

# The Effect of Vertebral Flexibility on Musculoskeletal Complaints in Adolescents in Pontianak City

Wuriani

Lecturer at the Muhammadiyah Institute of Technology and Health in West Kalimantan

Email address: wuriani@stikmuhtk.ac.id

**Abstract**—The development of bones and muscles in adolescents began to halt the moment they reached adulthood, and at this time adolescents would likely to ignore the importance of useful and systematic movements resulting in a loss of flexibility in their muscles and bones. When the muscles and bones experience any stiffness or decrease of flexibility during adolescence, the individual will experience complications such as stiffness, numbness, and pain on their bones, joints and muscles which will result in a decreased productivity and higher risk of injury as they get older. **Goal:** To identify respondents' characteristics (age, gender, vertebral flexibility and musculoskeletal complaints) and to identify the significance of flexibility on musculoskeletal complaints. **Method:** Quantitative descriptive research with a sample of 150 quantitative students with a quasi-experimental pre-test post-test approach. Using a modified Schober test to measure vertebrae flexibility and the level of complaints assessed by the Nordic Body Map (NBM). **Result:** That there are significances of flexibility on musculoskeletal complaints in Muhammadiyah High School students in Pontianak City. There was a decrease in the number of complaints of musculoskeletal pain in the neck, upper arms, back and waist. **Conclusion:** The more flexible a person's body is, the easier it is to move and the less musculoskeletal complaints there are.

**Keywords**— Flexibility, Musculoskeletal Complaints.

## I. INTRODUCTION

The increased daily study time coupled with the long exposure of bad sitting posture risks high school students to be inundated and prone to fatigue. This situation burdens the student's back muscles workloads even more. An increase of workload on their back muscles due to the bad sitting posture will result in an imbalance in body posture where the body leans to only one side, and eventually resulting in an overuse of the muscles (Pulcheria, 2016). If this situation happens for a long time, it will reduce the range of motion of the spinal joints (vertebrae), especially in the lumbar region. The decreased ability to move the lumbar spine will interfere with the ability to move, especially in the lumbar flexibility of high school students (Jayanti, 2014). The flexibility ability varies for each individual, depending on factors such as joint structure, age, gender, and body mass index (BMI) status. According to data from the Risesdas (Basic Health Research) in 2010, there was an increase in the number of adolescents categorized as having a high BMI, which was 1.4%, and it dramatically rose to 7.3% in 2013 (Windiastoni, 2014). The increase in the number of adolescents with a high BMI can

lead to a higher possibility of experiencing decreased lumbar flexibility.

Flexibility is the ability of tissues or muscles to stretch to their maximum extent, allowing the body to move with a full range of motion without pain or obstruction (Wismanto, 2011). Good flexibility of the hamstring muscles means they can contract concentrically and eccentrically with a maximum range of motion without any pain or disruption. When the hamstring muscles experience shortening, it can lead to an increased risk of injury and affect the balance strength of the muscles, resulting in suboptimal muscle function and performance (Gago, Lesmana, & Muliarta, 2013). According to Pristianto et al. (2018), flexibility is the ability to smoothly and easily move a joint or a series of joints through a pain-free and unrestricted Range of Motion (ROM). It is influenced by the joint capsule's distensibility, muscle viscosity, and the tightness of ligaments and tendons. The ability to achieve maximum Range of Motion (ROM) plays a crucial role in daily activities, such as reaching, bending, and engaging in sports activities.

In sports that involve a lot of kicking motions, rapid acceleration or deceleration, and sudden changes of direction, there is a possibility of strain in the hip adductor muscles (Dutton, 2016; Naufal et al., 2021).

Adequate mechanical flexibility is essential for effective balance responses. Therefore, a decrease in trunk flexibility is caused by changes in collagen within the annulus and a reduction in the water content of the nucleus pulposus, leading to a decrease in disc volume, making it less flexible. Joint flexibility is an important element for overall health and physical fitness. Reduced flexibility can result in decreased efficiency and effectiveness of muscles in maintaining balance (Stanley, 2007).

## II. OBJECTIVES

To determine the influence of musculoskeletal flexibility on the level of comfort among students of SMA Muhammadiyah in West Kalimantan.

## III. METHODOLOGY

The research design used in this study is quantitative with a quasi-experimental pre and post-test without control group approach. This research has gone through an ethical testing process and has received an Ethical Clearance Decision Letter

Number: 86/II.IAU/KET.ETIK/III/2023. The researchers utilized the modified Schober test to measure vertebral flexibility and assessed the level of complaints using the Nordic Body Map (NBM). The intervention provided to the participants was a standard flexibility stretching exercise.

IV. RESULT

TABLE 1. Characteristics of Gender and Age of Students at SMA Muhammadiyah 1 in Pontianak City.

Respondent's Characteristics	(f)	(%)
<b>Gender</b>		
Male	65	43,3
Female	85	56,6
<b>Total</b>	<b>150</b>	<b>100</b>
<b>Age</b>		
17	71	47,3
18	79	52,6
<b>Total</b>	<b>150</b>	<b>100</b>
<b>Modified Scober</b>		
< 20	80	53,3
>20	70	46,6
<b>Total</b>	<b>150</b>	<b>100</b>

The table above explains that out of thirty-eight respondents, there were 65 males, which accounts for 43.3% of the total, and 85 females, which represents 56.6%. In terms of age, 71 respondents were 17 years old, making up 47.3%, and 79 respondents were 18 years old, comprising 52.6%. Regarding the Modified Schober test results, 80 students had measurements less than 20 cm, which is 53.3%, and 70 students had normal measurements of 20 cm or more, accounting for 46.6%.

TABLE 2. Influence Of Flexibility To Neck Pain

Variable	Min-Max	p
Flexible – Musculoskeletal pain	1-8	0.001

The table above explains that there is an influence of flexibility on musculoskeletal pain with a P-value of 0.001. Based on the research results, it can be concluded that there is an influence of flexibility on the comfort level of students at SMA Muhammadiyah 1 in Pontianak City.

TABLE 3. Complaints Of Neck Pain Using Nbm Before And After The Intervention Group, Level Of Flexibility

Location	Before								After							
	N	%	L	%	M	%	H	%	N	%	L	%	M	%	H	%
Upper Neck	58	38,6	52	34,6	40	26,6	4	2	80	53,3	50	0,34	20	13,3	0	0
Lower Neck	46	30,6	22	14,6	82	54,6	0	0	75	50	62	41,3	13	8,8	0	0

1 N = No pain, L =Low Pain, M = Moderate Pain, H= High Pain

Of the 150 students in the upper neck before being given intervention, 58 students had no pain (38.6%), 52 students had mild pain (34.6%), 40 students had moderate pain (26.6%) and four students had severe pain ( 0.02%). After being given the intervention, there were no pain in 80 students (53.3%), mild pain in 50 students (0.34%), moderate pain in 20 students (13.3%) and no severe pain. Meanwhile, in the lower neck, before the intervention was given, 46 students (30.6%) had no complaints, 22 students (14.8%) complained of mild pain, 82 students (54.6%) had moderate pain and no severe pain occurred. After being given the intervention, 75 students (50%) experienced no pain, 62 students (41.3%) had mild pain, 13 students (8.8%) had moderate pain and no students had severe pain.

VI. DISCUSSION

Prolonged sitting duration with a bad posture during class could lead to stiffness of muscles in the lower back, resulting in back pain. To prevent this, a back exercise program is necessary. This research provides intervention with several exercises that can increase bone and muscle flexibility in the neck, shoulders, lower back, both hands, and both legs. Before and after the exercises, a comparison is made to measure flexibility and the reduction of musculoskeletal pain or discomfort. The sitting position is significantly related to many complaints on the back pain in adolescents. Prolonged and continuous bad sitting posture can cause muscle tension. Incorrect body posture while sitting creates abnormal pressure on tissues, leading to lower back pain (Pratiwi et al., 2009).

Neck pain that occurs due to the weight of the bag The back makes the backpack strap put too much pressure on the

muscles in the neck, which can cause muscle tension neck. Neck pain can also increase due to prolonged and static sitting positions. Pressure on the nerves and blood vessels in the neck, causing pain and tingling neck part (Lisa, 2018)

Having adequate flexibility can improve lumbar mobility and individual functional abilities while reducing the risk of muscle tension (Pradipta, 2022). To restore lumbar mobility and functional activities can be achieved through a back exercise program. Various methods of back exercises have been developed, including exercises that focus on back flexion.

The research conducted by Gupta (2015) indicates that the implementation of McKenzie Exercises can lead to many benefits such as pain relief, improved lumbar mobility, restoration of normal functioning in daily activities, minimized hospital visits, and reduced treatment sessions required for recovery.

This study discusses that the more flexible and supple an individual's bones and muscles are, the easier it becomes for the body to move to many directions. Consequently, increased ease of movement can lead to a better movement range which will in turn boost the body's metabolism by enhancing the blood circulation to all cells, particularly bone and muscle cells, leading to a reduction in the accumulation of lactic acid in muscles. This, in turn, results in a decrease in muscle pain or musculoskeletal complaints such as numbness, pain, and stiffness. It can be concluded that greater flexibility and suppleness of muscles lead to an improved sense of comfort in bones and muscles.

Conclusion

The more flexible a person's body, the easier it is for them to move and the risk of musculoskeletal complaints will be reduced. Conversely, if a person's body, especially their bones, joints, and muscles, are stiff or extremely inflexible, they may experience discomforts such as stiffness, numbness, and even muscle pain. Increasing the flexibility of bones and muscles through regular exercise will lead to better overall mobility. It is hoped that after bones and muscles become more flexible, the students will find it easier to engage in their daily movements and even to continue it as a routine. This will boost not only their physical fitness, but also their metabolism which will be very helpful in preventing obesity.

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