talenta PUBLISHER

SUMEJ
Sumatera Medical Journal
Journal homepage: https://talenta.usu.ac.id/smj

Research Article

Pulse Rate and SpO_2 in Prolonged Sitting versus Specific Isotonic Exercises Among Young Adults in UniKL RCMP

Insyirah Arifah Binti Ismail, Khadijah Binti Mohamad Sukri, Muhammad Ar Rizq Bin Zainal, Nur Hasliana Fatiha Binti Hasfarizal, Nur Maisarah Binti Noorzaid, Syed Faris Danial Bin Syed Syahril Anuar, Noorzaid Bin Muhamad[*]

Cluster Integrative Physiology and Molecular, Preclinical Department, Faculty of Medicine, UniKL Royal College of Medicine Perak, Ipoh, 30450, Malaysia

[*]Corresponding Author: noorzaid@unikl.edu.my

ARTICLE INFO

Article history:
Received 30 July 2025
Revised 17 August 2026
Accepted 22 August 2026
Available online 1 September 2026

E-ISSN: 2622-1357
P-ISSN: 2622-9234

How to cite:
Insyirah Arifah Binti Ismail, Khadijah Binti Mohamad Sukri, Muhammad Ar Rizq Bin Zainal, Muhammad Ar Rizq Bin Zainal, Nur Hasliana Fatiha Binti Hasfarizal, Nur Maisarah Binti Noorzaid, Syed Faris Danial Bin Syed Syahril Anuar, Noorzaid Bin Muhamad, "Blood Pressure, Pulse Rate And Spo_2 In Prolonged Sitting versus Specific Isotonic Exercises Among Young Adults In Unikl Rcmp", SUMEJ, Vol. 09, No. 03, September 2026.

https://doi.org/10.32734/sumej.v9i3.22297.

ABSTRACT

Background: This study seeks to investigate the relationship between prolonged seated immobility and lower extremity circulation and to identify effective lower extremity exercises that can be performed in confined spaces to improve venous blood flow, with emphasis on isotonic exercises. **Objective:** To enhance health and well-being during prolonged sitting by implementing strategies that improve lower extremity circulation. **Methods:** This observational study investigates the physiological responses to prolonged sitting including and excluding isotonic exercises among medical students at UniKL RCMP. The study measured muscle activation patterns using electromyography (EMG) and a pulse oximeter for oxygen saturation (SpO_2). **Results:** After 60 minutes of uninterrupted sitting, PR showed a decline during extended sitting but increased following tiptoe exercises and squats. SpO_2 remained stable throughout, suggesting efficient oxygen transport. However, squats induced a greater cardiovascular response than tiptoe exercises. **Conclusion:** This study shows that lower limb isotonic exercises (tiptoes, squats) significantly improve lower limb circulation and venous return.

Keywords: deep vein thrombosis, isotonic exercises, prevention, venous thromboembolism

1. Introduction

Prolonged seated immobility during work or long-distance air travel plays a significant role in the development of venous thromboembolism (VTE) [1]. VTE refers to blood clots in the veins and includes both deep vein thrombosis (DVT) and pulmonary embolism (PE). DVT commonly occurs in the lower leg, thigh, or pelvis, but can also affect the arms. The three key components of Virchow's triad hypercoagulability, stasis, and endothelial dysfunction are all known risk factors for VTE. Despite being serious medical conditions, DVT and PE are often underdiagnosed but are also largely preventable. It is important to recognize that VTE can affect anyone, potentially causing serious illness, disability, or even death. However, the relationship between VTE and prolonged workplace sitting remains less clearly defined.

Initially identify this link through case reports of patients who experience VTE events after sitting for extended periods at work [2]. Further support these observations with case series involving hospitalizations due to work-related immobility. Additional reports, such as those, highlight the connection between prolonged recreational computer use and VTE [3]. These incidents are often life-threatening and occur in individuals without any prior risk factors. Note that nearly two billion people travel by commercial aircraft annually, with over 300 million taking long-haul flights . Though VTE after air travel is first documented in 1954, the exact magnitude of risk is still under investigation. To encompass all scenarios of prolonged immobility including travel, work, or leisure introduce the term Seated Immobility Thromboembolism (SIT) syndrome [2].

A case-control study, finds that long periods of sitting at work significantly increase the risk of DVT or PE [5]. Both the total time spent seated in a day and the longest uninterrupted sitting session are associated with a higher likelihood of hospital admission due to VTE. Fortunately, VTE remains both preventable and treatable. Active leg movements serve as a simple mechanical method of VTE prevention. According to the JCS Joint Working Group, combined ankle and knee exercises improve venous velocity more effectively than ankle movement alone. Shimizu et al. find that short bursts of ankle activity enhance femoral venous flow more efficiently than intermittent pneumatic compression. Exercise increases cardiac output and promotes blood flow by activating skeletal muscles and reducing vasoconstriction.

The risk of VTE also increases with immobility after surgery or during extended sedentary periods. This is the focus of the current study, which acknowledges that long-duration sitting especially at work or during air travel raises VTE risk. Although healthy young individuals generally face lower risk, those with contributing factors such as obesity, cancer, heart disease, or blood disorders are more vulnerable. In some cases, VTE occurs without symptoms, making diagnosis difficult. If left untreated, VTE can block blood flow and oxygen delivery, damaging tissues and organs. Lower limb muscle inactivity is a major concern, especially during economy class flights where restricted movement limits circulation. This phenomenon leads to the term "economy class syndrome" or "traveler's thrombosis." Dehydration, advanced age, pregnancy, and limited legroom further increase the risk.

This study aims to evaluate the effectiveness of isotonic exercises in promoting circulation and reducing VTE risk among UniKL RCMP students many of whom face long travel times or extended sitting in lecture halls. It investigates which types of exercises, such as tiptoes (ankle-based) or squats (knee-based), offer the greatest benefits in restricted environments. The study also explores whether exercise speed (rapid vs. slow movements) influences outcomes. In addition, it considers factors like hydration, seat design, air pressure, age, gender, obesity, and medical history. Ultimately, the study seeks to develop practical, evidence-based guidelines for seated exercises and educational strategies to reduce VTE risk in students and other sedentary populations.

2. Methods

2.1 Sampling size and sampling method

The sample size for this study was applied based on recommendations from previous research guidelines (Tamiya et al., 2024). Sample sizes were calculated using the G*Power version 3.1.9.7 software (Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany). A pilot study was conducted on six healthy young men, who were asked to recline in a supine position and then sit in an upright position for three hours each, and the change in MAP was measured to estimate the effect size. Based on the obtained effect size of 0.25, the sample size was calculated by setting α to 0.05 and 1-β to 0.8. As a result, the required sample size was 16 cases. The convenient sampling method to be used is selecting the participants within the sample frame is the list of medical students in UniKL RCMP.

2.2 Data Collection

This study used direct physiological measurements and structured experiments for data collection. Surface electromyography (EMG) records muscle activity from the lateral gastrocnemius, medial gastrocnemius, and soleus muscles using the PowerLab system during rest, tiptoe activity, and squats.Oxygen saturation (SpO_2) and pulse rate (PR) were monitored using a pulse oximeter at specific time points. This method ensures accurate, objective, and real-time data collection for analyzing muscle activation, cardiovascular responses, and oxygen levels.

2.3 Data analysis

Data obtained from this study first be collected and stored directly in PowerLab software for EMG data, segmented by activity type and spreadsheet software (Excel) for BP, PR and SpO_2 measurements, with time stamps for each measurement. The analysis focused on amplitude and frequency of EMG signals to assess muscle activation, using descriptive statistics for comparisons across activities. PR and SpO_2 data was analyzed for changes before, during, and after each activity, using descriptive statistics and paired sample t-test. Correlation analysis was conducted to explore the relationship between muscle activation and cardiovascular responses, with graphical representations to visualize trends.

3. Results

3.1 Electromyography (EMG) Reading In Prolonged Sitting And Isotonic Exercises

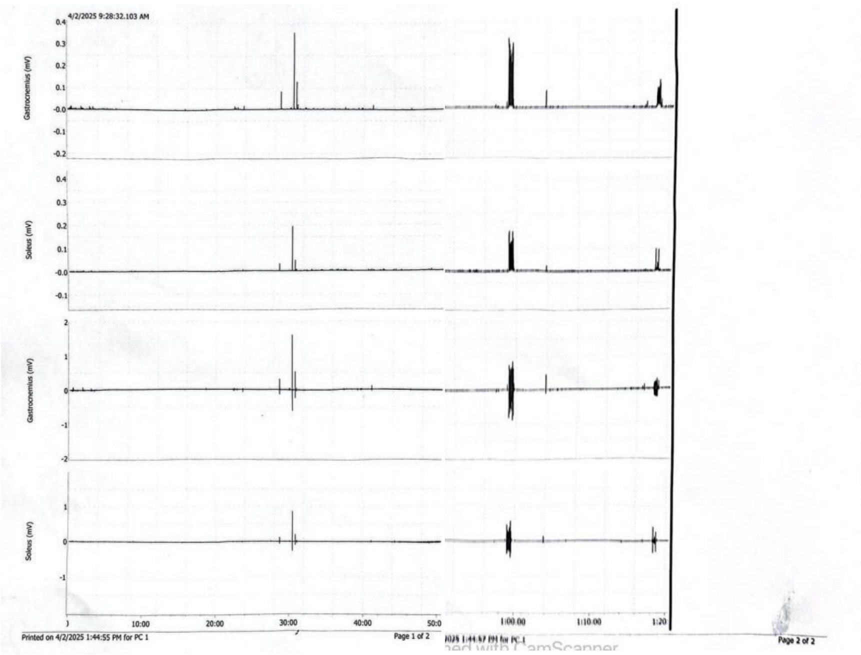

Figure 1. Electromyography of Gastrocnemius and Soleus Contraction

Figure 1 shows the EMG reading of muscle contraction for gastrocnemius and soleus. There are 4 channels at the EMG reading where the 1st and 2nd channels show the actual direct contraction from the soleus and gastrocnemius. For the 3rd and 4th channels are the smoother versions of the 1st and 2nd channels respectively. At the 30th minute, there is a spike in EMG reading due to environment disturbance that proved no consistent contraction. While in the 60th minute, the EMG reading showed there is contraction of gastrocnemius and soleus muscle to show the tip toe activity that has been done. Lastly, in 80th minutes EMG reading showed the consistent contraction of gastrocnemius and soleus muscle indicated for the squats activity that has been done by the samples. The contraction of gastrocnemius and soleus at 60th minute is greater compared to 80th minute due to tiptoe activity mainly activating calf muscle for contraction while squats mainly use quadriceps muscle located in the thigh for contraction. This proved the EMG reading at 60th minute has greater value than EMG reading in 80^{th} minute.

3.2 Means And Standard Deviation

Table 1. Descriptive Statistics of Females

Composition	N	Mean	Std Deviation	Variance
Pulse Rate bpm 0 min	8	85.88	8.999	80.982
Pulse Rate bpm 30 min	8	82.00	7.856	61.714
Pulse Rate bpm 60 min	8	80.38	8.667	75.125
Pulse Rate bpm After Tiptoe	8	79.25	7.517	56.500
Pulse Rate bpm Before Squat	8	79.50	8.281	68.571
Pulse Rate bpm After Squat	8	85.75	7.421	55.071
SpO2 0 min	8	95.38	1.847	3.411
SpO2 30 min	8	95.13	3.399	11.554
SpO2 60 min	8	93.88	2.949	8.696
SpO2 After Tiptoe	8	94.13	5.566	30.982
SpO2 Before Squat	8	92.75	6.182	38.214
SpO2 After Squat	8	91.88	5.540	30.696
Valid N (listwise)	8			

Table 2. Descriptive Statistics of Males

Composition	N	Mean	Std Deviation	Variance
Pulse Rate bpm 0 min	8	72.75	12.612	159.071
Pulse Rate bpm 30 min	8	73.25	7.649	58.500
Pulse Rate bpm 60 min	8	71.38	7.539	56.839
Pulse Rate bpm After Tiptoe	8	73.00	8.194	67.143
Pulse Rate bpm Before Squat	8	70.00	8.976	80.571
Pulse Rate bpm After Squat	8	75.00	11.880	141.143
SpO2 0 min	8	95.13	2.167	4.696
SpO2 30 min	8	92.63	3.583	12.839
SpO2 60 min	8	93.00	5.425	29.429
SpO2 After Tiptoe	8	90.63	5.755	33.125
SpO2 Before Squat	8	91.13	5.436	29.554
SpO2 After Squat	8	91.38	2.973	8.839
Valid N (listwise)	8			

Based on Table 1 and Table 2, regarding pulse rate, females demonstrated consistently higher values (ranging from approximately 79-86 bpm) compared to males (70-75 bpm). Oxygen saturation (SpO2) levels were similar between genders, though females maintained slightly higher levels overall (91-95%) compared to males (90-95%). All measurements were taken from equal sample sizes (N=8) for both groups, ensuring comparable statistical analysis. Notable variations in standard deviation and variance suggest individual differences in physiological responses to the activities, particularly during and after exercise.

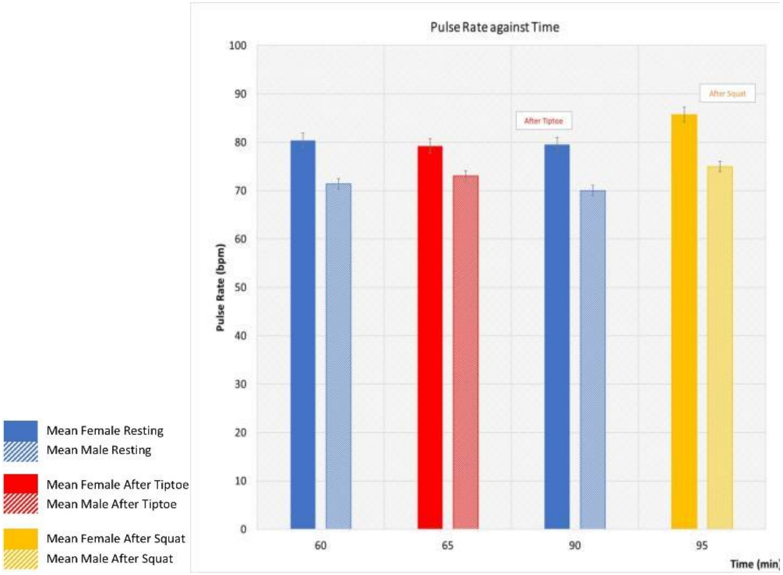

Figure 2. Pulse Rate against Time

Based on Figure 2 males exhibited a lower resting pulse rate than females but showed a greater increase after excursions, particularly after squats. In contrast, females had a more stable and controlled pulse rate response across all conditions, with smaller fluctuations between rest and post-exercise states.

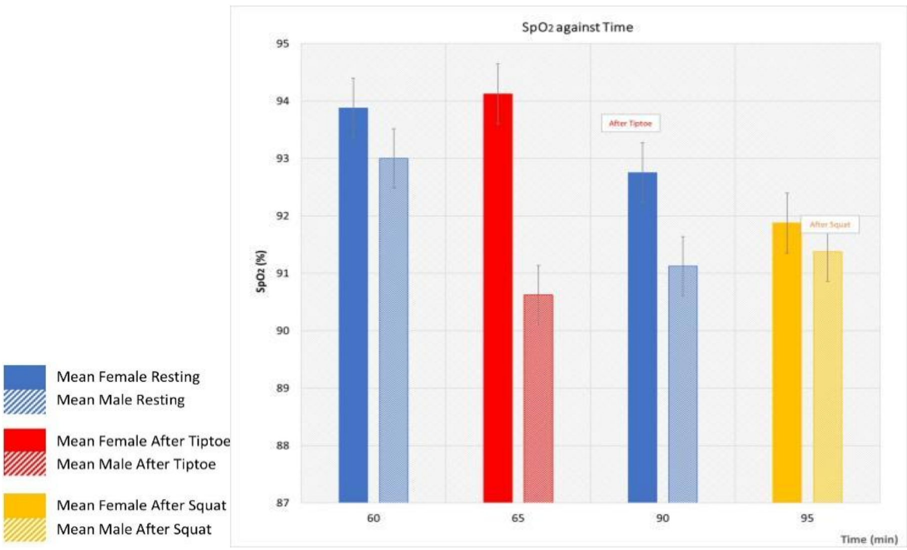

Figure 3. SpO2 against Time

Based on Figure 3 SpO2 levels remained relatively stable during rest for both males and females. After Tiptoe exercise, males showed a significant drop in SpO2 levels, whereas females exhibited a slight increase. However, after squats, both males and females showed a recovery trend, with SpO2 levels rising slightly in males compared to post-tiptoe.

3.3 Paired Sample T-Test

Pulse Rate

Table 3. Pulse Rate Comparison After Tiptoe and After Squat Female

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Pulse Rate bpm 60 min- Pulse Rate bpm After Tiptoe	-1.125000	4.12094	1.45697	-2.32019	4.57019	.772	7	.49165
Pair 2 Pulse Rate bpm Before Squat- Pulse Rate bpm After Squat	6.25000	4.52769	1.60078	-10.03525	-2.46475	-3.904	7	.006

Table 4. Pulse Rate Comparison After Tiptoe and After Squat Male

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Pulse Rate bpm 60 min- Pulse Rate bpm After Tiptoe	1.625	3.543	1.253	-4.587	1.337	-1.297	7	.236
Pair 2 Pulse Rate bpm Before Squat- Pulse Rate bpm After Squat	5.000	3.928	1.389	-8.284	-1.716	-3.600	7	.009

Based on Table 3.3a and Table 3.3b showing paired t-test results for pulse rate measurements, there are notable differences between female and male participants. Pair 1 of both female and male shows no significant difference ($p > 0.05$), while Pair 2 shows a significant difference ($p < 0.05$). It indicates that squat exercises significantly affected pulse rates in both gender groups, while tiptoe exercises did not produce significant changes.

Oxygen Saturation

Table 5. SpO_2 Comparison After Tiptoe and After Squat Female

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 SpO2 60 min- SpO2 After Tiptoe	.25000	4.30116	1.52069	-3.84586	3.34586	-.164	7	.874
Pair 2 SpO2 Before Squat- SpO2 After Squat	-.87500	1.45774	.51539	-.34370	2.09370	1.698	7	.133

Table 6. SpO2 Comparison After Tiptoe and After Squat Male

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 SpO2 60 min-SpO2 After Tiptoe	-2.375	6.346	2.244	-2.930	7.680	1.059	7	.325
Pair 2 SpO2 Before Squat-SpO2 After Squat	.250	3.327	1.176	-3.032	2.532	-.213	7	.838

Based on **Table 3.3c** and **Table 3.3d** showing paired t-test results for SpO2, revealed no statistically significant changes in either gender following both exercises (all $p > 0.05$). Females showed slightly increase in SpO2 after tiptoe exercises (mean difference = 0.25) and an decrease after squats (mean difference = -.087), males demonstrated a more pronounced decrease after tiptoe (mean difference = -2.375 mmHg) but slightly increase after squat exercises (mean difference = -0.25).

4. Discussion

This study showed the effects of pulse pressure and oxygen saturation(SpO2) in the prolonged sittings on healthy adults. After several periods of sitting, the samples needed to do brief and rigorous exercises such as tip toe activity and squats respectively. The activities done by the samples must be done with a fixed amount of repetitions for more obvious observation on the effects of pulse rate and SpO2.

The samples needed to sit for a period of one hour without any disturbance such as excessive movements of the leg and the temperature of the surroundings. We also use one hour as a standard of prolonged sitting because it is same with the study research from "The Effect of Sitting Duration on Peripheral Blood Pressure Responses to Prolonged Sitting, With and Without Interruption: A Systematic Review and Meta-Analysis". Furthermore, 60 minutes of sittings was required to achieve a hemodynamic steady-state, as cardiac output, calf pooling and thigh blood flow varied for up to an hour. After 1 hour, cardiac output may be unchanged and the total peripheral resistance increase likely caused by blood pressure may rise secondary to candidate mechanisms involved in total peripheral resistance.

The activities needed to be done by the samples are tiptoe and squats with 15 and 10 repetitions respectively. The tiptoe activity is done with low amount of repetition because the contraction is mainly from the calf muscles itself while the squats have high value of repetition compared to tiptoe because the contraction itself was needed by a small portion of other leg part other than quadriceps only. They also show that 8-10 repetitions of intensity exercises such as squat and dumbbell squats is enough to provide ideal stimulus for a postexercise hypotensive response especially for young adults. With these references, the less intensity training such as tiptoe must be increased in repetitions in response to achieve the equal postexercise hypotensive response like a high intensity training.

The pulse rate showed a distinct pattern, rising after tiptoeing and squatting but falling during extended sitting. The initial decline in pulse rate (PR) is consistent with a lower cardiac workload and metabolic requirement during extended periods of inactivity. PR increased as soon as movement was introduced, indicating increased sympathetic activity and improved cardiac output to sustain blood flow. More powerful muscle contractions include higher cardiovascular demand, requiring greater cardiac output and oxygen supply, as indicated by the greater increase in PR following squatting as opposed to tiptoeing. Since our subjects were young and healthy, their autonomic nervous system efficiently regulated PR without excessive strain. Gender differences also played a role, with females generally exhibiting a slightly higher PR than males. This is due to their smaller heart size and lower stroke volume, requiring a faster heart rate to maintain adequate blood flow. Additionally, hormonal influences such as estrogen's effect on increasing heart rate contribute to this difference, while testosterone in males supports a stronger stroke volume, leading to a lower resting PR. Differences in autonomic nervous system activity also impact PR, with females having greater sympathetic dominance, resulting in a naturally higher heart rate response during both rest and exercise.

From the SpO2 bar chart, our findings show the changes in peripheral oxygen saturation in participants during different activities which are prolonged sitting, tiptoeing, and squatting over time. The SpO2 levels show slight variation observed indicating the difference in the oxygen demand depending on the intensity of the exercise. For instance, tiptoeing is a brief, low-intensity movement with minimal impact on respiratory demand, whereas squatting engages larger muscle groups and requires greater oxygen consumption. The sitting posture promotes reductions in blood flow and flow-mediated dilation in the lower extremity. It is assumed that the sitting-induced decrease in blood flow and flow-mediated dilation reduces oxygen availability and substrate exchanges in peripheral tissues. However, evidence regarding the effects of acute prolonged sitting on microcirculation and oxygenation in peripheral tissues of the lower extremity in healthy young adults is still lacking.

Considering both male and female gender, there was a slight drop of spO2 levels in both genders after an hour of prolonged sitting which is between 93% to 94% which is still below 95% to 100%, the normal range of spO2 level. There is a study that shows the same result after prolonged sitting where there is decrease in the levels of oxyhaemoglobin and total haemoglobin in the lateral heads of the gastrocnemius muscles which are the lower limb muscles [6]. The results indicate a reduction of the blood flow and shear rate, and blunted oxygen diffusion and substance exchange in peripheral tissues during prolonged sitting. Basically, compromised peripheral circulation influenced muscle microcirculation and particularly oxygen delivery, as evidenced by the decrease in oxyhaemoglobin and total haemoglobin in the lateral heads of gastrocnemius muscles. However, the findings after tiptoe exercise between male and female are different. In females, the spO2 levels slightly increase indicating efficient vascular function in transporting oxygen towards gastrocnemius and soleus for contraction to elevate the calcaneus in tiptoeing while in males, the spO2 levels drop significantly mainly because male has bigger muscle mass so it requires greater oxygen demand and the body's sudden temporary struggle to meet sudden higher demand of oxygen cause the drop of spO2 level. During the 25 minutes resting period between tiptoeing and squatting, the females show slight drop in spO2 level indicating less to none oxygen demand to muscles because of sedentary state while males show oxygen saturation recovery by gradually increasing the spO2 level [7,8]. After squatting, the spO2 levels pattern of both genders remains the same which decreases in females and increases in males. As for females, the decrease indicates that their muscles need greater oxygen demand because squatting is a high intensity exercise for energy production and muscle activation [9]. At the peripheral level, females have lower arteriovenous oxygen content difference at peak exercise, which resulted from a lower hemoglobin concentration and the inability to decrease mixed venous oxygen saturation to the same level as in men. The lower peak oxygen uptake of females results from both central and peripheral factors. The significantly higher value for mixed venous oxygen saturation, which contributes to the lower arteriovenous oxygen difference of females, could result from their smaller muscle mass, lower capillary density, and lower oxidative potential [7]. As for males, their spO2 levels still gradually increase indicating oxygen recovery phase to a normal range.

5. Conclusion

This study investigated the effects of prolonged sitting and specific lower limb isotonic exercises (tiptoeing and squatting) on pulse rate (PR) and oxygen saturation (SpO_2) among healthy young adults. Given the known risks of venous stasis and deep vein thrombosis (DVT) associated with prolonged immobility, our research aimed to determine whether simple lower limb exercises could help improve circulation and mitigate potential cardiovascular risks.

Our findings suggest that while one hour of sitting did not induce significant cardiovascular changes, engaging in isotonic exercises led to a slight increase in pulse rate, indicating enhanced circulation. SpO_2 levels remained within the normal range throughout the study, further supporting the notion that healthy individuals may not experience immediate oxygenation deficits during brief sedentary periods. However, it is well-documented that extended immobility, particularly in at-risk populations, can contribute to impaired circulation and thrombotic events.

While our study provides valuable insights, it is important to acknowledge its limitations. The sample size was relatively small (n=16), and the duration of sitting was limited to one hour, which may not fully capture the long-term physiological effects of prolonged immobility. Future research should aim to include a larger, more diverse sample population and extend the sitting duration to better assess the potential benefits of isotonic exercises in preventing circulatory complications. Additionally, incorporating advanced hemodynamic measurements could provide a more comprehensive understanding of blood flow changes in response to these exercises.

Despite these limitations, our findings support the recommendation of incorporating simple isotonic exercises such as tiptoeing and squatting in environments that promote sedentary behavior, including workplaces, long-haul travel, and academic settings. These exercises are easy to perform, require no special equipment, and may serve as an effective preventive measure against venous stasis, potentially reducing the risk of DVT in susceptible individuals. Encouraging regular movement and physical activity remains a crucial aspect of maintaining vascular health and overall well-being.

6. Data Availability Statement

The datasets generated and analyzed during the current study are not publicly available due to privacy and ethical considerations but are available from the corresponding author upon reasonable request.

7. Ethical Statement

A few ethical issues are addressed and shall be noted throughout the research. Ethical approval before executing this research was obtained from UniKL RCMP. Participation is voluntary and a consent letter was issued to every participant to guarantee that they are well-informed of the main purpose of performing this study. All data and information gained from the study were kept confidential. These data are strictly utilized for teaching and learning purposes only.

8. Author Contributions

Each author has made substantial contributions to this study, including conceptualization, study design, implementation, data collection, analysis, and interpretation. All authors have participated in drafting, revising, and critically reviewing the manuscript. They have provided final approval of the version to be published and have been involved in the decision regarding the journal for submission. Furthermore, all authors agree to take full responsibility for every aspect of the work.

9. Funding

This research did not receive any external funding.

10. Acknowledgements

The researchers and authors would like to express their sincere gratitude to UniKL Royal College of Medicine Perak for providing facilities and support throughout the research process, including sample preparation and data evaluation.

11. Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

References

1. Johannesen C, Flachs EM, Ebbehøj NE, Marott JL, Jensen GB, Nordestgaard BG, et al. Sedentary work and risk of venous thromboembolism. Scand J Work Environ Health. 2020;46(1):69–76. Available from: https://doi.org/10.5271/SJWEH.3841.
2. Beasley R, Raymond N, Hill S, Nowitz M, Hughes R. eThrombosis: the 21st Century variant of venous thromboembolism associated with immobility. Eur Respir J. 2003;21(2):374–6. Available from: https://doi.org/10.1183/09031936.03.00039403.
3. Aldington S, Pritchard A, Perrin K, James K, Wijesinghe M, Beasley R. Prolonged seated immobility at work is a common risk factor for venous thromboembolism leading to hospital admission. Intern Med J. 2008;38(2):133–5. Available from: https://doi.org/10.1111/j.1445-5994.2007.01597.x.
4. Lee H. A New Case of Fatal Pulmonary Thromboembolism Associated with Prolonged Sitting at Computer in Korea. Yonsei Med J. 2004;45(2):349. Available from: https://doi.org/10.3349/ymj.2004.45.2.349.
5. West J, Perrin K, Aldington S, Weatherall M, Beasley R. A case–control study of seated immobility at work as a risk factor for venous thromboembolism. J R Soc Med. 2008;101(5):237–43. Available from: https://doi.org/10.1258/jrsm.2008.070366.
6. Kurosawa Y, Nirengi S, Tabata I, Isaka T, Clark JF, Hamaoka T. Effects of prolonged sitting with or without elastic garments on limb volume, arterial blood flow, and muscle oxygenation. Med Sci Sports Exerc. 2022 Mar 1. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC8830891/.
7. R T. Gender differences in the oxygen transport system during maximal exercise in hypertensive subjects. Chest. 1999. Available from: https://pubmed.ncbi.nlm.nih.gov/10084493/.
8. Correia RR, Veras ASC, Tebar WR, Rufino JC, Batista VRG, Teixeira GR. Strength training for arterial hypertension treatment: a systematic review and meta-analysis of randomized clinical trials. Sci Rep. 2023;13(1). Available from: https://doi.org/10.1038/s41598-022-26583-3.
9. Tamiya H, Hoshiai M, Abe T, Watanabe H, Fujii Y, Tsubaki A. Prolonged Sitting Induces Elevated Blood

Pressure in Healthy Young Men: A Randomized Crossover Trial. Cureus. 2024. Available from: https://doi.org/10.7759/cureus.55224.