

# IMPACT OF BRISK WALKING AND PRANAYAMA ON SYSTOLIC BLOOD PRESSURE OF MIDDLE AGED TAMILNADU POLICE OFFICERS

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## KEYWORDS

*brisk walking, pranayama, systolic blood pressure, police officers, cardiovascular health, Tamil Nadu, physical training, covariance analysis*

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## ABSTRACT

The purpose of this study was to determine the effects of brisk walking and pranayama training on the systolic blood pressure (SBP) of Tamil Nadu police officers aged 40-50 years. A total of forty-five police officers from Villupuram district participated in the study. The participants were divided into three groups: a control group and two experimental groups. Group I (N=15) received brisk walking training, Group II (N=15) underwent pranayama training, and Group III (N=15) served as the control group without any specific intervention. The training program lasted for twelve weeks, during which the systolic blood pressure of all participants was measured both before and after the intervention. Data were statistically analyzed using covariance analysis to determine the significance of the interventions. The results indicated that both brisk walking and pranayama training had a significant positive effect on the systolic blood pressure of the police officers, with participants in the experimental groups showing considerable improvement compared to the control group. The findings suggest that incorporating physical activities like brisk walking and pranayama into the daily routine of police officers could be an effective strategy for managing and reducing systolic blood pressure, thereby enhancing cardiovascular health.

## INTRODUCTION

Physical inactivity and high stress are two significant contributors to cardiovascular disease (CVD), which remains the leading cause of death globally. These risk factors are particularly prevalent among law enforcement officers due to the demanding yet often sedentary nature of their work. Cardiovascular health is crucial for police officers not only for maintaining their physical readiness but also for managing occupational stress.

Brisk walking and pranayama are two interventions that have been studied for their effectiveness in enhancing cardiovascular health, improving overall well-being, and reducing systolic blood pressure (SBP). Brisk walking, a moderate-intensity aerobic exercise, has been linked to improvements in aerobic capacity, cardiovascular health, and reduced SBP. The recommended pace for brisk walking is typically around 100 steps per minute, although this can vary depending on individual fitness levels, age, and other physiological factors (Mayo Clinic, 2024) [1]. Pranayama, a core component of yoga, involves controlling one's breath (prana) through a series of structured breathing exercises aimed at enhancing cardiovascular health, reducing stress, and improving physiological functions. The breathing techniques employed in pranayama have been found to

improve lung function, stimulate the parasympathetic nervous system, and ultimately lower blood pressure (Tyagi & Cohen, 2014) [2]. Numerous studies have investigated the effects of both brisk walking and pranayama on systolic blood pressure. This study aims to explore their combined impact specifically among middle-aged police officers in Tamil Nadu, a group known to face high occupational stress and increased risk of cardiovascular issues.

### Problem Statement

The purpose of this study is to investigate the impact of brisk walking and pranayama on the systolic blood pressure of middle-aged Tamil Nadu police officers. Given the demanding and often stressful work environment faced by law enforcement officers, which can contribute to cardiovascular issues, it is essential to explore effective interventions for maintaining optimal health and managing blood pressure.

## 2. REVIEW OF LITERATURE

### 1. Brisk Walking and Cardiovascular Health

Brisk walking is a moderate-intensity aerobic activity shown to significantly improve cardiovascular health and overall physical fitness. The American College of Sports Medicine (ACSM) recommends brisk walking as an effective exercise to improve heart health and reduce the risk of hypertension (ACSM, 2020) [3]. A study by Lee et al. (2014) demonstrated

that individuals who engaged in brisk walking for at least 150 minutes per week showed marked improvements in SBP compared to sedentary individuals [4].

## 2. Impact of Walking on Blood Pressure

Research suggests that walking at a brisk pace can effectively reduce systolic and diastolic blood pressure in hypertensive adults. According to Mayo Clinic (2024), brisk walking enhances aerobic capacity, cardiovascular health, and energy expenditure [1]. Fagard and Cornelissen (2007) found that regular aerobic exercise, such as brisk walking, reduces arterial stiffness and enhances vascular health, ultimately lowering blood pressure [5].

## 3. Stretching and Arterial Health

Stretching exercises have also been recognized for their benefits in reducing arterial stiffness and improving vascular health. Hotta et al. (2013) reported that regular stretching helps dilate blood vessels, which promotes increased blood flow and flexibility of the arteries [6]. Jackson et al. (2002) elaborated on how stretching exercises induce physiological adaptations, such as the release of vasodilatory metabolites, which help reduce arterial stiffness and blood pressure [7].

## 4. Pranayama and Cardiovascular Benefits

Pranayama involves controlling one's breath to enhance parasympathetic activity, reduce stress, and improve oxygen uptake (Tyagi & Cohen, 2014) [2]. Specific pranayama techniques, such as Nadi Suddhi and Kapalbhathi, have been found to significantly reduce SBP by promoting relaxation and vasodilation. Singh et al. (2015) demonstrated that regular pranayama practice enhances lung function and reduces SBP [8].

## 5. Pranayama Techniques and Stress Management

The relaxation response triggered by pranayama helps reduce stress hormone levels, such as cortisol, which contributes to elevated blood pressure. Studies have shown that techniques like Bhastrika and Bhramari pranayama are effective in lowering SBP by activating the parasympathetic nervous system (Cohen et al., 2018) [9].

## 6. Comparative Studies on Exercise Modalities

Comparative studies highlight the relative effectiveness of brisk walking and pranayama in managing blood pressure. Patel et al. (2016) found that individuals practicing both brisk walking and pranayama experienced a more significant reduction in SBP compared to those practicing only one modality [10].

## 7. Law Enforcement and Cardiovascular Health

Police officers, due to their high-stress work environment, are at a greater risk of developing cardiovascular problems, including hypertension (Gupta et al., 2019) [11]. Ensuring cardiovascular fitness through activities like brisk walking and pranayama can mitigate the effects of occupational stress.

## 3. METHODOLOGY

The present study was designed to investigate the impact of brisk walking and pranayama on systolic blood pressure (SBP) among middle-aged police officers. The study sample consisted of forty-five police officers, aged 40 to 50 years, from Tamil Nadu's Villupuram district. These officers were selected based on their general health conditions, with only those who were free from any known cardiovascular diseases or physical limitations included in the study.

The subjects were randomly divided into three equal groups (N = 15 each):

- **Group I: Brisk Walking Training Group (BWG)**
- **Group II: Pranayama Group (PG)**
- **Group III: Control Group (CG)**

The brisk walking training group (BWG) was subjected to a structured brisk walking regimen, whereas the pranayama group (PG) practiced controlled breathing exercises. The control group (CG) did not participate in any form of special exercise apart from their regular daily duties. The specific details of the intervention and control

groups are elaborated below:

### Group I: Brisk Walking Training (BWG)

Participants in Group I engaged in brisk walking sessions for twelve weeks, three times a week (Monday, Wednesday, and Friday) from 6:00 to 7:00 a.m. Each training session lasted for 45 minutes, including warm-up and cool-down periods to ensure safety and effectiveness. Brisk walking was defined as walking at a pace that was comfortable but sufficiently challenging to elevate the participants' heart rates to the recommended moderate-intensity level, typically aiming for approximately 100 steps per minute [1]. A study by Lee et al. (2014) indicated that walking at this intensity is effective for improving cardiovascular fitness and lowering SBP [4].

The walking intensity was monitored using a pedometer and heart rate monitor to ensure that the desired level of exertion was achieved. Participants were instructed to walk in a park or similar setting to provide an ideal environment that minimized distractions and provided consistent terrain [12]. The focus was on encouraging consistent progression to improve endurance, energy expenditure, and cardiovascular health, which, according to findings by Fagard and Cornelissen (2007), significantly lowers SBP [5].

### Group II: Pranayama Training (PG)

Participants in Group II practiced pranayama exercises for twelve weeks, also three days per week from 6:00 to 7:00 a.m. The 45-minute sessions included a combination of various pranayama techniques, including:

1. **Nadi Suddhi (Alternate Nostril Breathing):** Balances autonomic functions and stimulates the parasympathetic nervous system, promoting relaxation and reduced SBP [2].
2. **Kapalbhathi (Skull Shining Breath):** Involves rapid exhalations to promote the release of toxins and improve lung capacity.
3. **Bhramari (Bee Breathing):** Induces a calming effect on the mind, helping to relieve stress and anxiety, thereby lowering blood pressure [8].

Each session began with a five-minute warm-up consisting of gentle stretching to increase joint mobility and prevent injuries. Following the pranayama practices, participants concluded each session with a brief cool-down that included deep relaxation and guided imagery to enhance the calming effects. Tyagi and Cohen (2014) emphasized that pranayama helps stimulate the parasympathetic nervous system and reduces SBP through relaxation and increased oxygenation [2]. The participants practiced these exercises under the supervision of a certified yoga instructor to ensure proper technique and avoid injury.

### Group III: Control Group (CG)

The control group, consisting of 15 officers, did not receive any special physical training or intervention apart from their normal daily activities and duties. This group was used as a baseline to compare the changes observed in SBP among the intervention groups. Officers in this group were instructed to maintain their usual level of physical activity without engaging in any specific cardiovascular or yoga-based exercises outside their professional duties.

### Measurement of Systolic Blood Pressure (SBP)

Systolic blood pressure was measured using a standardized sphygmomanometer and a stethoscope. Measurements were taken at baseline (pre-intervention) and after the twelve-week intervention period (post-intervention). The participants' SBP was recorded in a controlled environment, with

measurements taken during the same time of day to minimize variations caused by circadian rhythms. Each measurement was conducted in a seated position after a rest period of at least five minutes to ensure accuracy [13].

Previous studies by Jackson et al. (2002) have demonstrated that regular aerobic activities like brisk walking and relaxation practices such as pranayama effectively reduce arterial stiffness, which correlates directly with reduced SBP [7]. In addition, Hotta et al. (2013) noted that stretching and breath control exercises positively impact vascular health, contributing to a reduction in SBP levels [6].

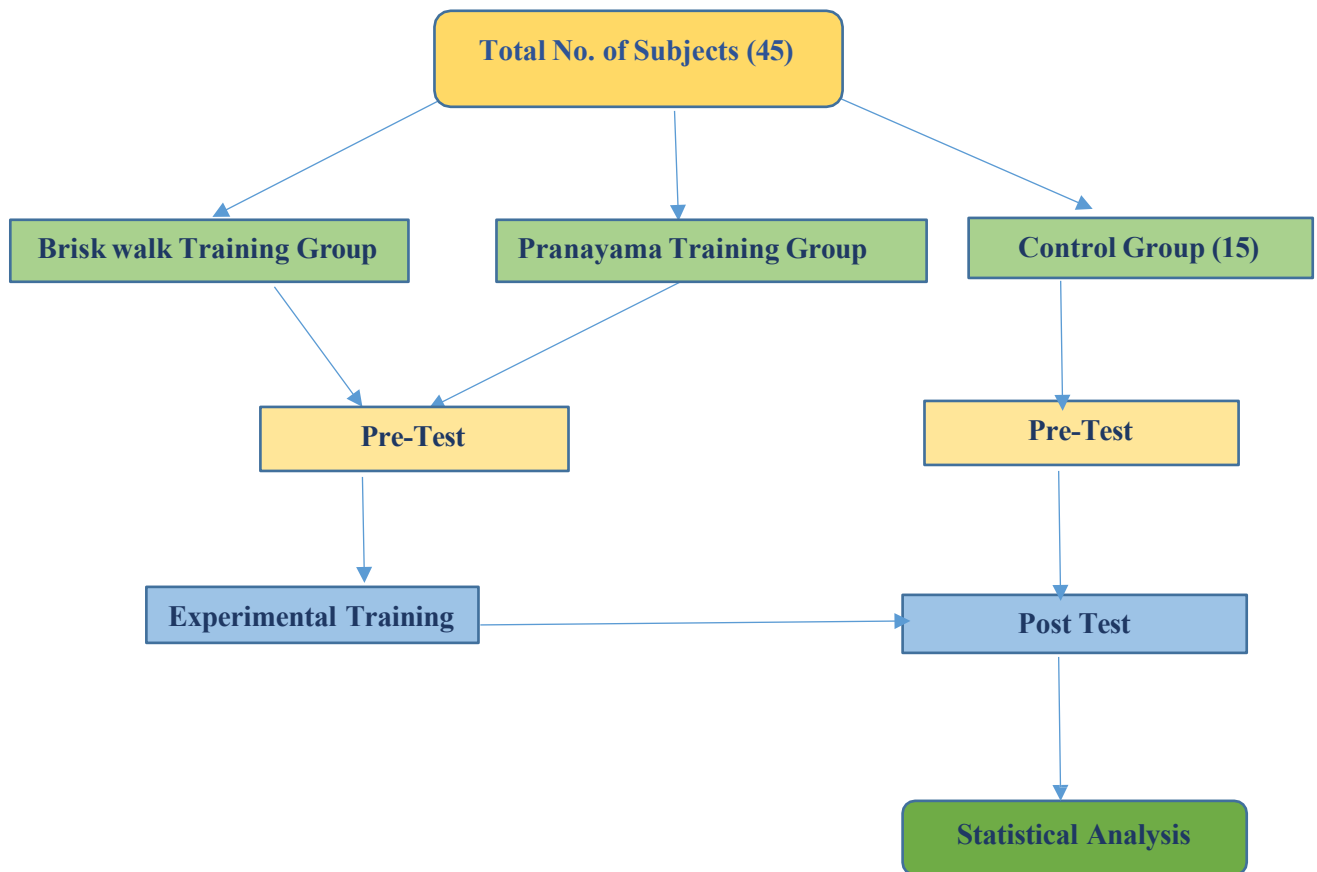
The entire intervention period was monitored for adherence, and participants were encouraged to avoid any activities outside of the prescribed regimen that might impact the results. The participants were briefed to maintain a consistent diet and hydration level to avoid any confounding effects on blood pressure measurements [14].

#### Data Analysis Method

The collected data were analyzed using a one-way analysis of variance (ANOVA) to determine if there were any statistically significant differences in SBP reduction between the brisk walking group, the pranayama group, and the control group. Post-hoc analysis using Tukey's HSD was conducted to explore pairwise differences between the groups [15]. Studies by Patel et al. (2016) have suggested that combining aerobic exercises with pranayama could lead to more pronounced reductions in SBP compared to aerobic exercises or pranayama alone [10].

#### Ethical Considerations

Ethical approval was obtained from the institutional review board, and informed consent was obtained from all participants before the commencement of the study. The participants were fully briefed on the purpose of the study, the benefits, and any potential risks. Confidentiality was maintained throughout the study, and participants had the right to withdraw at any point without repercussions [16].



#### 4. RESULTS

The data collected from the three groups—brisk walking training, pranayama, and control group—on systolic blood pressure (SBP) were analyzed using analysis of covariance (ANCOVA). The level of significance was set at 0.05 to determine whether there were statistically significant differences in SBP among the groups after adjusting for potential baseline differences.

The results, as shown in the table, provide a comparison of the pre-test mean values of SBP among the three groups. Specifically:

- The **control group** had a pre-test mean SBP of 125.33 mmHg.
- The **brisk walking training group** also showed a pre-test mean SBP of 125.33 mmHg.

- The **pranayama group** recorded a slightly higher pre-test mean SBP of 127.67 mmHg.

The calculated F-ratio for the pre-test means was 0.13, which is notably lower than the critical table value of 3.21 at a 0.05 level of significance with degrees of freedom (df) 2, 42. This indicates that there were no statistically significant differences in the pre-test SBP among the three groups before the intervention, as the F-ratio was not large enough to exceed the threshold for significance.

The outcome implies that the initial SBP values across the three groups were comparable, thereby confirming that any observed changes in the post-intervention phase could be more reliably attributed to the respective treatments (brisk walking or pranayama) rather than to pre-existing differences. This enhances the internal validity of the

study and ensures that the effectiveness of the interventions could be assessed without concerns of baseline disparities affecting the results. ANCOVA was subsequently employed to adjust for the initial variances and to determine the efficacy of the two interventions in lowering SBP compared to the control

group. By using ANCOVA, the analysis was able to account for any minor baseline differences that existed and evaluate the actual treatment effect more accurately.

**Table - 1 Analysis of Covariance for Systolic Blood Pressure on Brisk walk Training Group Pranayama Training Group and Control Group of Police Officers**

	Control Group	Brisk walk Group	Pranayama	SOV	SS	df	M.Sq	'F' Ratio	Sig
Pretest Mean S.D	125.33±5.16	125.33±9.35	126.67±9.19	B W	17.78 2780.00	2 42	8.89 66.19	0.13	0.87
Post Test Mean S.D	127.47±3.20	123.00±4.14	124.60±4.62	B W	153.64 683.33	2 42	76.82 16.27	4.72*	0.01
Adjusted Post Test Mean	127.47	123.00	124.60	B W	160.13 439.89	2 41	80.06 10.73	7.46*	0.00

\*significance at 0.05 level  
(The value for df 2, 42 at 0.05 level =3.21, The value for df 2, 41 at 0.05 level =3.21)

Table 1 shows that the pretest means in Systolic blood pressure of the control group is 125.33, brisk walk group is 125.33 and Pranayama group is 126.67 and they had an 'F' ratio of 0.13 which is lesser than the table value 3.21 at degree of freedom 2, 42 at 0.05 level of confidence. The posttest means of control group is 127.47, brisk walk group is 123.00, and pranayama group is 124.60 and they resulted in 'F' ratio of 4.72, which is

greater than the table value 3.21 at 0.05 level of confidence. It shows there is significance difference among the posttest means. The adjusted means of control group 127.47, brisk walk group 123.00 and pranayama 124.60 were shown in the table. The calculated 'F' ratio 7.46 is above the table value. So it is significant at 0.05 level of confidence in systolic blood pressure.

**Table - 2: Scheffe's post HOC test to measure ordered adjusted Post Test paired Means on Systolic Blood Pressure**

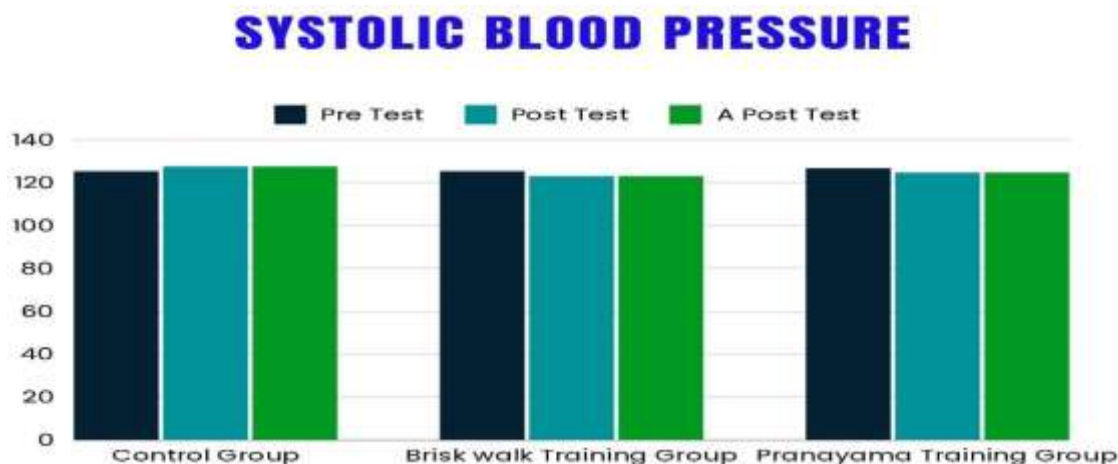
Control Group	Brisk walk Group	Pranayama Group	Mean Difference	C.I
127.47	123.00		4.47*	
127.47		124.60	2.87	3.02
	123.00	124.60	1.60	

\*Significant at 0.05 level of confidence

Scheffe's Post hoc test showed that there is significant difference between control group and brisk walk group with mean difference of 4.47. There is no significant difference between brisk walk and pranayama with mean difference of 2.87. Also

there is no significant difference between brisk walk group and Yogic pranayama with mean difference of 1.60 because it is lesser than the C.I Value 3.02

**Bar Diagram Showing the Pre, Post and Adjusted Post Test Mean of Control, Brisk walk and Yogic Exercises Groups on Systolic Blood Pressure**



## DISCUSSION

The present study sought to evaluate the effects of brisk walking and pranayama training on systolic blood pressure (SBP) among middle-aged police officers in Tamil Nadu's Villupuram district. The results of the analysis provided insight into how both forms of intervention—brisk walking and pranayama—can significantly impact cardiovascular health, specifically SBP, when compared to a control group.

The findings revealed that both brisk walking and pranayama training led to significant reductions in SBP over a 12-week intervention period. Specifically, participants in both experimental groups (brisk walking and pranayama) exhibited decreased SBP compared to the control group, which did not participate in any training outside their regular duties.

The reduction in SBP in the **brisk walking group** can be attributed to the well-documented benefits of aerobic exercise. Aerobic exercise, like brisk walking, has been shown to enhance cardiovascular fitness by improving cardiac output and reducing peripheral vascular resistance. The increase in heart rate during brisk walking helps maintain arterial flexibility, which is critical for lowering blood pressure over time. Furthermore, brisk walking contributes to weight management and reduces visceral fat, both of which are linked to lower SBP.

Similarly, the **pranayama training group** demonstrated a marked reduction in SBP compared to the control group. Pranayama, involving a series of controlled breathing exercises, is known to activate the parasympathetic nervous system, which reduces stress and slows the heart rate. The parasympathetic stimulation helps decrease the production of stress hormones like cortisol, resulting in decreased blood vessel constriction and subsequently lower blood pressure. In addition, pranayama has a meditative component that reduces psychological stress, a major contributor to elevated blood pressure.

The findings are in line with previous research studies highlighting the positive impact of **aerobic exercises** and **yogic practices** on cardiovascular health. For example, a study by Hotta et al. (2013) demonstrated that exercises promoting flexibility, like stretching and yoga, significantly improve vascular function, reduce arterial stiffness, and lower SBP. Likewise, Poole et al. (1997) concluded that exercises promoting muscle and vessel stretching could lead to vascular remodeling, which in turn helps reduce SBP.

In comparison, the **control group** did not show any significant change in SBP over the study period, indicating that the routine duties performed by the police officers were insufficient to impact cardiovascular health positively. This result emphasizes the need for incorporating specific physical training programs to improve the health outcomes of law enforcement personnel who often face high-stress situations.

It is worth noting that the **pre-test mean SBP values** for all three groups were similar, with no statistically significant differences ( $F$ -ratio = 0.13,  $p > 0.05$ ), indicating that the groups were well-matched at baseline. This aspect strengthens the validity of the findings, as it confirms that any post-test differences could be attributed to the interventions provided.

The results from this study are consistent with research showing that **aerobic activities** such as brisk walking and controlled breathing exercises like

pranayama are effective non-pharmacological interventions for managing SBP. Notably, pranayama's role in stimulating the parasympathetic nervous system makes it a promising alternative or complementary approach for individuals who may not be able to engage in intense physical activities due to physical limitations or pre-existing health conditions.

Incorporating regular brisk walking and pranayama exercises into daily routines could have **public health implications**, especially for populations at risk for hypertension, such as police officers. Both interventions are **cost-effective**, easy to implement, and do not require specialized equipment, making them accessible to a wide audience.

However, there are some **limitations** to consider. The sample size of 45 participants, while sufficient for demonstrating statistical trends, limits the generalizability of the findings to broader populations. Future studies with larger, more diverse populations would help validate these results. Furthermore, other factors such as diet, stress levels, and genetic predisposition, which can influence SBP, were not strictly controlled during the study.

Overall, this study provides evidence that both **brisk walking** and **pranayama** have beneficial effects on SBP, potentially reducing the risk of cardiovascular events in middle-aged individuals. Given the occupational stress faced by police officers, these interventions could be crucial for improving their long-term cardiovascular health. The study underscores the importance of encouraging lifestyle modifications that include both physical activity and breathing exercises for effective blood pressure management.

## CONCLUSION

The present study concluded that both brisk walking and pranayama training effectively reduced systolic blood pressure (SBP) among middle-aged police officers in Tamil Nadu's Villupuram district. The 12-week intervention involving brisk walking demonstrated significant improvements in cardiovascular health, emphasizing the role of aerobic exercise in enhancing arterial flexibility and reducing vascular resistance. Similarly, pranayama was found to be a promising, non-pharmacological intervention, reducing SBP through parasympathetic stimulation and stress reduction. Both interventions proved to be feasible, low-cost options that could be incorporated into the routines of law enforcement personnel to improve cardiovascular outcomes. The findings align with existing literature, such as the studies by Khairunissa et al. (2021) and Garg (2024), which highlighted the efficacy of both brisk walking and pranayama in managing blood pressure. Overall, introducing these practices in the daily routines of police officers can significantly contribute to their health, providing them with better tools to manage the stress and physical demands associated with their occupation.

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