Seasonal Variation in Sympathetic Autonomic Activity in Young Adults

Jay Prakash Jha (Presenter), Assistant professor, Karnali Academy of Health Sciences, Jumla, Nepal

Dilli Bahadur Pun, Assistant professor, Physiological Society of Nepal (PSN), Kathmandu, Nepal

Bobby Thapa, PhD Student, Lawrence Bloomberg Faculty of Nursing, University of Toronto, Toronto, Canada

Background

- Autonomic nervous system (ANS) exhibits seasonal fluctuations.
- Winter (cold) increase sympathetic activity, elevating cardiovascular risks (Yun et al, 2004).
- Winter elevates muscle sympathetic nerve activity, and cold-induced BP responses vary with temperature (season), age, sex, BMI, race and geography (Park et al, 2019).
- Individuals with heightened responses may have a higher risk of developing hypertension (Pramanik et al, 2009, Youssef et al, 2018).

Rationale

Variations in autonomic response is not well studied in our population.

Understanding such variation can aid in risk assessment and management of cardiovascular conditions, particularly in regions with large temperature variations like Nepal.

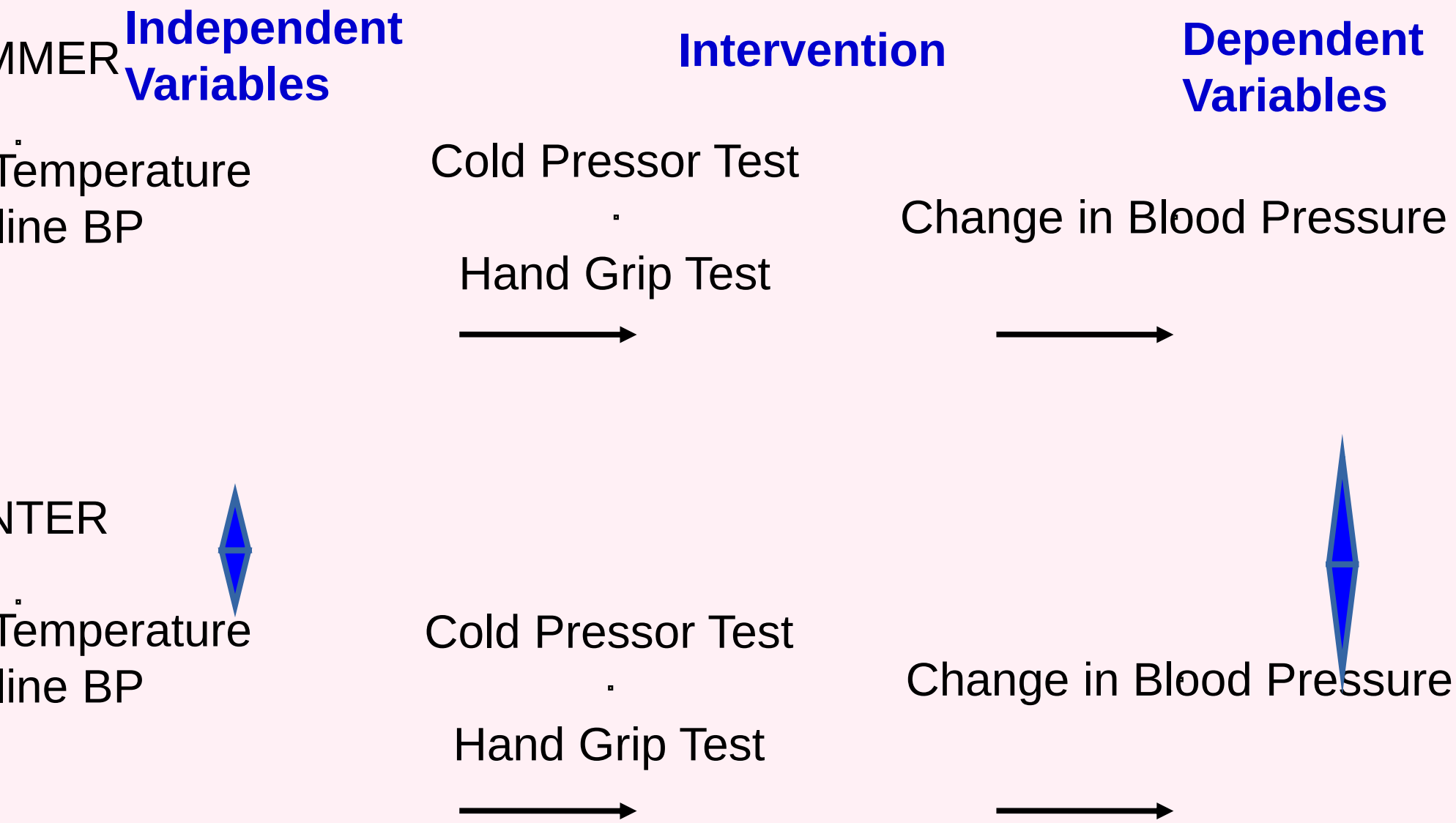
Objectives

To evaluate the seasonal differences in baseline blood pressure, and to determine how sympathetic autonomic responses vary between summer and winter in young adults.

Specific Objectives

- To measure the stress-induced sympathetic autonomic activity in summer in healthy young adults.
- To determine the stress-induced sympathetic autonomic activity in winter in them.
- To compare the sympathetic autonomic activity in the seasons.

Conceptual Framework



Methodology

Study Design & Participants:

- Pre-test post-test interventional study
- 45 healthy young adults age ranged from (17–30 years) from Karnali Academy of Health Sciences, Jumla.

Exclusion: Known diseases, medication use, substance abuse

Ethical approval :

- from ERB of NHRC (Ref. 2566).
- informed written consent taken

Autonomic Function Tests

Cold Pressor Test (CPT) (Silverthorn DU, Michael J., 2013)**:**

- Hand immersed in 4–8°C water for 1 minute;
- BP recorded at 1, 2, and 4 minutes post-immersion.

Handgrip Test (HGT)

(Garg et al, 2014)**:**

- Participants sustained 1/3 of maximal voluntary contraction (MVC) using a dynamometer for up to 4 minutes;
- BP recorded at 1st–4th minute and during recovery.

Methodology cont.

Tests conducted in both winter (December 2021) and summer (July 2022) on the same subjects.

Data Analysis:

- Descriptive statistics, t-tests, and multiple linear regression – SPSS v21.
- A *p*-value <0.05 was considered statistically significant.

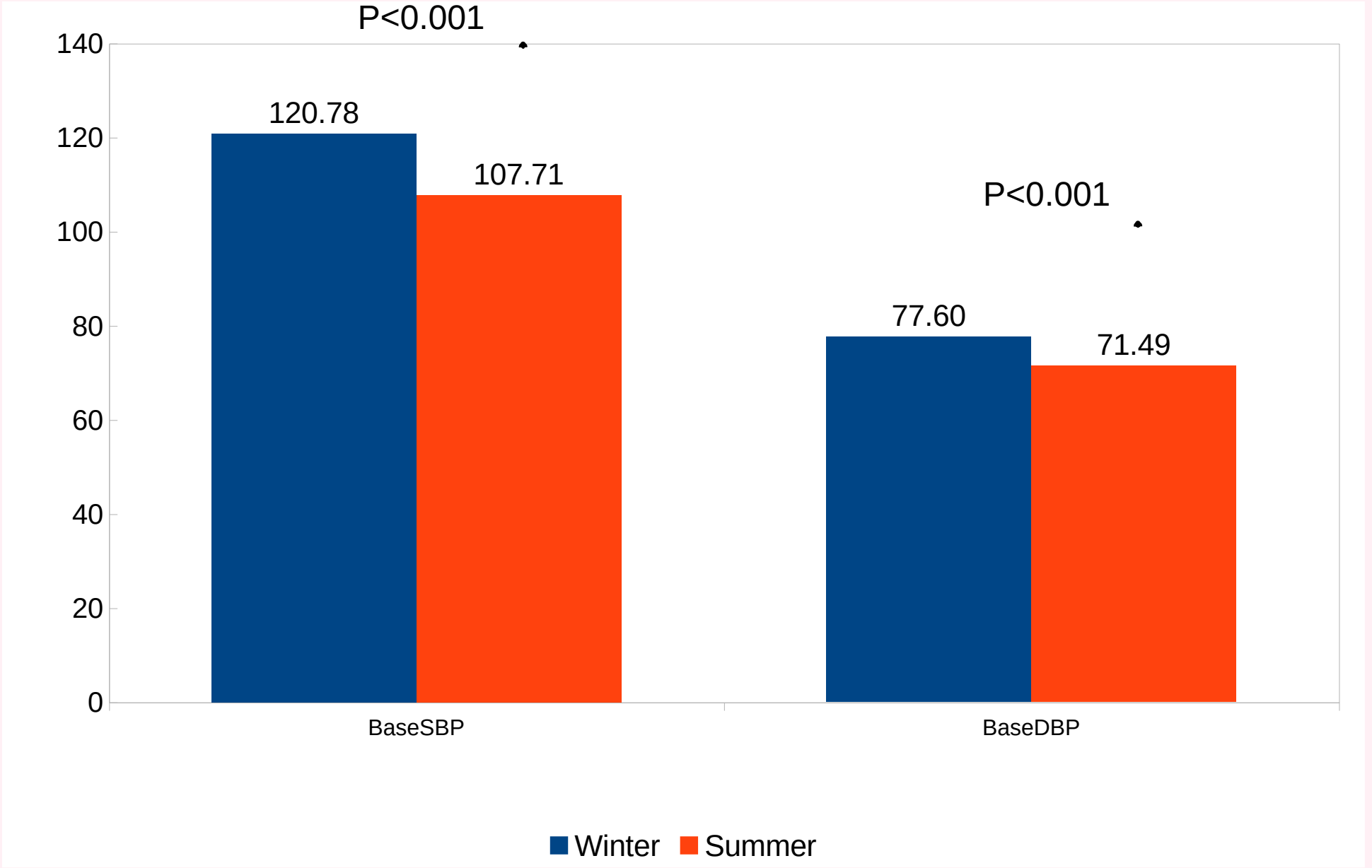
Results

- Forty-five healthy students (55.6% female)
- Mean age of 21.62±2.93 years.
- Room temperature in winter (10.32±5.63°C) and summer (22.5±3.35°C).

- Baseline BP – higher in winter than in summer.

Results cont.

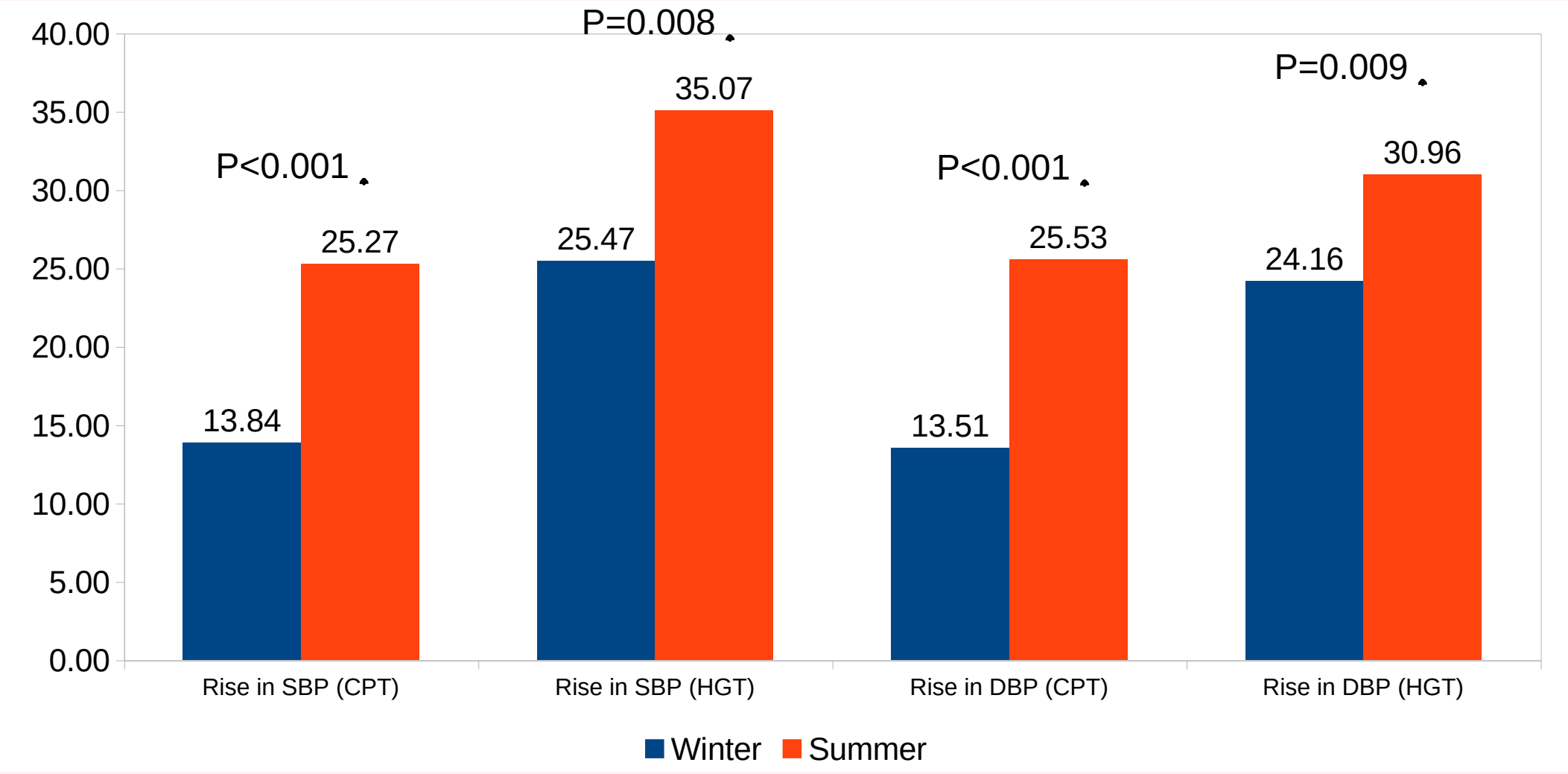
Seasonal Variation (baseline BP):



Results cont.

Seasonal Variation (stress response):

Greater rise in BP in summer than in winter.



Results cont.

Responder Categories:

- Hyperresponders (SBP rise >21 mmHg in CPT) were more frequent in summer (22, 48.89%) than in winter (10, 22.22%).
- Hyporesponders (DBP rise <10 mmHg) were more frequent in winter vs summer (CPT: 15 vs 3; HGT: 3 vs 1).

Results – Regression Analysis

Independent Var (test)	Adjusted R^2	F (p-value)	Significant Predictors	Unstd Coeff (B)	Std Coeff (Beta)	P value
SBP (CPT)	0.31	8.95 (<.001)	Baseline SBP	-0.44	-0.46	<0.001
			Season	7.62	0.3	0.004
DBP (CPT)	0.47	16.98 (<.001)	Sex	-5.22	-0.25	0.005
			Baseline DBP	-0.50	-0.44	<0.001
			Season	10.61	0.50	<0.001
SBP (HGT)	0.08	2.61 (0.030)	Season	9.41	0.28	0.017
DBP (HGT)	0.17	4.59 (0.001)	Baseline SBP	0.31	0.33	0.016
			Baseline DBP	-0.42	-0.32	0.014
			Season	8.03	0.33	0.004

- Summer season – higher BP rise.
- Baseline BP negatively influence the rise in DBP.
- Sex differences were not significant in most cases, except for DBP rise during CPT in summer.

Conclusion

- Season significantly affects baseline blood pressure as well as sympathetic reactivity.
- Other predictor: baseline blood pressure
- They should be considered during clinical management of autonomic and cardiovascular conditions.
- Further research could explore the long-term effects of such variation in healthy and in diseased population.

Takeaway message

- **Winter**: higher baseline BP but lower reactivity to stress.
- **Summer**: heightened sympathetic response to stress.
- Low baseline blood pressure correlates with higher sympathetic stress response.

Acknowledgements

- Participants of KAHS.
- Prof Dinesh Banstola for guidance and support.
- Mr Bibek Pun for help and support.
- NHRC for providing Provincial Research Grant.

References

1. Yun AJ, Lee PY, Bazar KA. Temporal variation of autonomic balance and diseases during circadian, seasonal, reproductive, and lifespan cycles. Med Hypotheses. 2004;63(1):155–62.

2. Park S, Kario K, Chia Y, Turana Y, Chen C, Buranakitjaroen P, et al. The influence of the ambient temperature on blood pressure and how it will affect the epidemiology of hypertension in Asia. J Clin Hypertens. 2019;22(3):438–44.

3. Pramanik T, Regmi P, Adhikari P, Roychowdhury P. Cold Pressor Test as a Predictor of Hypertension. J Tehran Univ Heart Cent. 2009;4(3):177–80.

4. Youssef M, Ghassemi A, Carvajal Gonczi CM, Kugathasan TA, Kilgour RD, Darlington PJ. Low Baseline Sympathetic Tone Correlates to a Greater Blood Pressure Change in the Cold Pressor Test. Aerosp Med Hum Perform. 2018 Jun 1;89(6):503–9.

5. Silverthorn DU, Michael J. Cold stress and the cold pressor test. Adv Physiol Educ. 2013 Mar;37(1):93–6.

6. Garg R, Malhotra V, Kumar A, Dhar U, Tripathi Y. Effect of Isometric Handgrip Exercise Training on Resting Blood Pressure in Normal Healthy Adults. J Clin Diagn Res JCDR 2014;8(9):BC08-BC10.

About the Presenter

Dr Jay Prakash Jha
MD in Basic and Clinical Physiology
(prakash.value120@slmail.me)

Dedicated medical professional with a strong background in education, clinical practice, research and journal editorial experiences. Committed to advancing scientific knowledge through rigorous research endeavors and mentoring the next generation of healthcare professionals.