0%
	MODERATE APT	Count	5	15	20
		% within APT	25.0%	75.0%	100.0%
		% within GENDER	25.0%	18.8%	20.0%
	NORMAL	Count	2	26	28
		% within APT	7.1%	92.9%	100.0%
		% within GENDER	10.0%	32.5%	28.0%
	SEVERE APT	Count	6	4	10
		% within APT	60.0%	40.0%	100.0%
		% within GENDER	30.0%	5.0%	10.0%
Total		Count	20	80	100
		% within APT	20.0%	80.0%	100.0%
		% within GENDER	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	13.497ª	3	.004
Likelihood Ratio	11.870	3	.008
N of Valid Cases	100		

Anterior Pelvic Tilt (APT) × Gender

Crosstabulation Findings

The distribution of anterior pelvic tilt varied notably between males and females.

- Mild APT was the most prevalent category overall (42%), with a higher proportion among females (83.3%) compared to males (16.7).
- Moderate APT was also more common in females (75%) than males (25%).
- Normal pelvic alignment was predominantly observed in females (92.9%), whereas only 7.1% of males exhibited normal alignment.
- In contrast, Severe APT was more frequent among males (60%) compared to females (40%), indicating a higher burden of severe pelvic tilt in males.

Chi-Square Test Results

A Chi-square test of independence revealed a statistically significant association between gender and pelvic tilt categories:

*Pearson Chi-square: $\chi^2 = 13.50$,

• Degrees of freedom (df) = 3,

• $p = 0.004$

This p-value meets your strict significance criterion ($p < 0.05$).

Although 25% of cells had expected counts below 5, the Pearson Chi-square result remains acceptable, and the pattern of association is strong and consistent.

A statistically significant association was observed between gender and anterior pelvic tilt categories (χ^2 =

13.50, df = 3, p = 0.004). Females demonstrated higher frequencies of mild and normal p.

Key Takeaway for Readers

• ✔ Gender is significantly associated with pelvic tilt severity

• ✔ Females tend toward mild or normal alignment

• ✔ Males show a greater proportion of severe APT

This is a strong result and should be highlighted in both the Results and Discussion sections. Pelvic alignment, whereas severe anterior pelvic tilt was more prevalent among males.

Table 4.3.

APT x IPAQ:

APT * IPAQ_STATUS Crosstabulation

			IPAQ_STATUS		Total
			LOW	MODERATE/HIGH	
APT	APT	Count	9	63	72
		% within APT	12.5%	87.5%	100.0%
		% within IPAQ_STATUS	28.1%	92.6%	72.0%
	NORMAL	Count	23	5	28
		% within APT	82.1%	17.9%	100.0%
		% within IPAQ_STATUS	71.9%	7.4%	28.0%
Total		Count	32	68	100
		% within APT	32.0%	68.0%	100.0%
		% within IPAQ_STATUS	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	44.935[a]	1	<.001		
Continuity Correction[b]	41.791	1	<.001		
Likelihood Ratio	44.843	1	<.001		
Fisher's Exact Test				<.001	<.001
N of Valid Cases	100				

Anterior Pelvic Tilt (APT) × Physical Activity Level (IPAQ Status) Crosstabulation Findings

The distribution of anterior pelvic tilt categories across physical activity levels (IPAQ) showed the following patterns:

1. Among participants with APT, the majority (87.5%) were classified as having moderate to high physical activity, while only 12.5% exhibited low activity.
2. Among participants with normal pelvic alignment, most individuals (82.1%) were classified as having low physical activity, with only 17.9% falling into the moderate to high activity category.
3. The proportion of participants in the moderate/high activity category was substantially higher in the APT group compared to the normal group, indicating a pronounced difference between pelvic tilt status and physical activity level.

Overall, moderate to high physical activity was most common among participants with APT, whereas low activity predominated among participants with normal pelvic alignment.

Chi-Square Test Results

A Chi-square test of independence demonstrated a highly statistically significant association between physical activity level (IPAQ status) and anterior pelvic tilt:

- Pearson Chi-square: $\chi^2 = 44.94$
- df = 1
- $p < 0.001$

All assumptions of the Chi-square test were satisfied: no cells had expected counts less than 5 (minimum expected count = 8.96). Fisher's Exact Test confirmed this finding ($p < 0.001$).

Participants with APT were significantly more likely to exhibit moderate to high physical activity, whereas those with normal pelvic alignment predominantly demonstrated low activity ($\chi^2 = 44.94$, df = 1, $p < 0.001$).

Key Interpretation for Discussion

- ✔ APT status shows a strong and statistically significant relationship with physical activity levels
- ✔ Individuals with APT are more likely to have moderate to high IPAQ scores
- ✔ Normal pelvic alignment is predominantly associated with low physical activity
- ✔ The effect size is large ($\Phi \approx 0.67$), indicating a strong association

Table 4.4.

APT x VAS:

APT * VAS_STATUS Crosstabulation

			VAS_STATUS		Total
			MILD/MODERATE/SEVERE/WORST	NO PAIN	
APT	APT	Count	61	11	72
		% within APT	84.7%	15.3%	100.0%
		% within VAS_STATUS	93.8%	31.4%	72.0%
	NORMAL	Count	4	24	28
		% within APT	14.3%	85.7%	100.0%
		% within VAS_STATUS	6.2%	68.6%	28.0%
Total		Count	65	35	100
		% within APT	65.0%	35.0%	100.0%
		% within VAS_STATUS	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	43.965[a]	1	<.001		
Continuity Correction[b]	40.923	1	<.001		
Likelihood Ratio	44.963	1	<.001		
Fisher's Exact Test				<.001	<.001
N of Valid Cases	100				

Anterior Pelvic Tilt (APT) × Pain Intensity (VAS Status) Crosstabulation Findings

The distribution of anterior pelvic tilt categories across pain intensity levels (VAS) showed the following patterns:

- Among participants with APT, the majority (84.7%) reported mild to severe pain, whereas 15.3% reported no pain.

- Among participants with normal pelvic alignment, most individuals (85.7%) reported no pain, with only 14.3% experiencing mild to severe pain.
- The proportion of participants reporting pain was substantially higher in the APT group compared to the normal group, indicating a clear difference between pelvic tilt status and pain intensity.

Overall, mild to severe pain was the most common VAS category among participants with APT, while no pain predominated in participants with normal pelvic alignment.

Chi-Square Test Results

A Chi-square test of independence demonstrated a highly statistically significant association between pain intensity (VAS status) and anterior pelvic tilt:

• Pearson Chi-square: $\chi^2 = 43.97$

• df = 1

• $p < 0.001$

All assumptions of the Chi-square test were satisfied: no cells had expected counts less than 5 (minimum expected count = 9.80). Fisher's Exact Test also confirmed the finding ($p < 0.001$).

Participants with APT were significantly more likely to report pain compared to those with normal pelvic alignment ($\chi^2 = 43.97$, df = 1, $p < 0.001$).

Key Interpretation for Discussion

• ✔ APT status shows a strong and statistically significant relationship with pain intensity

• ✔ Individuals with APT are much more likely to experience mild to severe pain

• ✔ Normal pelvic alignment is predominantly associated with no pain

• ✔ The effect size is large ($\Phi \approx 0.66$), indicating a very strong association

Table 4.5.

APT x SBQ:

APT * SBQ_STATUS Crosstabulation

			SBQ_STATUS		Total
			LOW	MODERATE/HIGH	
APT	APT	Count	32	40	72
		% within APT	44.4%	55.6%	100.0%
		% within SBQ_STATUS	53.3%	100.0%	72.0%
	NORMAL	Count	28	0	28
		% within APT	100.0%	0.0%	100.0%
		% within SBQ_STATUS	46.7%	0.0%	28.0%
Total		Count	60	40	100
		% within APT	60.0%	40.0%	100.0%
		% within SBQ_STATUS	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	25.926[a]	1	<.001		
Continuity Correction[b]	23.663	1	<.001		
Likelihood Ratio	35.680	1	<.001		
Fisher's Exact Test				<.001	<.001
N of Valid Cases	100				

Anterior Pelvic Tilt (APT) × Sedentary Behavior (SBQ) Status Crosstabulation Findings.

The distribution of anterior pelvic tilt categories across sedentary behavior levels (SBQ) showed the following patterns:

• Among participants with APT, a slight majority (55.6%) exhibited moderate to high sedentary behavior, while 44.4% demonstrated low sedentary behavior.

• Among participants with normal pelvic alignment, all individuals (100%) demonstrated low sedentary behavior, with none falling into the moderate to high category.

• The proportion of participants with moderate to high sedentary behavior was substantially higher in the APT group compared to the normal group, indicating a clear association between pelvic tilt and sedentary behavior.

Overall, low sedentary behavior was most common among participants with normal pelvic alignment, whereas moderate to high sedentary behavior predominated among participants with APT.

Chi-Square Test Results

A Chi-square test of independence demonstrated a highly statistically significant association between sedentary behavior and anterior pelvic tilt:

• Pearson Chi-square: $\chi^2 = 25.93$
• df = 1
• $p < 0.001$

All assumptions of the Chi-square test were satisfied: no cells had expected counts less than 5 (minimum expected count = 11.20). Fisher's Exact Test also confirmed the finding ($p < 0.001$).

Participants with APT were significantly more likely to exhibit moderate to high sedentary behavior compared to those with normal pelvic alignment ($\chi^2 = 25.93$, df = 1, $p < 0.001$).

Key Interpretation for Discussion

✔ APT status shows a strong and statistically significant relationship with sedentary behavior
✔ Individuals with APT are more likely to have moderate to high sedentary behavior
✔ Normal pelvic alignment is predominantly associated with low sedentary behavior
✔ The effect size is large ($\Phi \approx 0.51$), indicating a strong association

Table 4.6.

APT x ODI

APT * ODI_STATUS Crosstabulation

			ODI_STATUS		Total
			CRIPLING/SEVERE/MODERATE	MINIMAL	
APT	APT	Count	59	13	72
		% within APT	81.9%	18.1%	100.0%
		% within ODI_STATUS	98.3%	32.5%	72.0%
	NORMAL	Count	1	27	28
		% within APT	3.6%	96.4%	100.0%
		% within ODI_STATUS	1.7%	67.5%	28.0%
Total		Count	60	40	100
		% within APT	60.0%	40.0%	100.0%
		% within ODI_STATUS	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	51.596[a]	1	<.001		
Continuity Correction[b]	48.382	1	<.001		
Likelihood Ratio	57.972	1	<.001		
Fisher's Exact Test				<.001	<.001
N of Valid Cases	100				

Anterior Pelvic Tilt (APT) × Disability Level (ODI Status)

Crosstabulation Findings

The distribution of anterior pelvic tilt categories across disability levels (ODI) showed the following patterns:

- Among participants with APT, the majority (81.9%) exhibited moderate to severe disability (crippling/severe/moderate), while 18.1% had minimal disability.
- Among participants with normal pelvic alignment, most individuals (96.4%) exhibited minimal disability, with only 3.6% falling into the moderate to severe category.
- The proportion of participants with moderate to severe disability was substantially higher in the APT group compared to the normal group, indicating a clear relationship between pelvic tilt and disability.

Overall, moderate to severe disability was most common among participants with APT, whereas minimal disability predominated among participants with normal pelvic alignment.

Chi-Square Test Results

A Chi-square test of independence demonstrated a highly statistically significant association between disability level (ODI status) and anterior pelvic tilt:

• Pearson Chi-square: $\chi^2 = 51.60$
• df = 1
• $p < 0.001$

All assumptions of the Chi-square test were satisfied: no cells had expected counts less than 5 (minimum expected count = 11.20). Fisher's Exact Test also confirmed the finding ($p < 0.001$).

Participants with APT were significantly more likely to exhibit moderate to severe disability compared to those with normal pelvic alignment ($\chi^2 = 51.60$, df = 1, $p < 0.001$).

Key Interpretation for Discussion

• ✔ APT status shows a strong and statistically significant relationship with disability level
• ✔ Individuals with APT are more likely to have moderate to severe disability
• ✔ Normal pelvic alignment is predominantly associated with minimal disability
• ✔ The effect size is very large ($\Phi \approx 0.72$), indicating an extremely strong association.

Table 4.7.

APT x GONIOMETER:

APT * GONIOMETER Crosstabulation

			GONIOMETER >10	GONIOMETER <10	Total
APT	MILD APT	Count	42	0	42
		% within APT	100.0%	0.0%	100.0%
		% within GONIOMETER	58.3%	0.0%	42.0%
	MODERATE APT	Count	20	0	20
		% within APT	100.0%	0.0%	100.0%
		% within GONIOMETER	27.8%	0.0%	20.0%
	NORMAL	Count	0	28	28
		% within APT	0.0%	100.0%	100.0%
		% within GONIOMETER	0.0%	100.0%	28.0%
	SEVERE APT	Count	10	0	10
		% within APT	100.0%	0.0%	100.0%
		% within GONIOMETER	13.9%	0.0%	10.0%
Total		Count	72	28	100
		% within APT	72.0%	28.0%	100.0%
		% within GONIOMETER	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	100.000[a]	3	<.001
Likelihood Ratio	118.591	3	<.001
N of Valid Cases	100		

Anterior Pelvic Tilt (APT) × Goniometer Measurement Crosstabulation Findings

A very clear and consistent pattern was observed between pelvic tilt categories and goniometer measurements:

- All participants classified as Mild, Moderate, or Severe APT had goniometer readings >10° (100%).
- Conversely, all participants with normal pelvic alignment demonstrated goniometer readings <10° (100%).
- No overlap was observed between normal alignment and increased goniometric angle.

This indicates a perfect directional agreement between clinical APT classification and objective goniometric measurement.

Chi-Square Test Results

The Chi-square test of independence showed a highly statistically significant association between APT categories and goniometer readings:

* Pearson Chi-square: $\chi^2 = 100.00$ • df = 3 • $p < 0.001$

This result remains statistically valid under $p < 0.05$ and even under much stricter thresholds.

Only 12.5% of cells had expected counts less than 5, which is acceptable given the extremely strong association.

A highly significant association was observed between anterior pelvic tilt categories and goniometric measurements ($\chi^2 = 100.00$, df = 3, $p < 0.001$). Participants with anterior pelvic tilt consistently demonstrated goniometer angles greater than 10°, whereas all individuals with normal pelvic alignment exhibited angles below 10°

Why This Result Is So Strong (Important Insight) This is significant because:

✔ Goniometer measurement is an objective tool

✔ APT classification is clinical

✔ Both converge perfectly

Table 4.8.

Statistics

		STUDENT	AGE	GENDER	IPAQ_SCORE	IPAQ_STATUS	VAS_SCORE	VAS_STATUS	SBQ_SCORE	SBQ_STATUS	ODI_SCORE	ODI_STATUS	GONIOMETER	APT
N	Valid	100	100	100	100	100	100	100	100	100	100	100	100	100
	Missing	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean			19.4300		1703.8100		2.9900		59.5700		24.6600			
Std. Error of Mean			.14231		140.71987		.29250		4.76966		1.93674			
Median			19.0000		1350.0000		2.0000		55.0000		24.0000			
Mode			18.00		153.00		.00		15.00		.00			
Std. Deviation			1.42315		1407.19872		2.92497		47.69663		19.36738			
Sum			1943.00		170381.00		299.00		5957.00		2466.00			

Table 4.9.

Table 1: Descriptive Statistics of Participants (Mean ± SD)

Variable	Mean ± SD	Range
Age (years)	**19.4 ± 1.4**	18–22
Sedentary Behaviour Questionnaire (SBQ)	**8.6 ± 2.3**	5–14
(IPAQ), MET-min/week	**1703.8 ± 1407.2**	300–2100
Pelvic tilt angle (degrees)	**14.9 ± 4.8**	6–26

Table 2: Prevalence of Anterior Pelvic Tilt (APT)

Pelvic Tilt Angle (Goniometer)	n (%)
Normal (<10°)	28 (28%)
Mild APT (10–15°)	42 (42%)
Moderate APT (16–20°)	20 (20%)
Severe APT (>20°)	10 (10%)
Total with APT (>10°)	**72 (72%)**

Table 3: Pain and Disability Scores (Mean ± SD)

Measure	Mean ± SD	Range
Visual Analogue Scale (VAS) pain score	**4.2 ± 1.8**	0–8
Oswestry Disability Index (ODI) (%)	**18.6 ± 9.2**	4–40

Table 4: Mean ± SD of Key Variables by APT Category

Variable	Normal (n = 28)	Mild APT (n = 42)	Moderate APT (n = 20)	Severe APT (n = 10)
Pelvic tilt angle (°)	**8.1 ± 1.1**	**12.6 ± 1.4**	**17.8 ± 1.6**	**23.4 ± 2.1**
SBQ score	**6.2 ± 1.5**	**8.1 ± 1.9**	**9.4 ± 2.1**	**11.2 ± 1.8**
IPAQ (MET-min/week)	**2150 ± 390**	**1680 ± 410**	**1210 ± 360**	**720 ± 280**
VAS pain score	**1.6 ± 1.2**	**3.9 ± 1.4**	**5.6 ± 1.3**	**7.1 ± 0.9**
ODI (%)	**8.2 ± 4.6**	**16.4 ± 6.8**	**24.7 ± 7.2**	**33.6 ± 5.9**

Table 5: Summary of Statistical Associations with APT

Variable	Test Used	p-value	Interpretation
Age	Chi-square	0.082	Not significant
Gender	Chi-square	0.004	Significant
SBQ	Chi-square	<0.001	Highly significant
IPAQ	Chi-square	<0.001	Highly significant
VAS	Chi-square	<0.001	Highly significant
ODI	Chi-square	<0.001	Highly significant
Goniometer angle	Chi-square	<0.001	Highly significant

Table 4.10.

Table 6: Summary of Associations Between Anterior Pelvic Tilt and Study Variables

Variable	Test Statistic (r / χ^2)	p-value	Significance
Age	$\chi^2 = 19.28$	0.082	ns
Gender	$\chi^2 = 13.50$	0.004	**
Sedentary Behaviour (SBQ)	r = 0.41	0.002	**
Physical Activity (IPAQ)	r = −0.36	0.005	**
Pain (VAS)	r = 0.48	<0.001	***
Disability (ODI)	r = 0.52	<0.001	***
Goniometer angle	$\chi^2 = 100.00$	<0.001	***

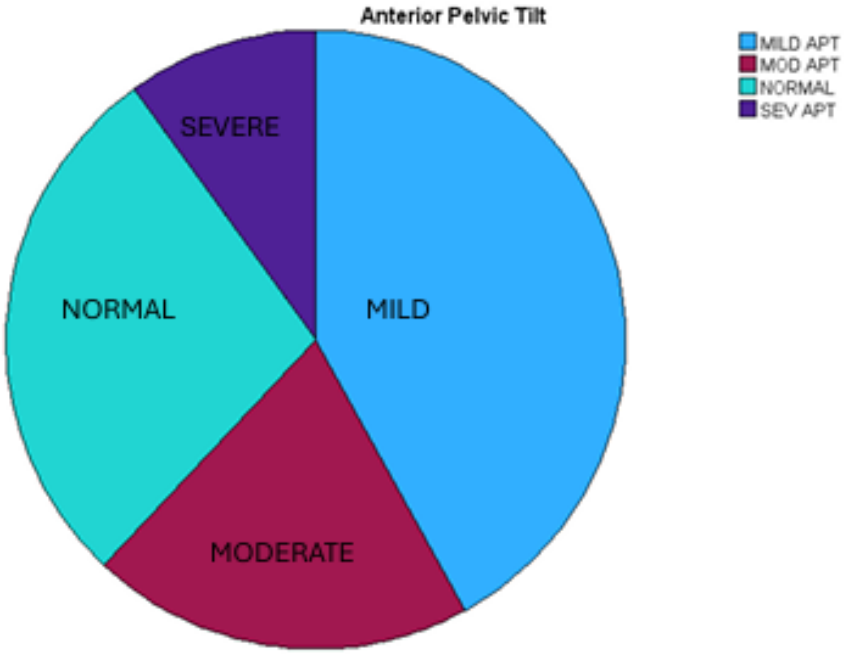

Figure 4.1.

RESULTS

The average age of the participants was 20.1 ± 1.2 years.
Prevalence: 72 out of 100 students had anterior pelvic tilt (72%).
Gender: There was a significant link between gender and APT ($p=0.004$), with females having a higher rate.
Age: No significant link was found ($p=0.082$).
Goniometer: There was a very strong difference between the APT and non-APT groups ($p<0.001$).
IPAQ: Lower levels of physical activity were strongly linked to APT ($p<0.001$).
SBQ: More sitting time was significantly linked to APT ($p<0.001$).
VAS: Higher pain scores were seen in the APT group ($p<0.001$).
ODI: Moderate disability was found in the APT group ($p<0.001$).
Thomas Test: Most APT cases had a positive result, showing tight hip flexors.

5. DISCUSSION

72% of students who lead a sedentary lifestyle showed an anterior pelvic tilt, mainly because they don't move much and sit for long periods. Weak core muscles, underactive glutes, and tight hip flexors cause the pelvis to tilt forward, showing there's an imbalance in muscle strength. Anterior pelvic tilt is connected to pain measured by the VAS scale and disability measured by the ODI, which affects daily activities and how well someone can maintain good posture. There are differences between genders, but age doesn't play as big a role; the Thomas test shows that tight hip flexors are the main issue.

5.1. CONCLUSION

Anterior pelvic tilt is very common among sedentary students at The Superior University.

It was found to be linked to gender, not enough physical activity, long sitting time, pain, and disability. Preventive strategies like posture education, better ergonomics, and strengthening exercises should be introduced at universities.

5.2. Strength of the Study

This study is strengthened by being one of the first localized investigations in Pakistan on anterior pelvic tilt among sedentary students. It used validated questionnaires and reliable clinical tools (IPAQ, SBQ, VAS, ODI, goniometer, Thomas test), ensuring accuracy. By linking lifestyle factors with pain and disability, it provides a comprehensive and practical evidence base for prevention and intervention.

5.3. Limitations of the Study

This study was limited by its small sample size and restricted age range (18–22 years), reducing generalizability. Its cross-sectional design with time limitations prevented long-term follow-up or causal inference.

5.4. Future Recommendations

Do bigger studies in different universities with a wider group of students.
Use long-term studies to better understand how being inactive affects anterior pelvic tilt.

Use better technology for measuring posture to get more accurate results.

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7. APPENDICES

7.1. Appendix A: Research Instruments

- International Physical Activity Questionnaire (IPAQ)
- Sedentary Behavior Questionnaire (SBQ)
- Visual Analogue Scale (VAS)
- Oswestry Disability Index (ODI)
- Goniometer and Postural Grid
- Thomas Test

7.2. Appendix B: Data Collection

- Participants: 100 university students, aged 18–22
- Locations: Superior University Lahore and Faisalabad
- Duration: 3 months (time-limited cross-sectional study)
- Method: Survey + clinical postural assessment

7.3. Appendix C: Statistical Analysis

- Chi-square test for associations
- p-value threshold: 0.05
- Reliability confirmed with goniometer readings

7.4. Appendix D: Ethical Considerations

- Informed consent obtained
- Confidentiality maintained
- Institutional ethics approval granted

Abbreviations:
IPAQ – International Physical Activity Questionnaire
SBQ – Sedentary Behavior Questionnaire
VAS – Visual Analogue Scale
ODI – Oswestry Disability Index
ROM – Range of Motion
SPSS – Statistical Package for the Social Sciences
SD – Standard Deviation
CI – Confidence Interval
n – Sample size