

ORIGINAL ARTICLE

RELATIONSHIP BETWEEN SITTING DURATION AND BODY MASS INDEX TO DEEP-VEIN THROMBOSIS RISK ON EMPLOYEEFaiza Shafia¹, Magdalena Wartono^{2*}**ABSTRACT****BACKGROUND**

Deep vein thrombosis (DVT) is a condition where a blood clot forms in the deep venous circulation system, especially in the femoral and popliteal vein. This disease has various factors, including obesity and a sedentary lifestyle such as sitting for long period of time. Employees who spend most of their time sitting at work are at risk of developing this condition. Previous studies showed different results, thus further research is needed.

METHODS

An analytic observational study with a cross-sectional method conducted on 90 employees at Bank BTN Head Office Jakarta from October to November 2021. Data were collected by interview using the OSPAQ questionnaire to assess sitting duration, Wells criteria to assess DVT risk, and calculation of body mass index (BMI). Sample was done by simple random sampling technique and analysis using chi-square.

RESULT

There are more male respondents (60%) than female respondents (36%). It was found that 4.4% of employees have a thin BMI, 52.2% of employees have a normal BMI, and 43.3% of employees have a fat BMI. The respondents' average sitting duration was 2.6 hours/day without interruption. There was no relationship between sitting duration ($p=0.903$) and the risk of DVT. There was a relationship between BMI ($p=0.008$) and the risk of DVT.

CONCLUSIONS

A body mass index above normal is a risk for deep vein thrombosis, but long sitting duration is not related significantly with this disease.

KEYWORDS : Sitting Duration, Body Mass Index, Deep Vein Thrombosis, Employee

¹Medical Undergraduate Programe, Faculty of Medicine, Universitas Trisakti, Jakarta, Indonesia

²Occupational Health Department, Faculty of Medicine, Universitas Trisakti, Jakarta, Indonesia

***Corresponding Author at:**

Occupational Health Department, Faculty of Medicine, Universitas Trisakti, Jl. Kyai Tapa No.260, Grogol Petamburan, Jakarta Barat 11440, Indonesia.

Email: Magdalena_w@trisakti.ac.id

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ABSTRAK

Hubungan Durasi Duduk Dan Indeks Massa Tubuh Terhadap Risiko Deep-Vein Thrombosis Karyawan

LATAR BELAKANG

Deep vein thrombosis (DVT) adalah keadaan terbentuknya bekuan darah dalam sistem sirkulasi vena dalam terutama pada vena femoralis dan vena poplitea. Penyakit tersebut dipengaruhi berbagai macam faktor di antaranya yaitu obesitas dan gaya hidup sedenter seperti duduk dalam durasi yang lama. Karyawan yang menghabiskan sebagian besar waktunya untuk duduk bekerja di kantor memiliki risiko mengalami keluhan ini. Berbagai penelitian sebelumnya menunjukkan hasil yang berbeda, dengan demikian diperlukan penelitian lebih lanjut.

METODE

Penelitian ini menggunakan studi observasional analitik dengan metode *cross-sectional*. Dilakukan pada 90 karyawan di Kantor Pusat Bank BTN Jakarta pada bulan Oktober hingga November 2021. Data dikumpulkan dengan wawancara menggunakan kuesioner OSPAQ untuk menilai durasi duduk, Kriteria *Wells* untuk menilai risiko DVT, dan perhitungan indeks massa tubuh (IMT). Pemilihan sampel dilakukan dengan teknik *simple random sampling*, dan analisis menggunakan *chi-square*.

HASIL

Responden laki-laki (60%) lebih banyak dari responden perempuan (36%). Didapatkan 4.4 % karyawan memiliki IMT kurus, 52.2% karyawan memiliki IMT normal, dan 43.3% karyawan memiliki IMT gemuk. Rerata durasi duduk responden yaitu 2.6 jam/hari tanpa interupsi. Tidak terdapat hubungan antara durasi duduk ($p=0.903$) dengan risiko *deep vein thrombosis*. Terdapat hubungan antara indeks massa tubuh ($p=0.008$) dengan risiko *deep vein thrombosis*.

KESIMPULAN

Indeks massa tubuh di atas normal merupakan risiko terjadinya *deep vein thrombosis*, namun durasi duduk yang lama tidak berhubungan secara bermakna dengan penyakit ini.

KATA KUNCI: Durasi Duduk, Indeks Massa Tubuh, Deep Vein Thrombosis, Karyawan.

INTRODUCTION

Office workers or employees tend to adopt sedentary habits both at work and outside the workplace. Research in the United States proves that there is an increase in the duration of sedentary at work and outside the workplace where in 1965 the duration of sedentary was 26 hours per week while in 2009 it was 38 hours per week, while in the UK it was 30 hours per week in 2005. 1960 and 42 hours per week in 2005. This, of course, raises concerns.⁽¹⁾

This sedentary habit can undoubtedly impact health, one of which is increasing the risk of cardiovascular diseases such as deep vein thrombosis (DVT). Deep vein thrombosis is the third most common cardiovascular disorder after coronary artery disease and stroke.⁽²⁾ Deep vein thrombosis is where blood clots form in the deep venous circulation system, especially in the femoral and popliteal veins.^(3,4) It is estimated that 1 to 2 per 1000 individuals develop venous thromboembolic disorders annually in the United States, with a recurrence risk of approximately 30% within eight years.^(5,6) In A prospective study by Evan et al. for 22.9±6.7 years, venous thromboembolism was 5.2%, with an incidence

ratio of 2.3 per 1000 person-years.⁽⁷⁾ The authors have not found a national prevalence rate of DVT, but a study by Tambunan et al. at Kariadi Hospital Semarang estimated about 37.1% of bed rest patients suffer from DVT.⁽⁸⁾

Deep vein thrombosis is a multifactorial disease that can be influenced by genetics, sociodemographic characteristics of pathological abnormalities, pregnancy, surgery, and drugs.^(4,7) A sedentary lifestyle such as sitting for long durations and body mass index (BMI) appears to be related to the risk of DVT.^(9,10) In addition, certain diseases can increase the risk of DVT, including cancer, heart failure, inflammatory bowel disease, chronic obstructive pulmonary disease, and varicose veins.⁽¹¹⁾

In terms of work-related sedentary work, the prevalence of sedentary work increased by 20% in the United States between 1960 and 2008, with the decline in physically active professions.⁽¹⁾ In France, working adults have been shown to spend an average of 9.96 hours per day sitting on weekdays (with at least 4.17 hours/day sitting at work) and 7.58 hours/day sitting outside workdays.⁽¹²⁾ Nausheen et al. reported a case of DVT in Singapore in men aged 50 years due to

prolonged sitting in front of a computer while working for an average of 12 hours per day.⁽¹³⁾ However, Johannesen et al.'s study in Denmark on a population aged 20-65 years stated that there was no relationship between sitting duration and risk of DVT.⁽¹⁴⁾

Body mass index is also closely related to the risk of DVT. The study by Evan et al. proved that for a group of respondents with a high genetic score, a lower body mass index was associated with a reduced risk of venous thromboembolism with a hazard ratio (HR) of 0.79.^(7,15) A study by J Klovaite et al. conducted in Denmark on a population aged 20 – 100 found an association between obesity and DVT.⁽¹⁶⁾ Due to the many contradictions in the results of previous studies, this study was conducted to assess the relationship between sitting duration and body mass index to the risk of deep vein thrombosis, especially in employees whose majority have long sitting duration at work.

METHODS

This study uses a cross-sectional method conducted at the Bank BTN Head Office Jakarta in October-November 2021. The target population of this study are employees in 2 divisions, namely the retail funding & services division and the corporate strategic & performance division. The sample selection method was simple random sampling because the employees in both divisions worked in sitting positions and had the same working hours. Therefore, the sample size of this research is 90 people with the following criteria: employees who are still actively working at the Bank BTN Jakarta Head Office, aged <65 years, who are willing to sign an informed consent and work at least 8 hours/day. In addition, for those who have cancer or are on cancer treatment such as taking tamoxifen, history of undergoing surgery for leg and spine fractures in the last 12 weeks, history of bed rest in the previous three days, being pregnant, history of suffering from varicose veins, using hormonal contraception and hormonal therapy, history of suffering from heart failure, inflammatory bowel disease (ulcerative colitis and Crohn's disease), chronic liver disease (chronic hepatitis, cirrhosis, and liver cancer with onset of 6 months), stroke, chronic obstructive pulmonary disease, systemic lupus erythematosus,

hypothyroidism, and diabetes mellitus, taking oral anticoagulant and antiplatelet drugs such as aspirin, clopidogrel, warfarin, fraxiparin, and enoxaparin were not included in this study.

To assess the risk of DVT, the Wells Criteria adaptation questionnaire was used. This questionnaire is available in English, so it will be tested for validity and reliability. The validity test was carried out on 30 respondents with the r table value of 0.3610 and the calculated r-value between 0.397 and 0.694. The reliability was tested using the Cronbach alpha test and obtained a Cronbach alpha of 0.680. It can be concluded that the questionnaire is reliable and valid to use.

The OSPAQ questionnaire assessed the duration of sitting at work in the last seven days. The results of this questionnaire were obtained by multiplying the percentage of activity for each domain (sitting, standing, walking, and doing strenuous activities) by the number of hours worked per day and then converted into minutes. The final result of this questionnaire is the duration of each domain in hours/day or minutes/day.⁽¹⁷⁾ Measurement of body mass index by measuring weight and height. Body weight was measured using a Camry digital scale with an accuracy of 0.1 kg. Height was measured using a General Care microtoise.

This research was started after obtaining ethical approval from the Research Ethics Commission of the Medical Faculty, Universitas Trisakti and permission from the Head of Bank BTN Jakarta Head Office. The data analysis used in this research is the univariate and bivariate analysis. Univariate analysis used descriptive analytics to describe the percentage and frequency of the results obtained for each variable studied. The bivariate analysis used in this study was the chi-square test with a significance level of $p < 0.05$.

RESULT

As shown in table 1, the results of this study indicate that more respondents are male (60%). Most respondents were between 25-35 years old (58.9%). Based on the body mass index, as many as 39 (43.3%) of the respondents belonged to the obese category (52.2%). Respondents with a duration of sitting without interruption of 3 hours/day are 40%. The average duration of the respondent's sitting is 2.6 hours/day without

Table 1. Distribution of subject characteristics

Characteristic (n = 90)	Frequency (n)	Percentage (%)
Gender		
Male	54	60
Female	36	40
Age		
Late adolescence (17-25 years)	16	17.8
Early adulthood (25-35 years)	53	58.9
Late adulthood (36-45 years)	14	15.6
Early elderly (46-55 years)	5	5.6
Body Mass Index		
Skinny (≤ 18.4 kg/m ²)	4	4.4
Normal (18.5-25.0 kg/m ²)	47	52.2
Obese (≥ 25.1 kg/m ²)	39	43.3
Sitting duration		
Not long (<3 hours)	54	60
Long (≥ 3 hours)	36	40
Risk of deep vein thrombosis		
Unlikely (score ≤ 1)	77	85.6
Likely (score >1)	13	14.4

interruption. Respondents who have a risk of likely suffering from DVT are 13 people (14.4%). sitting is 2.6 hours/day without interruption. Respondents who have a risk of likely suffering from DVT are 13 people (14.4%).

Table 2 shows the bivariate analysis results between BMI and duration of sitting and the risk of DVT. The body mass index initially used a 3x2 table (skinny, normal, obese BMI), but because it did not meet the Chi-Square test requirements, the cells were combined to form a 2x2 table (skinny and normal BMI, obese). As a result, respondents in the obese BMI category were 10 (25.6%), and in the thin-normal category were 3 (5.9%), including those at risk of DVT. The statistical test results got a p-value=0.008 (<0.05), so it can be concluded that there is a significant relationship between BMI and the risk of DVT.

A total of 8 people (14.8%) of respondents with short sitting duration and five respondents (13.9%) with long sitting duration were at risk of suffering from DVT. Based on the results of the

Chi-Square test, p-value=0.903 (>0.05), it can be interpreted that there is no significant relationship between sitting duration and the risk of DVT.

DISCUSSION

Sitting for a long time is a risk factor for the formation of thrombus and embolism in the veins.⁽¹⁸⁾ Sitting for a long time can compress the veins and cause endothelial damage, decreasing blood flow by 1.4 times and by two times when a person sits motionless with the legs do not touch the floor.^(10,14,19) Silent position for a long time will cause stress on the feet, which increases oxidative stress and is followed by endothelial dysfunction.⁽¹⁰⁾

Deep vein thrombosis occurs when a person sits for at least 8 hours and at least 3 hours without interruption.^(10,13,20) After 3 hours of sitting without interruption, blood flow disturbance will occur.⁽²⁰⁾ Decreased blood flow will cause hypoxia, activate blood clotting factors, and cause a hypercoagulable state that triggers thrombus

Table 2. Relationship between body mass index and body duration to the risk of deep vein thrombosis

Characteristic	Deep vein thrombosis risk				p-value*
	Unlikely (n = 77)		Likely (n = 13)		
	n	%	n	%	
Body Mass Index					
Skinny and normal	48	94.1	3	5.9	0.008
Obese	29	74.4	10	25.6	
Sitting duration					
Not long	46	85.2	8	14.8	0.903
Long	31	86.1	5	13.9	

*Chi-Square test

formation.^(3,10) However, the results of this study showed no relationship between sitting duration and the risk of DVT. Thosar et al.⁽²¹⁾ explained that sitting for a long time can increase stress on the feet, thereby increasing oxidative stress and causing endothelial dysfunction. Likewise, a study by Restanio et al. assessed endothelial dysfunction in the popliteal artery due to prolonged sitting experimentally and found that blood flow disturbance occurred after 3 hours of uninterrupted sitting. However, in practice in the field, even though they are in a sitting position for a long time, employees tend to move their legs so that there is an interruption to the duration of sitting which allows for endothelial dysfunction to occur. This is confirmed by Morishima et al., which states that minimal movement of the feet can prevent endothelial dysfunction.⁽²²⁾ The results of this study are in line with those of Johannesen et al., which state that there is no relationship between sedentary work and the risk of DVT. This is evidenced by the absence of a difference in the risk of venous thromboembolism in workers who sit at work for a total duration of 6.5 hours/day with those who sit for a total duration of 3.5 hours/day.⁽¹⁴⁾ The study's results by Suadicaní P et al. also stated that work with a long duration of sitting that was not ergonomic did not significantly increase the risk of DVT. It is said that this may be because the respondents are drivers of various vehicles who do not sit in a narrow position even though it is not ergonomic for a long time.⁽²³⁾

This study's results prove a significant relationship between body mass index and the risk of DVT. Similar to the study by Klovaite J et al.⁽¹⁶⁾ which found a strong relationship between obesity (BMI>25) and DVT, which was supported by a genetic relationship between the obesity-specific FTO (fat mass and obesity-associated) locus and DVT. Pathophysiologically, the increase in fat mass leads to inactivity, increased intra-abdominal pressure, and slowed blood flow to the lower extremities, which causes a prothrombic state that causes blood clots and increases the risk of DVT. Obesity is an inflammatory condition characterized by increased C-reactive protein and inflammatory markers such as interleukin-6, interleukin-8, and tumor necrosis factor-alpha. These cytokines will cause the expression of tissue factors and inflammatory mediators that activate

the coagulation pathway, thereby increasing the risk of DVT.⁽²⁴⁾

El-Menyar et al.⁽²⁵⁾ stated that obese patients have a higher risk for abnormal coagulation factors, recurrent venous thromboembolism (VTE), and distal DVT. Previous studies have shown that the risk of VTE is increased by 2x in obese patients compared to non-obese patients despite adjustments for sex, age, and components of the metabolic syndrome. Yang G et al.⁽²⁶⁾ mentions several studies that state obesity is a moderate risk factor for the incidence of VTE. Still, if there are other risk factors, such as genetic and environmental factors, obesity will be a high-risk factor.

However, the results of this study contradicted the retrospective study by Samuel et al.⁽²⁷⁾, which examined overweight and obese hospitalized patients; they did not find an increase in the incidence of VTE with an increase in obesity rates. This was because the patients in the study received thromboprophylaxis such as heparin, which prevented developing a prothrombic state. Likewise, the study's results by Tajik F et al.⁽²⁸⁾ stated that body mass index was not an important risk factor for VTE because there were other more decisive factors such as race and hyperlipidemia. The results of this study prove that body mass index has a significant relationship with the incidence of DVT. Thus body mass index needs to be considered in terms of education and prevention of DVT.

This study has several limitations; namely, it cannot exclude respondents with a genetic predisposition to suffer from DVT due to limited tools and resources. In addition, complaints of DVT are still subjective without a physical examination or supporting examinations such as venous ultrasound.

CONCLUSIONS

Based on the results of this study, it can be concluded that there is no significant relationship between sitting duration and DVT risk in employees, and there is a significant relationship between BMI and DVT risk in employees. Thus, it is necessary to monitor the nutritional status of employees so that there is no increase in cardiovascular risk, including deep vein thrombosis.

Future researchers are expected to exclude other risk factors such as genetic factors and use more objective measurement methods in diagnosing and determining the risk of DVT.

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AUTHORS' CONTRIBUTION

SF contributes in data collection, analysis and draft manuscript preparation. SF and WM, both contribute in interpretation of results. WM reviewed and made revision of the manuscript. SF and WM approved the final version of the manuscript.

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CONFLICT OF INTEREST

There is no conflict of interest.

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