

BLOOD PRESSURE VS ALTITUDE IN HYPERTENSIVE AND NON-HYPERTENSIVE HIMALAYAN TREKKERS

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Introduction

- Hypertension is the most common cardiovascular disease found in individuals recreating at high altitudes.¹
- Evidence is conflicting on how blood pressure (BP) changes with altitude in hypertensive (HTN) and normotensive (NTN) individuals.
- Most studies are done at altitudes <3500m using small numbers of subjects.²
- In NTN, acute hypoxia causes increased, decreased, or unchanged BP; in HTNs, BP may increase and then gradually decline.²
- Evidence for efficacy of BP medication at altitude is limited.
- There is no evidence ACEIs effectively control BP in HTNs at altitude.
- ARBs control BP <3400m but does not at higher elevations in NTN.³
- Selective and non-selective β -blockers blunt rising BP in NTN traveling to altitude.^{4,5}

Objectives

- Determine how BP changes in HTN and NTN trekkers at altitude.
- Determine effectiveness of antihypertensive medications at altitude.

Methods

- This study was a prospective, observational cohort carried out in the Khumbu Valley of Nepal, en route to Everest Base Camp. October-November 2014.
- Demographics, anthropometrics, medical history and medication use was gathered.
- Manual BP was measured in the same arm at 2800m, 3400m, and 4400m.

Results

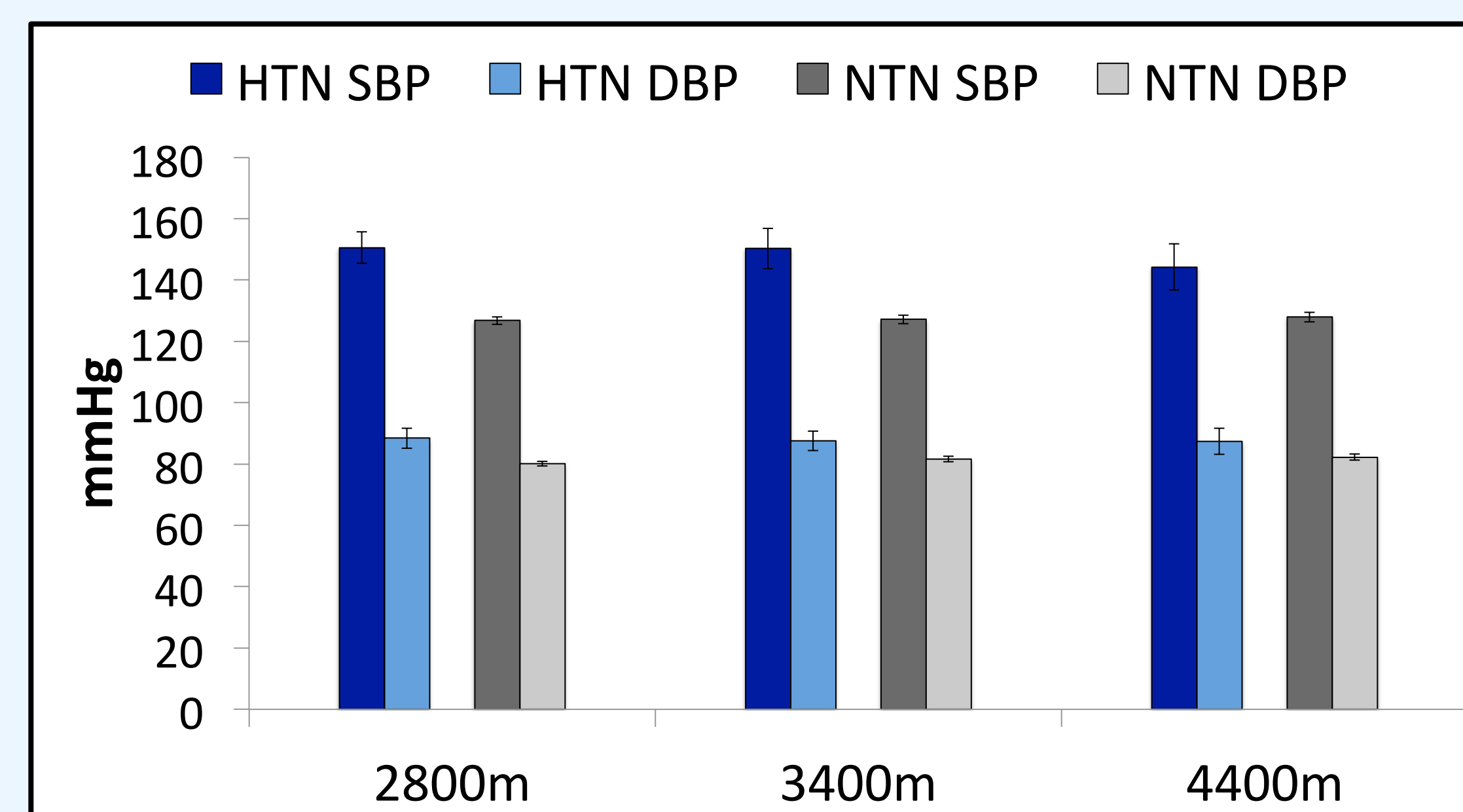
Subjects

Altitude	HTN (n=60)	NTN (n=604)
2800m	58	601
3400m	42	479
4400m	25	335

HTN Trekkers Older, More Overweight

	HTN	NTN
Gender	M = 43 F = 17	M = 346 F = 257
Age (years)	58	47
BMI	25	24

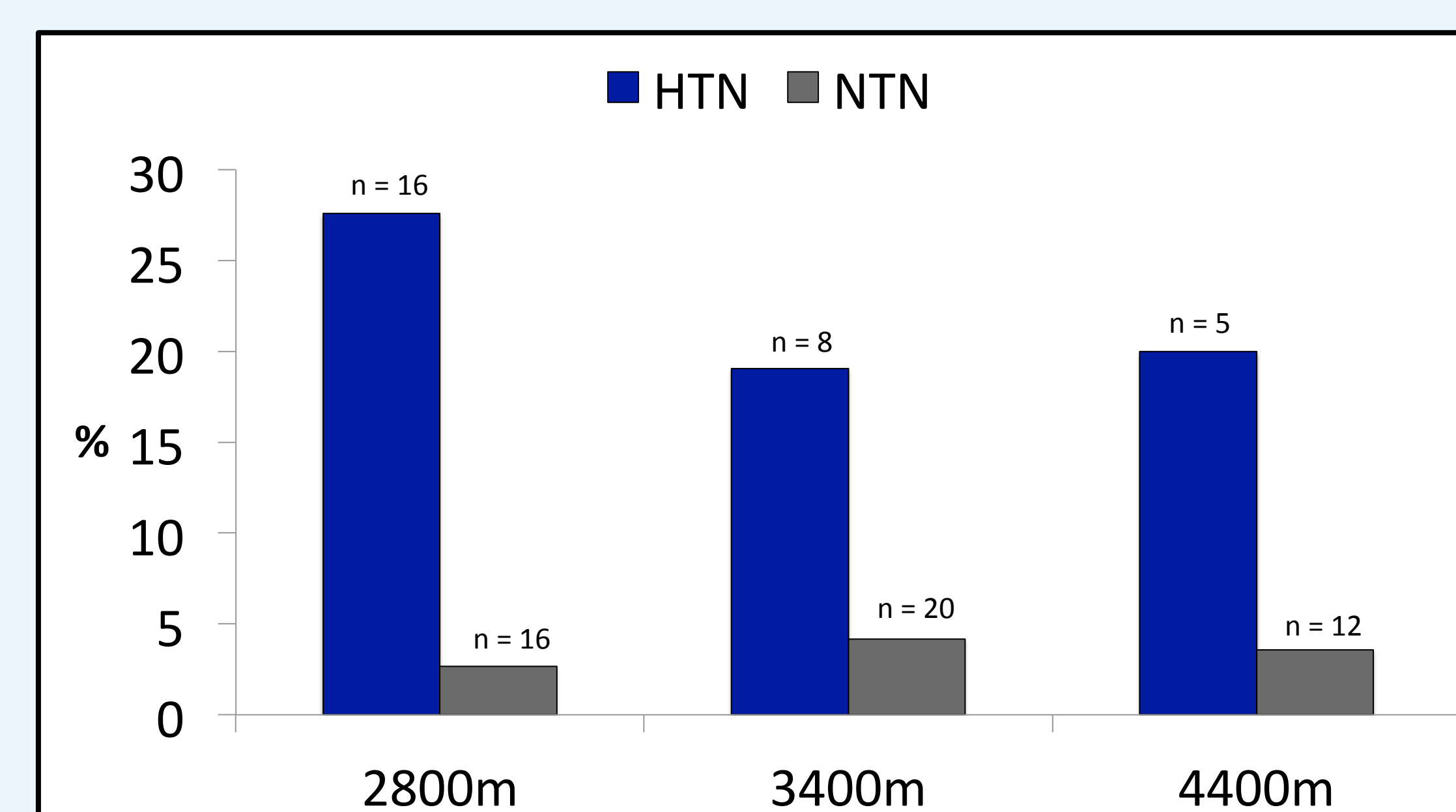
Blood Pressure Did Not Change with Altitude in HTN and NTN Trekkers



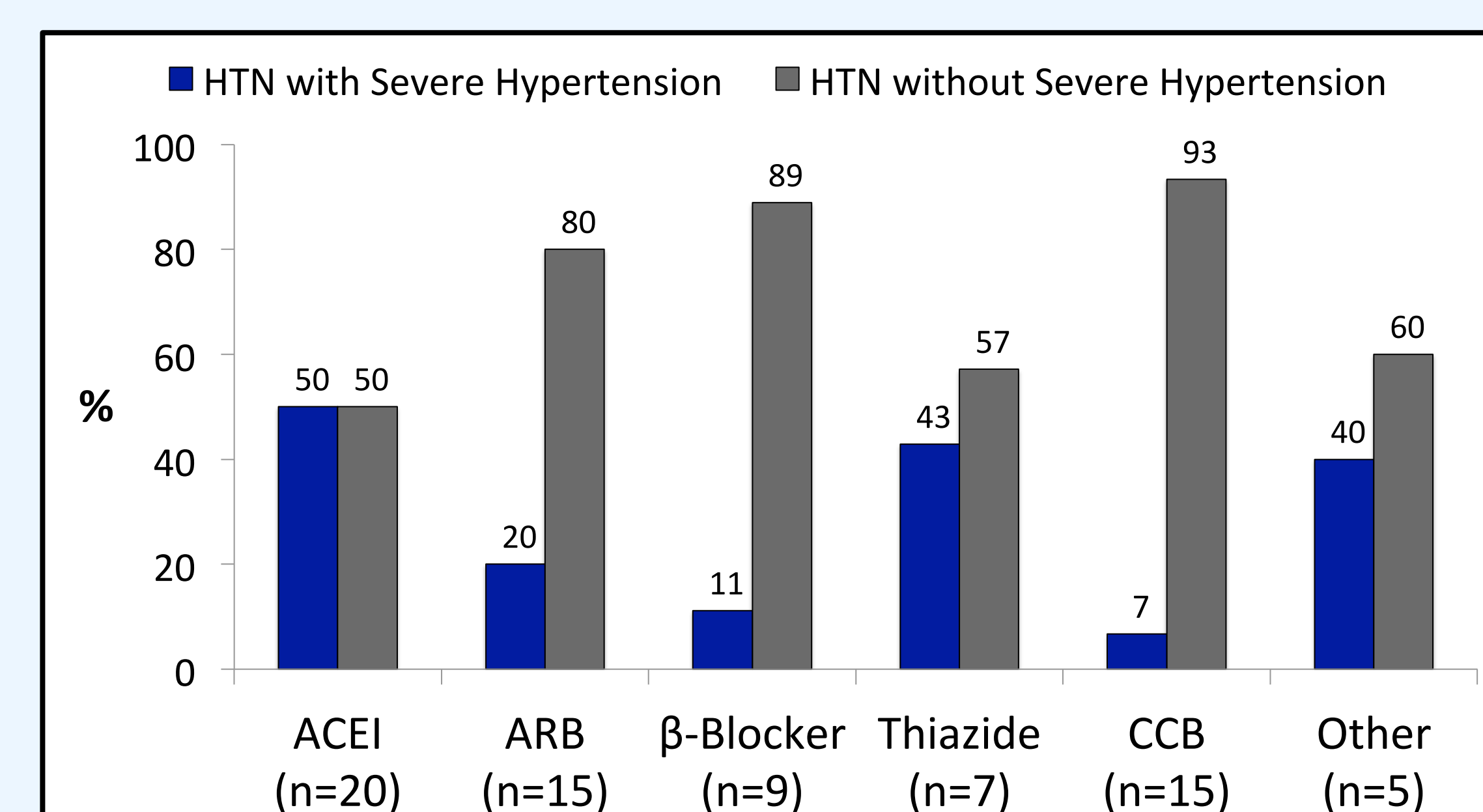
Direction of BP Change Varied, More Likely to Decrease in HTN Trekkers

	2800m to 3400m		3400m to 4400m		
Δ SBP (mmHg)	HTN	NTN	Δ SBP (mmHg)	HTN	NTN
$\Delta < -10$	39%	23%	$\Delta < -10$	35%	20%
$-10 < \Delta < 10$	37%	51%	$-10 < \Delta < 10$	39%	54%
$\Delta > 10$	24%	26%	$\Delta > 10$	26%	26%

Severe Hypertension (>180/100) Found Most Frequently in HTN Trekkers Across Altitudes Relative Risk (5.59; 95% CI 3.47-9.02)



Severe Hypertension (>180/100) Found Most Frequently In HTN Trekkers Taking ACEIs and Thiazides



Conclusions

- BP change with altitude is variable in individual trekkers; decreased BP with ascent is more likely in HTN trekkers than NTN trekkers, but demographic and anthropometric differences may exist between the cohorts.
- Severe hypertension is more common in HTN trekkers than NTN trekkers but was asymptomatic in all cases.
- Subjects on ACEIs and thiazides were more likely to have severe hypertension than those on other medications.
- Further study is required to determine the clinical importance of these findings.

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