The Egyptian Journal of Hospital Medicine (October 2021) Vol. 85 (2), Page 3949-3952

Novel Overview of Seasonal Blood Pressure Variation: Review Article

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ABSTRACT

Background: One of the world's most common health issues is high blood pressure. Hypertension's dangers are well-documented and have been shown in numerous large-scale investigations. Seasonal variation in blood pressure is largely due to changes in the temperature of the surrounding environment. Several studies have found a negative correlation between the temperature outside and blood pressure. No observational study has been done in Egypt so far using either healthy people or patients to examine the effect of weather on blood pressure. Evidence suggests that seasonal fluctuations in ambient temperature have an impact on cardiovascular events and blood pressure levels.

Objective: Study the blood pressure levels in the winter and summer to see whether they differ.

Conclusion: In both men and women, young and elderly, the seasonal change in BP appears to be a global phenomenon that has been documented in regions with varying climate conditions.

Keywords: Seasonal Blood Pressure Variation, Systemic Hypertension.

Systemic Hypertension:

It is estimated that one third of the world's population would be affected by hypertension by 2025 because of increased obesity and population ageing. Hypertension is rapidly increasing in developing countries (80% of the world), a situation where insufficient treatment and control of hypertension contributes to the burgeoning epidemic of cardiovascular disease (CVD). Globally, high blood pressure (BP) is the leading cause of strokes and ischemic heart disease, accounting for two-thirds of all cerebrovascular accidents (strokes) **(1)**.

Seasonal blood pressure variation:

Temperature-dependent oscillations in blood pressure have been seen in numerous investigations, warmer temperatures result in lower blood pressure, while cooler temperatures result in higher blood pressure**.** All age groups, people with and without high blood pressure, those who are neither hypertensive nor those who are being treated for it have seen seasonal changes in their blood pressure. This suggests that seasonal variations in blood pressure are a worldwide phenomenon **(2)**. Hypertensive individuals who are well-managed in the winter may experience an unexpected decline in BP over the summer, which may necessitate a reduction in the dosage of their medication **(3, 4)**.

Hypertensive patients who manage their BP in the summer may need to increase their medication dosages in the winter because of an increased risk of their BP rising above the acceptable level. The same can happen when people go from cold to hot climates, or the other way around. It's imperative for a practitioner to verify the change in blood pressure and adjust antihypertensive drug therapy in order to maintain a safe and effective BP level without symptoms. 13.5 percent of the 667 patients in a recent study who sought treatment for high blood pressure throughout the summer had their prescription decreased, with diuretics having the highest rate of reduction **(4)**.

Mortality and blood pressure patterns in relation to the seasons:

Globally, seasonal temperature change is linked to seasonal variations in BP and cardiovascular mortality, according to accumulating research. Many major studies of various designs have proven the relationship between season and temperature and mortality **(5)**. In both temperate and frigid areas in the Southern and Northern Hemispheres, winter is the highest season for mortality**.** Near the equator, winter mortality is at its lowest, whereas in the Mediterranean region, it is at its highest **(6)**.

Pathophysiological mechanisms:

Increasing peripheral resistance and vasoconstriction in cold, together with vasodilation and decreased resistance in warmer temperatures, are thought to be responsible for the observed link between blood pressure (BP) and temperature in epidemiological studies **(7)**. Prolonged exposure to cold air may activate additional regulating systems, as blood pressure remained elevated even when measured indoors in a room with a constant temperature. Seasonal changes in temperature affect the activity of the sympathetic nervous system. During cold exposure, norepinephrine excretion increases and the maximum outside temperature has a negative link with norepinephrine **(8)**.

In the winter season, less sweating, which reduces salt loss, may contribute to a rise in blood pressure **(7)**. Increased parathyroid hormone production as a result of decreased ultraviolet (UV) light exposure may boost the development of vascular smooth muscle and improve its contractility via adrenaline reactivity, endothelial function, and changes in intracellular calcium **(9)**. There may be a correlation between the amount of sunshine exposure and changes in corticosterone, adrenaline, and prolactin release **(10)**.

People with untreated mild essential hypertension who received repeated full-body UVB radiation treatment

Received: 17/8/2021
Accepted: 3/10/2021

showed an improvement in their blood pressure (BP) while they were awake [11]. Endothelial function and the structure of the vascular endothelium can be affected by vitamin D insufficiency. This results in an increased vascular resistance, which may be caused by a shortage of vitamin D or other factors [12]. Expulsion of bioactive nitric oxide from skin storage could also be caused by sunlight exposure, according to some researchers. Circadian cycles, body weight, physical activity, sleep patterns, and dietary habits are just a few of the things that can alter seasonally and have an impact on blood pressure levels in addition to the weather [13].

Changes in office and out-of-office blood pressure due to seasonal changes:

According to the data, systolic blood pressure (SBP) is 5-10 mmHg greater in winter when compared to summer, and BP is inversely connected with outdoor temperatures under various climatic circumstances. It was shown that all BP parameters except nighttime BP were higher in the winter than in the summer when the same patients were examined in the office, at home, and with 24-hour ambulatory blood pressure measurement (ABPM) [3].

Variation in "Home blood pressure" during the seasons:

It's better to do monitoring of blood pressure while away from the workplace studies, particularly those that track the same subjects over time. In large group cohort studies [14, 15] and cross-sectional studies [16, 17] there have been widespread differences in home blood pressure between winter and summer of around the (4-7/2-5 mmHg).

Ambulatory blood pressure fluctuates with the seasons:

In the Harvest study **Minami *et al.*** [18] reported that temperature differences of 3-4 mmHg between winter and summer were found to be substantially linked with 24-hour and daytime arterial blood pressure.

Summer had a 3.5/2.5 mmHg difference in daytime ambulatory systolic blood pressure/diastolic blood pressure (SBP/DBP) compared to winter, according to **Minami *et al.*** [18]. With ambulatory blood pressure monitoring, several studies suggest seasonality and temperature influence the diurnal rhythm, with a more prevalent dip pattern in the winter than in the summer. This resulted in an overall prevalence of dippers of 58.2 percent in winter and a non-dipping tendency of 61.9 percent during summer, which resulted in a 9.8 percent prevalence of isolated night hypertension in winter compared to 15.2 percent in summer [19]. A study of treated hypertension patients found that the percentage of non-dippers increased by 55% in the summer compared to the winter months [3].

Systematic review and meta-analysis:

It has been determined that there are 47 papers (N = 856539, with a mean age of 49.7 years, and 39% of patients being treated for hypertension) that describe seasonal fluctuations in blood pressure that have been systematically evaluated [20].

Estimates of summer-winter BP changes are based on a variety of different methods of measurement. More than 52,000 people with identical seasonal BP changes were studied in 28 prospective trials (N = 5278). Summer BP drops 5/3 mmHg (SBP/DBP) in all measurement modalities except for night-time ambulatory BP, and these reductions tend to be stronger in older individuals and in patients who have been treated for hypertension [20].

Variations in blood pressure in specific populations during the year:

In chronic kidney disease patients:

For individuals with chronic kidney disease, the seasonal BP variation has been studied in sixteen research, the largest of which included more than 87,000 hemodialysis patients [21], all of these studies except one, **Fine** [22]; dialysis dose, stage of chronic renal disease, caloric intake, or body mass index were not associated with the considerable seasonal variation in SBP (ranging from 2 to 12 mmHg). In the winter months, the death rate was greater [21].

Young vs older:

Studies involving more than 1400 participants evaluated old adults versus young ones as regard BP variations in different seasons. Higher circadian variability in older persons was proposed by **Umishio *et al.***[23] whereas **Guinsburg *et al.***[21] suggested that winter blood pressure increases in older adults could be connected with increased physical activity and ambient temperature levels. Over the course of the winter, the mean SBP/DBP increased by 4.5/2.4 mm/hg, while the average outside temperature was strongly linked to SBP [24].

Seasonal variations in blood pressure have prognostic value:

Seasonal fluctuations in BP have been examined in several studies for their ability to predict future outcomes. Cold-induced elevated blood pressure in the winter may be linked to the sympathetic nervous system and the activation of the renin-angiotensin-aldosterone pathway, which increases cardiovascular mortality [25].

During the winter and summer, **Charach *et al.*** [26] found a 31/15 mmHg SBP/DBP difference in 182 older individuals who had been treated for hypertension for at least 3-5 years. This demographic had twice as many cardiovascular occurrences (stroke, and myocardial infarction) in the winter than in any other season.

The mean seasonal BP change in a 10,000 South African population with a mean age of 35 years was 4.2/4.0 mmHg, which was impacted by socioeconomic level and age. During the winter, the 10-year cumulative extra risks for men, smokers, and low-income households were all higher (Framingham) [27].

24 populations (n = 237 979) from 15 nations were studied. There was a 2.9 mmHg and 3.4 mmHg seasonal change in SBP in the Northern and Southern

Hemispheres, respectively, according to **Marti-Soler *et al.*** [28]**.** There was a much smaller disparity between the two. Researchers compared the summer-winter home BP difference in patients who received antihypertensive medication titration and tapering drug dosages dependent on the season to see if early treatment modifications based on long-term home BP monitoring can enhance cardiovascular outcomes [29]**.**

Heart failure, and pre-existing coronary artery disease have yet to be fully explained, although an increase in cardiovascular events in the winter months is inevitable [29]**.**

Consensus recommendations for clinical practice:

Seasonal fluctuations in blood pressure (BP) can have a significant impact on the treatment of hypertension, so healthcare providers and their patients should be aware of this. Additionally, doctors should be instructed on when and how to adapt treatment for seasonal fluctuations in blood pressure (BP) [30].

Antihypertensive medication modifications have not been well studied in patients with large seasonal fluctuations in BP (reduction in hot weather or rise in cold winter). On the other hand, the requirement for long-term BP control and medication modification if BP appears to be controllable or greatly lowered is undeniable. Rather than recommending a 'threshold,' the 2018 ESC/ESH guidelines advocate treating patients with BP levels in the "range" rather than "threshold" [31].

Noncompliance with treatment, infections (i.e., digestive) that cause dehydration, weight loss and the use of drugs or substances that raise blood pressure are examples of behavioral causes of BP fluctuations that can be identified through a medical history and physical examination, as well as a thorough examination of the patient's medical history and physical examination. Seasonal variations in blood pressure (BP) can be reduced by providing adequate dwelling conditions (temperature) and clothes [31]. It is also important to keep in mind when dealing with vulnerable individuals.

As a result of seasonal fluctuations in blood pressure (BP), physicians and patients should be educated to avoid making unnecessary changes to their medication regimen. It is necessary to pay close attention to the genuine BP level and seasonal variations because BP is a continuous dynamic variability measure in response to intrinsic or external variables or treatment-induced variables. It is not only difficult to standardize and reproducibly measure office BP, but may also miss an extreme fall or increase in BP. Seasonal fluctuations in blood pressure (BP) can be spotted early if patients regularly monitor their own BP levels at home, especially in those who have been prescribed antihypertensive medication [31].

CONCLUSION

In both men and women, young and elderly, the seasonal change in BP appears to be a global phenomenon that has been documented in regions with varying climate conditions.

Financial support and sponsorship: Nil.
Conflict of interest: Nil.

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