Effect of salat on blood pressure and pulse rate in stage one primary hypertension patients

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Original Article

ABSTRACT

Background: Hypertension is included in 15 major causes of death in the United States. Primary prevention and prompt treatment of hypertension can prevent mortality. Previous research on salat revealed that prayer provides a feeling of relaxation and activates parasympathetic activation, affecting the cardiovascular system.

Objective: This study aims to investigate the effect of salat on blood pressure (BP) and pulse in patients with stage one primary hypertension.

Methods: This is a quasi-experimental study with a non-equivalent pre- and post-test control group design. The sample was taken by purposive sampling method. Thirty-six outpatients with stage one primary hypertension who met the inclusion and exclusion criteria were included. The data were analysed by the Friedman and Wilcoxon post-hoc follow-up tests.

Results: The statistical analysis showed significant differences in systolic BP (SBP) at 5 minutes after salat, 10 minutes after salat, and 5 minutes vs 10 minutes after salat, both in the treatment and control groups. For the diastolic BP (DBP), a significant difference was found at 5 minutes after salat and 10 minutes after salat in the treatment group, as well as at 10 minutes after salat and 5 minutes after salat vs 10 minutes after salat in the control group. For the pulse variable, a significant difference was found at 5 minutes after salat and 10 minutes after salat in the treatment group, and 5 minutes after salat in the control group.

Conclusion: There is a decrease in BP and pulse rate in patients with stage one hypertension after salat.

Latar Belakang: Hipertensi primer stadium I didefinisikan sebagai peningkatan tekanan darah dengan tekanan sistolik antara 130 dan 139 mmHg atau tekanan diastolik antara 80 dan 89 mmHg serta tanpa diketahui penyebab sekundernya. Penelitian salat sebelumnya mengungkapkan bahwa salat memberikan perasaan rileks dan mengaktifkan aktivasi parasimpatis yang akan mempengaruhi sistem kardiovaskular.

Tujuan: Penelitian ini bertujuan untuk mengetahui pengaruh salat terhadap tekanan darah dan nadi pada penderita hipertensi primer stadium I.

Metode: Penelitian ini merupakan penelitian kuasi eksperimental dengan desain non-equivalent pre-test and post-test control group design. Subjek diambil dengan metode purposive sampling. Tiga puluh enam pasien rawat jalan dengan hipertensi primer stadium I yang memenuhi kriteria inklusi dan eksklusi dilibatkan dalam penelitian ini. Data dianalisis dengan uji Friedman dan Wilcoxon post-hoc follow-up test.

Hasil: Analisis statistik menunjukkan perbedaan tekanan darah sistolik yang signifikan pada 5 menit setelah salat, 10 menit setelah salat dan 5 menit vs 10 menit setelah salat baik pada kelompok perlakuan dan kontrol.

Untuk tekanan darah diastolik, perbedaan yang signifikan ditemukan pada 5 menit setelah salat dan 10 menit setelah salat pada kelompok perlakuan, serta pada 10 menit setelah salat dan 5 menit setelah salat vs 10 menit setelah salat pada kelompok kontrol. Untuk denyut nadi terdapat perbedaan yang bermakna pada 5 menit setelah salat dan 10 menit setelah salat pada kelompok perlakuan, dan 5 menit setelah salat pada kelompok kontrol.
***Kesimpulan:** Terdapat penurunan tekanan darah dan denyut nadi pada penderita hipertensi stadium I setelah salat.*

INTRODUCTION

The latest guidelines from the American College of Cardiology/American Heart Association (ACC/AHA) define stage one hypertension as a condition with systolic blood pressure (SBP) between 130-139 mmHg or diastolic BP (DBP) between 80-89 mmHg. This new definition leads to recommendations for non-pharmacotherapy (lifestyle changes) for patients who do not meet the Seventh Report of the Joint National Committee (JNC 7) definition of hypertension but meet the definition of the latest ACC/AHA guidelines.[1] Primary hypertension is defined as an increase in BP without any secondary cause.[2]

A mortality study reported that patients with hypertension had a greater risk of mortality due to all causes, specific cardiac disorders, specific cardiovascular disease (CVD), and specific cerebrovascular disorders. The study emphasised the benefits of secondary and primary prevention to prevent mortality risk.[3] Centers for Disease Control and Prevention (CDC) in 2017 showed that primary hypertension was ranked 13th of the 15 leading causes of death. The data also showed that heart disease ranked first among all the leading causes of death.[4] Heart failure has been known to be caused by chronic hypertension.[5]

Increased pulse rate has been linked to hypertension. A multi-centre study reported that 15% of patients with hypertension had a resting rate of > 85 beats per minute, and 27% had > 80 beats per minute.[6] Other studies reported that hypertensive patients with a persistent increase in pulse rate indicated an increased risk due to all cardiovascular and specific causes.[7]

Sayeed and Prakash define salat (prayer) as a form of the daily obligation of Muslims who have gone through puberty. Salat has identical movements for all Muslims in the world. Salat begins by lifting both palms to the side of the face while reciting verses of Al Quran, followed by bowing, standing and prostration, which will be repeated in accordance with the number of rak'ats (reading) of salat.[8]

A study about the role of salat showed the effect of reducing the adverse effects of stress on health.[9] Another research reviewed brain activities using electroencephalography (EEG) during duha (forenoon) salat and showed higher alpha waves in the brain during prostration that caused activation of parasympathetic nerves.[10] A systematic review also concluded that salat has a favourable effect on the cardiovascular system and can be used as a method of relaxation and meditation.[11]

METHODS

The current is a quasi-experimental study with a non-randomised pre- and post-test control group design. The population was all outpatients diagnosed with primary hypertension stage one in the Internal Medicine Outpatient Installation of Muhammadiyah Hospital of Palembang. The subjects were stage one primary hypertension patients who met the inclusion and exclusion criteria. The inclusion criteria were Muslim men and women diagnosed with primary stage one hypertension, aged 40-65 years, did not consume alcohol, received basic hypertension therapy, agreed to be the subject of the study and were not pregnant. The exclusion criteria were patients suffering from acute myocardial infarction and heart failure, chronic kidney disease (CKD), renal parenchymal disease, diabetes mellitus, Cushing's syndrome and other hormonal diseases, and refused to continue treatment for the allotted time. There were 18 respondents in each treatment and control group. Sampling was done by non-probability sampling with purposive sampling technique. Primary data

were collected by visiting respondents' homes for seven days during midday (zuhr) and afternoon (asr) salat time. Researchers measured BP using an aneroid sphygmomanometer and measured pulse using fingers II-III-IV. Secondary data were collected from medical records in Muhammadiyah Hospital of Palembang.

RESULTS

Based on table 1, there were 7 men and 11 women both in the treatment and control groups. Most respondents were in the > 55 age group and the most used antihypertensive drugs in treatment groups were Captopril and Amlodipine.

Table 1. Frequency distribution of sex, age, and antihypertensive drugs

Characteristics		Group	
		Treatment n (%)	Control n (%)
Sex	Men	7 (19.4%)	7 (19.4%)
	Women	11(30.6%)	11(30.6%)
Age	<50	4 (11.1%)	3 (8.3%)
	50 – 55	5 (13.9%)	5 (13.9%)
	>55	9 (25.0%)	10 (27.8%)
Antihypertensive drugs	Captopril	8 (22.2%)	6 (17.7%)
	Amlodipine	8 (22.2%)	9 (25.0%)
	Captopril & Amlodipine	1 (2.8%)	2 (5.6%)
	Isoprolol	1 (2.8%)	1 (2.8%)

Table 2 shows that the characteristics of understanding salat in treatment and control groups were quite similar.

Table 2. Characteristics of understanding salat in treatment and control group.

Characteristics		Group	
		Treatment n (%)	Control n (%)
Understanding salat readings	Yes	3 (16.7%)	6 (33.3%)
	No	7 (38.9%)	5 (27.8%)
	Slightly	8 (44.4%)	7 (38.9%)
Effort to complete salat	Always	14 (77.8%)	10 (55.6%)
	Sometimes	4 (22.2%)	7 (38.9%)
	Never	0 (0%)	1 (5.6%)
Effort to do salat on time	Always	9 (50.0%)	11(61.1%)
	Sometimes	9 (50.0)	5 (27.8%)
	Never	0 (0%)	2 (11.1%)
Thuma'ninah in salat	Always	9 (50.0%)	8 (44.4%)
	Sometimes	9 (50.0%)	7 (38.9%)
	Never	0 (0%)	3 (16.7%)
Solemnity scale	A little	6 (33.3%)	4 (22.2%)
	Quite more	8 (44.4%)	10 (55.6%)
	More solemn	3 (16.7%)	4 (22.2%)

Table 3 shows the characteristics of five daily salat habits and other sunnah prayers in the treatment and control groups. For the five daily salat habit variables, most respondents answered "always", which were 17 respondents (94.4%) in the treatment group and 18 respondents (100%) in the control group. For the rawatib (sunnah prayers associated with fard prayers) salat habit variable, most of the respondents in the treatment group answered "never" (44.4%), while most respondents in the control group answered "rarely" (61.1%). For the duha prayer habit variable, most respondents answered "never", consisting of 13 respondents (72.2%) in the treatment group and 10 respondents (55.6%) in the control group. For the tahajjud (night) prayer habit variable, both the treatment and control groups showed 8 respondents (44.4%) answering rarely and never, while most respondents from the control group answered "never" (72.2%).

Table 3. Respondents' habit of *salat*

| Characteristics | | Group | |
		Treatment n (%)	Control n (%)
Five-time *salat* habit	Always (35 times/weeks)	17 (94.4%)	18 (100%)
	Rarely (10-15 times/weeks)	1 (5.6%)	0 (0%)
Rawatib *salat* habit	Often (5-7 times/weeks)	4 (22.2%)	2 (11.1%)
	Rarely (2-5 times/weeks)	6 (33.3%)	11 (61.1%)
	Never (0 times/weeks)	8 (44.4%)	5 (27.8%)
Dhuha *salat* habit	Rarely (2-3 times/weeks)	5 (27.8%)	8 (38.9)
	Never (0 times/weeks)	13 (72.2%)	10 (55.6%)
Tahajud *salat* habit	Often (4-6 times/weeks)	2 (11.1%)	2 (11.1%)
	Rarely (2-3 times/weeks)	8 (44.4%)	13 (72.2%)
	Never (0 times/weeks)	8 (44.4%)	3 (16.7%)

Table 4 shows the mean SBP in the treatment and control groups. The results showed that SBP decreased 5 and 10 minutes after salat in both the treatment and control groups. Table 5 shows the mean DBP in the treatment and control groups. DBP decreased 5 minutes after and 10 minutes after salat in both groups.

Table 6 shows the mean pulse rate of respondents from both groups. In both treatment and control groups, a decrease in pulse rate at 5 minutes and 10 minutes after salat was found.

Table 4. Respondents' systolic blood pressure

| Time | | Systolic blood pressure | |
		Treatment group	Control group
Before salat	Mean (±SD)	149.12 (±4.85)	148.74 (±6.21)
	Range	142.85-155.71	137.14-158.57
5 minutes after salat	Mean (±SD)	145.23 (±4.49)	146.74 (±6.53)
	Range	135.71-152.85	132.85-157.14
10 minutes after salat	Mean (±SD)	143.56 (±4.80)	144.99 (±6.79)
	Range	135.71-154.28	134.28-157.14

Table 5. Respondents' diastolic blood pressure

Time		Diastolic blood pressure	
		Treatment group	Control group
Before salat	Mean (±SD)	89.44 (±2.08)	89.59 (±2.84)
	Range	85.71-94.28	84.28-94.28
5 minutes after salat	Mean (±SD)	88.17 (±2.63)	88.45 (±3.00)
	Range	82.85-91.42	81.42-95.71
10 minutes after salat	Mean (±SD)	87.77 (±2.73)	86.50 (±4.66)
	Range	81.42-91.42	74.28-94.28

Table 6. Respondents' mean pulse rate.

Time		Pulse rate	
		Treatment group	Control group
Before salat	Mean (±SD)	78.78 (±4.53)	77.69 (±3.60)
	Range	72.85-86.14	74.14-86.00
5 minutes after salat	Mean (±SD)	78.24 (±4.72)	77.08 (±3.87)
	Range	71.57-86.14	72.28-85.57
10 minutes after salat	Mean (±SD)	77.48 (±4.16)	77.11 (±4.86)
	Range	71.14-85.00	70.28-88.57

Table 7 shows the comparison between SBP before and 5 minutes after salat, before and 10 minutes after salat, and between SBP at 5 minutes after salat and 10 minutes after salat. The result of the Wilcoxon post-hoc test showed a more significant p-value in the treatment group compared to the control group at all times.

Table 7. Results of Post-hoc Wilcoxon test on systolic blood pressure.

Time	Group	
	Treatment (p value)	Control (p value)
Before vs 5 minutes after salat	<0.001	0.013
Before vs 10 minutes after salat	<0.001	0.003
5 minutes after salat vs 10 minutes after salat	0.012	0.013

Table 8 shows the comparison of DBP before and 5 minutes after salat, before and 10 minutes after salat, and the comparison between DBP 5 minutes and 10 minutes after salat. Wilcoxon Post-hoc test result showed a significant difference in the treatment group before and 5 minutes after salat as well as before and 10 minutes after salat, and a significant p-value was also found in the control group before and 10 minutes after salat; as well as 5 minutes after salat compared to 10 minutes after salat. Table 9 shows the results of the Wilcoxon Post-hoc test analysis on pulse rate in both groups. The results showed a significant p-value for the pulse rate of the treatment group before and 5 minutes after salat, as well as before and 10 minutes after salat.

Table 8. Results of Post-hoc Wilcoxon test on diastolic blood pressure.

Time	Group	
	Treatment (p value)	Control (p value)
Before vs 5 minutes after salat	0.017	0.086
Before vs 10 minutes after salat	0.006	0.012
5 minutes after salat vs 10 minutes after salat	0.254	0.011

Table 9. Results of Post-hoc Wilcoxon test on pulse rate

Time	Group	
	Treatment (p value)	Control (p value)
Before vs 5 minutes after salat	0.011	0.028
Before vs 10 minutes after salat	0.001	0.348
5 minutes after salat vs 10 minutes after salat	0.066	0.368

DISCUSSION

The statistical analysis showed significant differences in SBP at 5 minutes after salat, 10 minutes after salat and 5 minutes vs 10 minutes after salat both in the treatment and control groups. For the DBP, a significant difference was found at 5 minutes after salat and 10 minutes after salat in the treatment group, as well as at 10 minutes after salat and 5 minutes after salat vs 10 minutes after salat in the control group. For the pulse variable, a significant difference was found at 5 minutes after salat and 10 minutes after salat in the treatment group, and 5 minutes after salat in the control group. Meanwhile, the control group showed a significant decrease in all three variables. The treatment group showed a more significant difference compared to the control group, except for DBP at 5 minutes after salat and 10 minutes after salat.

The results of this study were in accordance with Doufesh et al., which showed a decrease in systolic and DBP during and after salat. The study measured BP during salat, after actual salat, and after imitation of salat movement. Average systolic and DBP in the actual salat was lower than the BP after imitation of salat movement: systolic BP decreased by 2.5% after actual salat and by 1.7% after imitation of the salat movement; diastolic BP decreased 2.8% after actual salat and 1.6% after imitation of the salat movement. This significant decrease indicated a gradual change from sympathetic to parasympathetic activity.[12] It was also thought to be related to the position and movement of salat that was similar to yoga and Tai chi, causing replacement of sympathetic nerve activity by parasympathetic nerves and resulting in lowered BP.[13] The difference in statistical analysis results between actual salat and imitation of salat could be due to the activity of reading verses from the Al Quran during actual salat that was not done in the imitation of salat. A study of nine Muslims with EEG recordings during duha salat showed higher alpha wave amplitude in the parietal and occipital lobes of the brain during prostration, causing activation of parasympathetic nerves and relaxed feeling.[10]

This study also showed a significant difference in pulse rate at 5 minutes and 10 minutes after salat in the treatment group and 5 minutes after salat in the control group. A study by Rufa'I et al. also showed a significant decrease in systolic and DBP at one minute in the head down crooked kneeling (HDCK) position, but the pulse rate increased at one and three minutes of prostrating position compared to pulse rate at rest.[14]

A study by Doufesh et al. indicated that the pulse rate during salat was increased in the standing position (highest increase), bowing and sitting, and decreased to the lowest level in the prostration position compared with the baseline (supine position). In the standing position, venous return decreased due to venous pooling in lower limbs by the effects of gravity. Decreased venous return will cause a decrease in cardiac output, resulting in decreased baroreceptor stimulation in the aorta and carotid artery. Decreased baroreceptor response would decrease parasympathetic nerve activity and increase sympathetic nerve activity, increasing pulse. In the prostration position, the venous return will increase. At this position, the brain had a lower position than the heart. Therefore, blood would flow to the brain with maximum gravitational pull. Due to an increase in the amount of blood reaching the head, the amount of oxygen in the brain cells would increase. High oxygen levels in the brain would greatly impact concentration, memory, vision and hearing.[13,15] Salat has a good impact on the cardiovascular system, and in addition to BP, it would also affect the pulse rate. Therefore, researchers recommended salat as a part of therapy for hypertensive patients.[13]

CONCLUSION

This study showed that salat significantly reduced BP and pulse rate in patients with stage one primary hypertension, showing that salat could be considered a part of non-pharmacological treatment of hypertension. Further research will be needed to analyse each movement of salat and its effect on the cardiovascular system with larger sample sizes and multivariate analysis. Further research that considers other confounding factors affecting BP, such as dietary salt, the obedience of patients in taking medication, and frequency of exercise, is also highly anticipated.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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