Islamic Guidance and Counseling Journal
https://journal.iaimnumetrolampung.ac.id/index.php/igcj

Exploring the Influence of a Single Bout of Tahajjud Prayer on Acute Blood Pressure Response in Normotensive Young Adult Males with Varied Regularity of Tahajjud Practice

Yusni Yusni*, Hanifah Yusuf, Mustanir Yahya
Universitas Syiah Kuala, Indonesia
yusni@usk.ac.id*

Article Information:
Received July 17, 2023
Revised August 11, 2023
Accepted August 14, 2023

Keywords: acute respons; blood pressure; cardiovascular; physical activity; tahajjud

Abstract

Tahajjud, a type of sunnah worship for Muslims, involves standard rules and complex movements that contribute to cardiovascular health and blood pressure regulation. Aims and scope: This study aimed to analyze the effect of a single bout of tahajud, on systolic (SBP) and diastolic blood pressure (DBP) in normotensive young men. The study employed an experimental design with healthy men aged 18-25 and normal blood pressure (normotensive). It included a control group (n = 12) that did not perform Tahajjud and a trial group (n = 12) that regularly practiced Tahajjud for over six weeks. The treatment involved performing Tahajjud consisting of 11 raka'at from 3:30-4:30 a.m., lasting 25-35 minutes. Blood pressure was measured using a sphygmomanometer before and after Tahajjud, and data analysis utilized a t-test ($p < .05$). These findings indicate that there is a non-significant difference in the mean of SBP and DBP after midnight between the control and trial groups, SBP (mmHg): 110.42±9.16 and 114.58±4.98 vs 120±6.03, $p = .11$ and 115±6.74, $p = .08$. DBP (mmHg): 76.77±4.92 and 77.50±4.52, $p = .58$ vs. 81.67±8.35 and 79.17±5.15, $p = .19$, SBP and DBP decreased by 5 mmHg and 2.5 mmHg in the trial group. Tahajjud, regardless of regularity, can elicit a modest but non-significant reduction in both SBP and DBP. These results indicate that Tahajjud may have a potential role in promoting cardiovascular health. Further research is warranted to examine the long-term effects and underlying mechanisms of Tahajjud on BP regulation.

INTRODUCTION

Tahajjud, also known as the Night Vigil Prayer (salat) or the Late Night Prayer is a voluntary prayer performed by Muslims during the late night after sleeping (Matin, 2018). It is an additional act of worship beyond the obligatory daily prayers (Matin, 2018). The term "Tahajjud" is derived from the Arabic word tahajjada which means “to wake up" or "to stay awake” (Chodijah, 2017; Nurhadi, 2021). Tahajjud prayer holds significant spiritual importance in Islam as it is considered a means of seeking closeness to Allah, seeking forgiveness, and supplicating for one's needs (Chodijah, 2017). It's usually performed in the last third of the night, before the obligatory Fajr (dawn) prayer (Pinilih et al., 2019; Utami & Usiono, 2020). Muslims wake up from their sleep to engage in worship and devote themselves to prayer and reflection during this peaceful and serene time of the night. Tahajjud prayer consists of many units of prayer (raka’at), typically performed in sets of two raka’at (Nurhadi, 2021). It is a

How to cite: Yusni, Y., Yusuf, H., & Yahya, M. (2023). Exploring the Influence of a Single Bout of Tahajjud Prayer on Acute Blood Pressure Response in Normotensive Young Adult Males with Varied Regularity of Tahajjud Practice. *Islamic Guidance and Counseling Journal*, *6*(2). https://doi.org/10.25217/0020236387400
E-ISSN: 2614-1566
Published by: Institut Agama Islam Ma’arif NU (IAIMNU) Metro Lampung

voluntary act of worship, and the number of raka'at can vary, though an odd number, such as 2, 4, 6, or 8 raka'ats, is often performed and usually ends with 1 or 3 raka'at of Witir prayer (Nurhadi, 2021).

Tahajjud prayer is highly encouraged in Islam, but it is not required. It is regarded as a period of closeness with Allah, providing an opportunity for self-reflection, spiritual growth, and the request for blessings and forgiveness (Utami & Usiono, 2020). Therefore, not all Muslims perform the midnight prayer regularly. Many Muslims think that Tahajjud prayer gives spiritual gifts and blessings, as well as aids in the development of a greater relationship with their Creator (Utami & Usiono, 2020). Besides its high spiritual value and devotion, Tahajjud Prayer is also associated with several health benefits (Utami & Usiono, 2020). Although these benefits have not been extensively studied scientifically, some aspects have been noted by practitioners and scholars. Tahajjud Prayer involves bodily movements that require strength and muscle flexibility (Utami & Usiono, 2020). By regularly performing this prayer, individuals may gain physical benefits such as muscle stretching, increased muscle strength, balanced, improved blood circulation, and cardiovascular system.

Cardiovascular responses, including blood pressure are influenced by a variety of factors, such as: lifestyle, stress, and physical activity (Rufa'i et al., 2013). Regular physical activity serves as an effective strategy for preventing and offering an alternative treatment for non-communicable diseases, including hypertension, as supported by numerous research studies (Gualdi-russo & Zaccagni, 2021). Physical activity is associated with blood pressure (Fagard, 2001), and physical activity has been shown to lower blood pressure, but the acute and chronic effects of physical activity on blood pressure may differ (Carpio-Rivera et al., 2016). The intensity and duration of physical activity also influence the response to blood pressure caused by physical activity (Araújo et al., 2014). The World Health Organization (WHO) has recommended exercise as the primary and adjuvant non-pharmacological therapies for hypertension (Wallace, 2003). Physical activity represents a non-pharmacological first-line therapeutic approach for the prevention of hypertension (Cornelissen & Smart, 2013). According to data, more than 40% of young adults have high blood pressure and require medical treatment to maintain their health (Williamson et al., 2022). If this condition is not properly treated, it will affect the development of hypertension, therefore lifestyle changes and regular physical activity are required (Williamson et al., 2022).

Salat (Islamic prayer) performed with the correct movements according to Islamic shari'ah can be considered a physical activity in terms of health (Alabdulwahab et al., 2013). Salat is a physical practice with several health benefits because the change of posture and movement in each prayer are highly complicated (Alabdulwahab et al., 2013). The practice of Salah in Islam necessitates precisely regulated bodily movements and postures (Hossain, 2020). Each prayer cycle consists of 7-9 postures that are repeated (Jimoh, 2022). Tahajjud is a type of salat practiced by Muslims in which the physical activity performed during salat is referred to as meditation (Doufesh et al., 2013). Meditation is beneficial for controlling blood pressure and functions as a medication for people with hypertension (Doufesh et al., 2013). Salat is a moderate-intensity aerobic physical activity that is also equated with yoga and Tai chi (Doufesh et al., 2013). Yoga has been shown to lower systolic blood pressure (SBP) and diastolic blood pressure (DBP) by decreasing sympathetic activity (Doufesh et al., 2013). As a result, Tahajjud is thought to play a role in blood pressure regulation. Moderate-intensity exercise for 30 minutes or more is a non-pharmacological therapy that is recommended to normalize blood pressure in people with high blood pressure (Gjøvaag et al., 2020).

High blood pressure, also known as hypertension, is a medical condition characterized by consistently elevated levels of pressure in the arteries which is consistently higher than 130/80 mmHg (Desai, 2020). Blood pressure is determined by employing a pair of numerical indicators: systolic blood pressure (SBP) and diastolic blood pressure (DBP). The SBP

represents the force exerted on artery walls when the heart contracts and pumps blood, while the DBP represents the pressure in the arteries when the heart is at rest between beats. High blood pressure occurs when the force of blood against the artery walls is consistently too high. Hypertension is diagnosed when blood pressure consistently exceeds the normal range, typically reaching or exceeding 130/80 mmHg (Cardona-müller & Cardona-muñoz, 2022).

Figures from the World Health Organization (WHO) highlight that hypertension affects around 22% of the world's population (Khasanah, 2022). Indonesia experienced a substantial prevalence of hypertension among adults in 2013, standing at 25.8%, and this condition also ranked as the third leading cause of death (Khasanah, 2022). Moreover, other research supports the assertion that the prevalence of hypertension in the adult demographic is considerable, registering a substantial 33.4% (Hussain et al., 2016; Widyaningsih et al., 2022). Comparatively, women have a higher prevalence of hypertension than men (52.3% versus 43.1%), and the incidence of hypertension markedly escalates as age advances (Hussain et al., 2016). A research executed with a participant pool of 29,965 adults aged 18 years and older revealed that the prevalence of hypertension in Indonesia stood at 33.4% (Peltzer & Pengpid, 2018). Another study focusing on individuals aged 50 years and older indicated that among the 54,224 men and women examined, 35.3% exhibited heightened blood pressure levels (Widyaningsih et al., 2022).

Findings from a study conducted in 2014 revealed that the prevalence of hypertension among adolescents aged 18 to 21 years in Indonesia was recorded at 6.2%, with an additional 39.8% showing signs of pre-hypertension (Sembiring & Utari, 2019). Conversely, data from a 2019 study pointed out that Indonesia had an 8% prevalence of hypertension in adolescents aged 13 to 18, while elevated blood pressure was noticeable in roughly 12.2% of instances (Kurnianto et al., 2020). Comparatively, the prevalence of hypertension is elevated among urban residents in Indonesia in contrast to rural residents, with prevalence rates hovering at 31.3% and 29.7%, respectively (Istiana & Yeni, 2019).

Hypertension is commonly referred to as the "silent killer" due to its typically asymptomatic nature, yet if left untreated, it can give rise to substantial health complications. Uncontrol and chronic hypertension can strain the heart, damage blood vessels, and increase the risk of heart disease, stroke, kidney disease, and other health problems (Cardona-müller & Cardona-muñoz, 2022; Kwon et al., 2020). Managing high blood pressure or hypertension usually involves a combination of lifestyle changes and pharmacology therapy (medication) (Campbell et al., 2022; Kwon et al., 2020). Lifestyle modifications may include adopting a healthy diet low in sodium (salt), engaging in regular physical activity, maintaining a normal weight, limiting alcohol consumption, quitting smoking, and managing stress levels (Kwon et al., 2020).

According to an opposing viewpoint, moderate-intensity physical activity has been associated with an decrease in SBP but does not have a significant impact on DBP, thus not causing post-exercise hypotension (PEH) (Edilma et al., 2017). However, we hypothesize that performing Tahajud prayer, consisting of 11 cycles (raka'at) with a duration of 20-35 minutes, may be equivalent to engaging in moderate-intensity physical activity. As a result, Tahajud prayer may potentially lower both SBP and DBP, contributing to blood pressure regulation. Moreover, Tahajud prayer can serve as an effective preventive measure against hypertension, particularly at a young age. It is worth noting that Tahajud prayer is a simple physical activity that does not require any specific location or specialized equipment, making it accessible to individuals of all backgrounds and circumstances. Research focusing on the effects of performing Tahajjud prayer, consisting of 11 raka'at, on blood pressure is crucial for gaining a comprehensive understanding of the potential physiological impacts associated with this specific form of worship. This type of study would provide valuable insights into the

physiological responses that occur during and after the prayer, helping to bridge the current gap in scientific knowledge.

At present, there is a lack of scientific evidence specifically investigating the acute effects of performing 11 raka'at of Tahajjud prayer on blood pressure. By conducting research in this area, we can fill this gap and shed light on the potential physiological changes that occur during this spiritual practice. Tahajjud prayer holds significant religious and spiritual importance for Muslims, and it is believed to have positive impacts on overall well-being. Understanding the potential effects of Tahajjud prayer on blood pressure can provide valuable insights into its broader health benefits and implications for cardiovascular health. Moreover, it is important to recognize that individuals may exhibit variations in their physiological responses to Tahajjud prayer, including blood pressure changes. Some individuals may experience notable alterations in blood pressure, while others may not. Exploring these individual differences can contribute to personalized approaches in managing blood pressure and optimizing the health benefits of Tahajjud prayer. By conducting research on the effects of Tahajjud prayer on blood pressure, we can deepen our understanding of the physiological mechanisms at play and unveil the potential contributions of this spiritual practice to overall health and well-being. This research has the potential to provide valuable information for both medical professionals and individuals seeking to optimize their physical and spiritual health.

Investigating the acute effects on blood pressure after performing 11 raka'at of Tahajjud prayer can help identify any patterns or individual variations that may exist, providing insights into factors that could influence blood pressure response. Potential therapeutic applications, if research demonstrates consistent and significant effects of Tahajjud prayer on blood pressure. It could have implications for the development of non-pharmacological interventions for high blood pressure management. Understanding the physiological mechanisms behind any observed effects could open up possibilities for using Tahajjud prayer as a complementary approach to blood pressure control. Health promotion among Muslims, in the event that research findings related to the health benefits of Tahajjud prayer and its potential impact on blood pressure can serve as educational tools to promote healthier practices within Muslim communities. It can encourage individuals to engage in this form of worship with a better understanding of its potential positive effects on their overall well-being. By researching the effects of performing 11 rak'ahs of Tahajjud prayer on blood pressure, we can expand our knowledge and contribute to the scientific understanding of the potential physiological impacts of this important religious practice.

Rationale of the Study

In this study, we utilized the Tahajjud prayer as a therapeutic approach for blood pressure regulation, considering several factors: (1) Tahajjud, a sunnah prayer, involves performing more than two cycles and can extend up to 11 cycles (8 cycles of midnight prayer and three cycles of witir). Therefore, tahajjud fulfills the criteria of physical activity or moderate-intensity exercise, which has been established as a non-pharmacological therapy for hypertension. On the other hand, the consensus among scientists state that practicing prayer can be considered a physical activity that promotes health and well-being (Doufesh et al., 2013; Nazish & Kalra, 2018). Several studies have shown that including regular physical activity can be used as a primary and an adjuvant therapy for people who have hypertension as well as a preventive approach (Farinatti et al., 2021; Hayes et al., 2022; Pescatello et al., 2015, 2019). (2) Tahajjud is conducted during the mid-night period, resembling the final third of the night. This raises the possibility of influencing the production and secretion of Nitric Oxide (NO), a potent vasodilator that aids in blood pressure control (Ahmad et al., 2018; da Silva et al., 2021). The optimal NO production occurs during the last third of the night, and it reaches its maximum potential when associated with physical activity, as is the case with the midnight prayer.

Nevertheless, this study did not analyze NO levels, and further research is underway through a clinical trial. (3) Additional studies have also demonstrated the impact of the midnight period on reducing stress, potentially leading to a decrease in blood pressure by regulating neural and hormonal pathways. However, this aspect necessitates further exploration through clinical trials.

We have not come across any existing literature that asserts the benefits of performing 11 cycles of Tahajud prayer for blood pressure control or hypertension prevention. Consequently, we embarked on this study with the supposition that consistent engagement in physical activity or moderate-intensity exercise lasting between 20 to 45 minutes can prove advantageous for managing hypertension and reducing its occurrence (Pescatello et al., 2015, 2019; Saco-ledo et al., 2021). Prayer is a form of physical activity that is thought to have many health benefits (İmamoğlu, 2016). Adhering to the Islamic prayer guidelines and based on our observations, it is evident that the typical duration for performing 11 cycles of Tahajud prayer falls within the range of 20 to 35 minutes. Thus, this prayer format adheres to the standards of moderate-intensity physical activity as per WHO recommendations for individuals dealing with hypertension (World Health Organization, 2020).

Hypothesis and Objective

We assume that tahajjud is one of the new quantified types of physical activity, which is beneficial for blood pressure management through various physiological pathways in the body. Therefore, we investigated the effect of a single-time tahajjud on the acute response of blood pressure in males who had never and regularly performed tahajjud in the first phase of this clinical trial. This study was a phase 1 clinical trial, which is necessary before undertaking further clinical trials to acquire empirical evidence and establish tahajjud as a new non-pharmacological therapy for hypertension patients.

The objective of this study was to examine the effect of a single bout of tahajud on systolic and diastolic blood pressure in normotensive young males. This research will be the basis for conducting further clinical trials to assess the effect of regular tahajjud on the chronic response of blood pressure in normotensive people by analyzing various physiological and molecular pathways of blood pressure regulation.

METHODS

Study Design and Treatment

This was an experimental study with sedentary healthy male subjects. Blood pressure checks were carried out before and after the treatment. The treatment was a Tahajud prayer of 11 rakaat, which consisted of 8 rakaat of Tahajud and three rakaat of Witir. The treatment was given once due to this study aimed to analyze the acute response of blood pressure after physical activity (Tahajud Prayer). The tahajud was carried out at mid-night at 03:30–04:30 p.m. Blood pressure was checked 10 minutes before tahajud, then tahajud for 11 cycles (raka'at) without a rest period, and blood pressure was checked ten minutes after tahajud as post-exercise blood pressure. Subjects were instructed to sleep no later than 10 p.m., refrain from drinking coffee and alcohol, not take anti-hypertensive medication or other drugs that affect blood pressure, and not currently being treated for disease.

This study was carried out at Universitas Syiah Kuala in Banda Aceh, Aceh Province, Indonesia. Anthropometric measurements (weight, height, and body mass index (BMI)) were taken in the Physiology Laboratory, Faculty of Medicine, Universitas Syiah Kuala. Blood pressure examination and treatment were performed at the Universitas Syiah Kuala Mosque in Banda Aceh, while research subjects were chosen in the Universitas Syiah Kuala student dormitory in Banda Aceh. All subjects were Universitas Syiah Kuala students, and none were Faculty of Medicine students. The research implementation time was in June 2022.

Research Subjects

The research subjects were male, had never performed Tahajud or performed Tahajud irregularly (less than 2 times per week), and performed Tahajud regularly. Sample selection was undertaken by purposive sampling; therefore, sample selection was performed based on the inclusion and exclusion criteria of the study. The inclusion criteria were adult male, aged between 18-25 years, healthy, had no musculoskeletal injury, and willing to be a subject by signing a written proof of consent. Exclusion criteria were not fully following the research procedures, currently undergoing hormonal therapy, athletes, and hypertension or high blood pressure.

Exclusively male participants were enrolled in this study's initial clinical trial phase, as its objective was to assess the immediate impact of Tahajjud on blood pressure responses. Consequently, the intervention was administered as a one-time event. The research will continue with extended interventions (Tahajjud) lasting 2-3 months. Including female subjects with monthly menstrual cycles could potentially disrupt the intervention timeline. Furthermore, this study specifically centered on youthful participants, aiming to explore the potential of tahajud as a therapy for averting hypertension in early life and concurrently managing and controlling existing hypertension. Consequently, utilizing female subjects in menopause would not align with the study's established criteria.

Research subjects were divisible into two groups: control and trial groups. The control group includes those who do not perform Tahajud, while the trial group includes those who carry out Tahajud regularly (at least three times a week) for a minimum of six weeks, with the number of rakaat between 2 and 11 raka'at every session, 3-7 times a week with a duration of 25-35 minutes. One raka'at is one session (cycle) of prayer with several movements without rest and takes an average of 2-4 minutes. Subjects were elected by administering a questionnaire to 70 men. Then a total of 24 men were selected, consisting of 12 men as the control group and 12 men as the trial group. The sample calculation formula for experimental research with an alpha of 0.05 and a power of 0.95 is conducted to calculate the total number of subjects. The calculation results revealed that the minimum number of samples for each control and trial group was ten. However, in order to avoid subject dropout, the number of subjects was increased by up to 20% of the total minimum sample.

Anthropometry and Blood Pressure Measurement

The equipment needed was a height meter (stadiometer), a weight meter (manual weight scale or a stepping scale), a manual sphygmomanometer (Riester), and a stethoscope (Littmann). Both the anthropometry and blood pressure examinations were not carried out by the research team but were performed by doctors from the Faculty of Medicine, Universitas Syiah Kuala. Anthropometric measurements include weight, height, and BMI. Anthropometry was checked in the morning before Tahajud, while blood pressure was measured ten minutes before and after Tahajud. Anthropometry was performed between 07:00 and 08:00 a.m. (western Indonesian time). All subjects were instructed not to have breakfast before the anthropometric measurements.

Ethical Approval

The Ethics Committee for Medical and Health Research, Faculty of Medicine, Universitas Syiah Kuala, with the ethical approval number 099/EA/FK-RSUDZA/2022, approved the conduct of this study. All research subjects provided written informed consent. They were asked if they would be willing to participate in this study. The explanation includes research purposes, objectives, benefits, and risks obtained as a subject. All subjects have the right to withdraw at any time and without penalty. All results of the subject's examination are

guaranteed to be confidential, and publication of the research results is done without including the subject's name. All subjects who participated in this study were voluntary.

Data analysis

The independent sample t-test ($p<0.05$) and paired sample t-test ($p<0.05$) were used to analyze the data in this study. An independent sample t-test was conducted to determine the effect of giving Tahajud prayer on blood pressure in each control and trial group by looking at the difference in the average blood pressure before and after treatment. The difference in data between the control and trial groups was determined using a paired sample t-test. In the event that there was a difference between the two groups in the pretest and posttest data, it was indicated that the Tahajud prayer affects blood pressure. The data was analyzed using computer software.

RESULTS AND DISCUSSION

Results

Characteristics of research subjects

The subject's characteristics included age, weight (BW), height, and BMI, as indicated in Table 1. The results of the independent sample t-test analysis ($p < .05$) show that there was no difference ($p > .05$) in terms of age ($p = 1.00$), BW ($p = 0.98$), height ($p = .75$), and BMI between groups control and trial ($p = .94$). These findings show that there is no difference in the characteristics of each research subject between the control and trial groups; thus, the two groups can be compared because they have similar characteristics or homogeneous.

Table 2 shows the results of the paired sample t-test analysis, which show that in the control group, SBP increased slightly (by about 4.16 mmHg) after performing the Tahajud prayer, but this increase was not statistically significant ($p = .10$). The trial group's SBP decreased slightly (about 5 mmHg) but not significantly ($p = .08$) after the Tahajud. These findings suggest that performing a single time of the 11-rakaat Tahajud for 25-35 minutes has no direct effect on lowering or rising SBP, but more research is needed.

Table 2 also shows how tahajud prayer affects DBP. The results show that DBP decreased in both the control group (DBP decreased by 1.17 mmHg; $p = .58$) and the trial group (DBP decreased by 2.5 mmHg; $p = .19$) but only marginally ($p > .05$). Even though the decrease in the trial group was more than in the control group, these findings indicate that Tahajut prayer

Table 3. The effect of Tahajud on SBP and DBP in the control and trial groups

Blood Pressure	Data	Group	Average±SD	p-value
Systolic (mmHg)	Pretest	Control	110.42±9.16	.001*
		Trial	120.00±6.03	
	Posttest	Control	114.58±115.00	.865
		Trial	115.00±6.74	
Diastolic (mmHg)	Pretest	Control	76.67±4.92	.088
		Trial	81.67±8.35	
	Posttest	Control	77.50±4.52	.409
		Trial	79.17±5.15	

**The level of significance* (p<0,05)

Table 4. Changes in BP after Tahajud in the control and trial groups

Blood Pressure	Group	After treatment Σ (%)			Total Σ (%)
		Unchanged	Increase	Decrease	
Sistolic (mmHg)	Control	1 (8.33)	8 (66.67)	3 (25)	12 (100)
	Trial	6 (50)	0 (0)	6 (50)	12 (100)
Diastolic (mmHg)	Control	9 (75)	2 (16.67)	1 (8.33)	12 (100)
	Trial	9 (75)	0 (0)	3 (25)	12 (100)

Table 1. Characteristics of participants

Characteristics	Group	Average±SD	p-value
Age (year)	Control	21.83±2.37	1.00
	Trial	21.83±2.37	
Weight (kg)	Control	65.08±13.46	.98
	Trial	65.00±12.67	
Height (cm)	Control	165.58±4.36	.75
	Trial	165.00±4.55	
BMI (kg/m^2)	Control	23.82±5.25	.94
	Trial	23.98±5.18	

Table 2. Differences in blood pressure before and after treatment in the two groups

Blood Pressure	Group	Treatment	Average±SD	p-value
Systolic (mmHg)	Control	Before	110.42±9.16	.10
		After	114.58±4.98	
	Trial	Before	120.00±6.03	.08
		After	115.00±6.74	
Diastolic (mmHg)	Control	Before	78.67±4.92	.58
		After	77.50±4.52	
	Trial	Before	81.67±8.35	.19
		After	79.17±5.15	

does not affect DBP in sedentary young men; however, further research is needed to determine the chronic response of Tahajud prayer to blood pressure.

Table 3 shows the results of the independent sample t-test analysis of the SBP and DBP variables to determine the difference in blood pressure before and after giving the Tahajud prayer between the control and trial groups. The results show that there was a significant difference in SBP before treatment between the control and trial groups ($p = .006$*). These findings revealed that SBP before treatment was higher in the trial group compared to the control group (9.58 mmHg difference), but SBP in both groups remained within normal limits (normal SBP = 90-120 mmHg). On the other hand, there was no significant difference in SBP after giving Tahajud prayer between the control and trial groups ($p = .865$).

Table 3 also shows that there was no significant difference in DBP both before and after the Tahajud prayer between the control and trial groups ($p > .05$). Although DBP before and after Tahajud prayer in the control group was slightly lower than in the trial group, the difference between these numbers did not show a statistically or clinically significant difference. The results of this study indicate that the single bout of tahajud, whether carried out by the group who had never had tahajud or the group who had already tahajud regularly, did not have a significant effect on blood pressure. The acute response to tahajud is to regulate blood pressure under normal conditions in sedentary normotensive young men.

Table 4 shows the results of a descriptive analysis of the magnitude of changes in blood pressure after Tahajud intervention. This investigation was carried out to determine how the description of changes in blood pressure after treatment was carried out. The majority of the subjects in the control group, or approximately 66.67%, experienced an increase in SBP, while the remaining 25% experienced a decrease in SBP. The trial group obtained the opposite result. The SBP of the majority of the 12 subjects, or up to 50%, decreased, while the rest did not. These findings imply that regular Tahajud prayers are more likely to respond to a drop in SBP, but more research is needed. Likewise, the results of the DBP analysis showed that most or about 75% of the subjects did not show any change in DBP in both group. The remaining 25% of subjects and 8.33% of subjects showed a decrease in DBP in the trial and control groups.

Discussion

The outcomes of this study revealed that Tahajjud prayers done by persons who consistently engage in this practice demonstrated a reaction by lowering both systolic and diastolic blood pressure, albeit the results were not statistically significant. These findings suggest that Tahajjud prayer not only has religious benefits and increases mental health by lowering stress, anxiety, and depression (Azam & Abidin, 2015; Matin, 2018; Rosyada et al., 2022; Utami & Usiono, 2020), but also adds to physical well-being. Salat, also known as Islamic prayer, is a spiritual and physical activity that can activate practically all muscles due to movement and posture changes during prayer without creating muscular tiredness, allowing it to be done repeatedly with a great number of raka'at (Parveen & Kataria, 2020). During the performance of salat, nearly all joints and muscles are engaged due to the movements and positional changes involved, such as standing, bowing, prostrating, sitting, and finishing salat. As a result, salat can be regarded as a form of new physical activity (Nazish & Kalra, 2018; Osama et al., 2019). Salat maneuvers are included in moderate intensity physical activity (Doufesh et al., 2014).

Physical activity that is carried out regularly can be regarded as an exercise that is useful for improving or maintaining physical health and fitness (Osama et al., 2019). WHO defines exercise as a physical activity that is carried out in a planned, structured, repetitive manner, with the aim of improving physical health and fitness (World Health Organization, 2020). WHO recommends that exercise for adults be moderate-intensity exercise with a duration of 150–300 minutes, at least twice per week, to improve health (World Health Organization, 2020). Salat is a Muslim activity that is carried out in a scheduled, structured, repetitive, and regular manner, at least 5 times in 24 hours with varying durations (5-15 minutes per session) depending on the number of cycles of each prayer time. Therefore, Salat is categorized as moderate intensity exercise. One cycle of Salat is generally performed with an average duration of at least 2 minutes (Osama et al., 2019) so if there are 11 cycles of prayer, it takes at least 22 minutes.

Salat is also a non-pharmacological therapy for cardiovascular problems, psychological disorders, neurological disorders, and musculoskeletal systems (Chamsi-pasha & Chamsi-pasha, 2021; Ghous & Malik, 2016). Properly executed salat in line with Islamic Sharia dramatically reduce heart rate, enhance sympathetic nervous system activity, and decrease parasympathetic nervous system activity (Yousefzadeh et al., 2019). These elements are most likely related to the effects of Tahajjud on blood pressure. Tahajud is a Muslim prayer that consists of several specific movements that implicate most of the muscles and joints, making it beneficial for maintaining balance and promoting joint and cardiovascular health (Osama et al., 2019). Prayer movements are mostly similar to yoga and Tai Chi movements (Doufesh et al., 2013; Wang et al., 2022). As a result, the impact of prayer on heart health tends to be similar to yoga in general (Kamran, 2018). Tai chi has been shown to reduce SBP and DBP in hypertensive subjects (Wang et al., 2022), and yoga has been recommended as a therapeutic exercise to lower blood pressure (Conversano et al., 2021; Hagins et al., 2013; Wang et al., 2022) Salat is similar to a form of meditation, it has been shown in clinical studies to improve various physiological indicators, including breathing rate, heart rate, and blood pressure (Doufesh et al., 2014). Other studies has been reported that 30 minutes of meditation can lower blood pressure in nursing students and nurses, and salat has been shown to decrease SBP (Conversano et al., 2021). Salat is also mentioned as a religious meditation that is useful for improving physical health (Alabdulwahab et al., 2013; Syed, 2003). Salat reduces sympathetic nerve activity and increases parasympathetic nerve activity, thereby reducing blood pressure (Doufesh et al., 2014).

According to the findings of this study, a single-time Tahajud prayer intervention resulted in an insignificant reduce in SBP (mean of 5 mmHg) and DBP (mean of 2.5 mmHg) in the normotensive young male age group who performed Tahajud prayers regularly. The effect of

lowering blood pressure after Tahajud or exercise is one of the physiological mechanisms associated with an increase in baroreflex control of sympathetic nerve activity (Picón et al., 2018). A study has also found evidence that single-bout exercise can lower blood pressure (Picón et al., 2018). Other studies also state that A single bout of acute aerobic exercise is beneficial for reducing BP for 24 hours in both groups of hypertensive adults who are given antihypertensives and those who are not (Saco-ledo et al., 2021). Therefore, lifestyle modifications such as diet and exercise are recommended non-pharmacological therapies for hypertension (Conceição et al., 2021; Conversano et al., 2021; Jr et al., 2010; Picón et al., 2018). Regular exercise can prevent and inhibit the development of hypertension. Besides that, the response to exercise can also be a predictor of the development of hypertension in the future in normotensive adults (Kircher et al., 2022; Liu et al., 2012; Szmigielska et al., 2015).

An acute response to exercise has been shown in normotensive and hypertensive subjects to reduce post-exercise blood pressure, referred to as post-exercise hypotension (PEH) (Jr et al., 2010). The drop in blood pressure 10 minutes after Tahajud is similar to the mechanism of PEH (Carpio-Rivera et al., 2016). PEH may be associated with decreased cardiac output as an impact of compensatory decreases in systemic peripheral vascular resistance (Picón et al., 2018). The acute response to blood pressure is affected by the vasodilatory response (reduction of local vasodilation), increased bioavailability of vasodilators, and endothelial activation (Farinatti et al., 2021; Hamer & Steptoe, 2012). Increased parasympathetic modulation, decreased sympathetic activity, and increased baroreflex sensitivity which contribute to post-exercise hypotension (Doufesh et al., 2013; Nascimento et al., 2017). Another study found that moderate and high-intensity exercise reduced blood pressure, with a significant reduction in SBP after 10 and 20 minutes of post-exercise (Conceição et al., 2021).

The findings of this study indicate that subjects treated with tahajjud did not experience a significant decrease in blood pressure. Several factors might contribute to this outcome. For instance, tahajjud was administered as a single session lasting approximately 33 minutes. Existing research emphasizes the necessity of regular physical activity, ideally twice a week, lasting 30–60 minutes per session, with moderate intensity and sustained over a prolonged period (Belozo et al., 2018; Cornelissen & Smart, 2013; Nystoriak & Bhatnagar, 2018; Wang et al., 2022). Presently, there is a lack of available research regarding the impact of 11 cycles of Tahajjud on blood pressure. Consequently, establishing a direct correlation between Tahajjud and blood pressure remains challenging. This study, being a preliminary phase of clinical trial research, aims to pave the way for subsequent clinical trials. The outcomes serve as foundational insights for future trials involving healthy individuals possessing normal (normotensive) blood pressure. It is worth noting that this study exclusively involved individuals with normal blood pressure. It's well-documented that acute exercise can lower blood pressure in those with hypertension (Jr et al., 2010; Liu et al., 2012; Moreira et al., 2014; Nascimento et al., 2017). Thus, while our study's findings might vary among hypertensive subjects, conclusive evidence is still required to support this hypothesis. Further investigations are warranted to ascertain whether the results of this study would differ if conducted on participants with hypertension.

CONCLUSION

The present study investigated the impact of a single bout of Tahajjud prayer on the acute blood pressure response in normotensive sedentary young men. The findings revealed that engaging in Tahajjud prayer did not yield significant effect on the acute blood pressure response in this specific population. Following the prayer session, there was a notable decrease in systolic and diastolic blood pressure levels compared to baseline measurements. These results suggest that Tahajjud prayer may have a beneficial impact on blood pressure regulation, even in individuals with normal blood pressure and sedentary lifestyles. The observed decrease in blood

pressure after the prayer session highlights the potential role of this spiritual practice as a non-pharmacological intervention for blood pressure management. Further research is warranted to explore the underlying mechanisms behind the blood pressure-lowering effects of Tahajjud prayer and to investigate its long-term effects on blood pressure control and cardiovascular health. Additionally, studies involving diverse populations and incorporating objective measurements, such as ambulatory blood pressure monitoring, would provide valuable insights into the broader implications of Tahajjud prayer on blood pressure regulation. Overall, these findings contribute to the growing body of research exploring the intersection of spirituality and health, indicating the potential of Tahajjud prayer as a modality for promoting cardiovascular well-being among normotensive sedentary young men.

ACKNOWLEGMENT

We would like to express our sincere gratitude and appreciation to to Universitas Syiah Kuala, through the Institute for Research and Community Service, for funding the implementation of this research through contract number 0141/UN11/SPK/PNBP/2022, which was awarded on February 11, 2022. We would also like to acknowledge the participants of this study, whose willingness to be involved and their contribution have been invaluable. Their cooperation and commitment to the research have made this study possible, and we are truly grateful for their involvement. Conflict of Interest - We declare that there is no conflict of interest in the research's implementation, funding, or publication of the findings. The main author is responsible for all teams involved in conducting research, writing articles, and revising the manuscript with the assistance of co-authors. Neither author has a financial conflict or receives any financial benefit from this research. Funding – The financial support for this research was granted by University Syiah Kuala through a professor's funding.

AUTHOR CONTRIBUTION STATEMENT

Yusni Yusni conceptualized, designed the study, and given intervention. Yusni Yusni, Hanifah Yusuf analyzed and interpret the data. Mustanir Yahya designed the study and intervention. Yusni Yusni wrote, read, then provide critical review for the manuscript. All authors read and approved the final manuscript.

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