

**THE EFFECT OF CLOTHES ON
SPHYGMOMANOMETRIC BLOOD
PRESSURE: COMPARISON OVER SLEEVED
ARM VERSUS UNSLEEVED (BARE) ARM**

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CONFLICTS OF INTEREST

- None to declare.

BACKGROUND

- Blood pressure (BP) measurement is an important component of clinical examination, requiring maximum accuracy during its measurement.
- Studies conducted among largely Caucasian populations, essentially by means of automatic oscillometric devices have yielded a general consensus that clothing has no statistically significant impact on measured BP, on normal subjects.
- There is no consensus on the effect of sleeves in the case of hypertensive subjects.

OBJECTIVES

- This study aims to investigate the variation in blood pressure between sleeved and unsleeved arms in an Asian population, consisting of a majority of hypertensive subjects, when measured manually with an aneroid sphygmomanometric device.

METHODOLOGY

- This was a cross-sectional analytical study conducted at Dhaka Medical College Hospital, Dhaka.
- 99 patients between the ages 29 and 85 years over a 3 month period were recruited.
- All subjects had their blood pressure recorded by auscultatory sphygmomanometric method, using the same regular aneroid sphygmomanometer device.
- All measurements were made by the principal investigator, blinded to the patients' diagnoses prior to measurement.

METHODOLOGY

- The cuff was placed over the unsleeved (bare) arm for one reading, and the sleeved arm for the other reading. This was repeated for both right and left arms.
- Common shirts and sweaters (thinner than 2mm) were used.
- Data were analyzed by means of descriptive statistics and unpaired T test, using Statistical Package for Social Sciences (SPSS) software system Version 16.
- A p value of <0.05 was considered statistically significant.

RESULTS: DEMOGRAPHIC CHARACTERISTICS

- The mean age of the subjects was 55.2 ± 11.2 years.
- Male-to female ratio of 2:1.
- 85.9% had hypertension.
- 56.6% had diabetes mellitus.
- 69.7% were dyslipidemic.
- 61.6% were smokers.
- 39.4% had normal BMI, 43.4% were overweight and 15.2% were obese.

RESULTS: COMORBIDITIES & RISK FACTORS

Comorbidities/Risk Factors	Frequency	Percentage %
HTN	85	85.9
DM	56	56.6
Dyslipidemic	69	69.7
CKD	19	19.2
IHD	83	83.8
Stroke	1	1.0
Smoking	61	61.6
Alcohol	6	6.1

Table 1. Distribution of patients by their comorbidities/ risk factors (n = 99).

RESULTS: VARIATION OF BLOOD PRESSURE BETWEEN SLEEVED AND UNSLEEVED ARMS

- Both systolic and diastolic blood pressures measured for bilateral sleeved arms were significantly lower than those found in unsleeved arms. ($p < 0.05$)
- This was also true for absolute systolic and diastolic blood pressures (i.e. BP irrespective of right or left arms).
- However, no significant difference in mean arterial blood pressure (MABP) was observed between sleeved and unsleeved arms bilaterally. ($p = 0.582$ and $p = 0.160$ respectively)

RESULTS: VARIATION OF BLOOD PRESSURE BETWEEN SLEEVED AND UNSLEEVED ARMS

- The systolic blood pressure difference between right unsleeved and sleeved arms, and between left unsleeved and sleeved arms were 2.5 mmHg and 2.6 mmHg respectively. ($p < 0.001$)
- Diastolic blood pressures between unsleeved and sleeved arms showed less variation, with a difference of 0.8 mmHg for right arm ($p = 0.052$), and 1.2mmHg for left arm. ($p=0.003$)

RESULTS: VARIATION OF BLOOD PRESSURE BETWEEN SLEEVED AND UNSLEEVED ARMS

Blood pressure (mmHg)	Arm status		P- value
	Sleeved	Un-sleeved	
Systolic (Right)	120.8 ± 19.5	123.3 ± 20.4	<0.001
Systolic (Left)	121.8 ± 20.3	124.4 ± 21.3	<0.001
Diastolic (Right)	78.5 ± 13.0	79.3 ± 12.8	0.052
Diastolic (Left)	79.1 ± 12.1	80.3 ± 11.7	0.003

Table 2. Variation in blood pressure between sleeved and unsleeved arms (n = 99)

RESULTS: VARIATION OF MABP BETWEEN SLEEVED AND UNSLEEVED ARMS

Arm	Arm status		Mean difference	p- value
	Sleeved	Unsleeved		
Right	64.4 ± 14.2	64.6 ± 14.0	0.25	0.582
Left	64.9 ± 12.9	65.6 ± 13.0	0.68	0.160

Table 3. Variation of Mean Arterial Blood Pressures between sleeved and unsleeved arms (n=99)

RESULTS: INTER-ARM VARIATION OF BLOOD PRESSURE

- No significant inter-arm variation of either systolic or diastolic blood pressure was noted between arms. Both systolic and diastolic blood pressures in right arm of either sleeved or in unsleeved state was 1.5 mmHg less than those in the left arm (Table 4).

RESULTS: INTER-ARM VARIATION OF BLOOD PRESSURE

Types of BP	Arm		Mean difference	p- value
	Right	Left		
Systolic BP (Unsleeved)	123.3 ± 20.4	124.4 ± 21.3	-1.222	0.158
Diastolic BP (Unsleeved)	79.3 ± 12.8	80.3 ± 11.7	-1.0606	0.122
Systolic BP (Sleeved)	120.8 ± 19.5	121.8 ± 20.3	-1.020	0.210
Diastolic BP (Sleeved)	78.5 ± 13.1	79.1 ± 12.1	-0.68687	0.286

Table 4. Inter-arm Variation of BP between right and left arms (n=99)

DISCUSSION

- This study shows that there is a statistically significant difference in systolic and diastolic blood pressures, measured over sleeved versus unsleeved arms. However, there was no statistically significant difference in mean arterial BP between the two groups.
- Some studies among Caucasian populations (Ma *et al.* 2008, Liebl *et al.* 2004, Holleman *et al.* 1993, Kahan *et al.* 2003) have yielded a general consensus that sleeves have no effect on BP. However, most of these studies observed BP readings taken by automated devices.
- This finding is contrary to our findings in terms of systolic and diastolic BP measured separately, but concurs with our findings for MABP.

DISCUSSION

- The studies above did not statistically analyse the calculated MABP, as we have.
- 86% of the subjects in our study were hypertensive, and the results reflect the outcome in general, for a hypertensive population. Two studies, conducted by Kahan *et al.* 2003 and Holleman *et al.* 1993 have recommended repeating BP measurements over bare arms in case of hypertensive subjects, based on confidence intervals of possible sleeved effects. This is in agreement with our study.
- However, Eder *et al.* 2008 and Pinar *et al.* 2010 found that sleeves have no effect on BP even among hypertensive subjects.

LIMITATIONS

- As the sample size was relatively small ($n=99$), caution is advised when generalizing the findings to reference population, and further studies with larger sample size are recommended for better assessment.
 - The BP was measured manually in order to reflect common practice, but perhaps greater uniformity and less error on measurement could have been established if readings were also taken by automated devices.
 - Further studies on subjects with clothing thicker than 2mm are recommended for additional evaluation of these findings.
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CONCLUSION

- There is a statistically significant difference in systolic and diastolic blood pressures measured over sleeved versus unsleeved arms.
 - Considering the subjects consisted of a largely hypertensive population, this study concurs with the outcome of previous studies conducted on hypertensive subjects.
 - We recommend that for all practical purposes, blood pressure be measured over bare arm when using an aneroid sphygmomanometric device.
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Thank you

