

# EFFECT OF GARMENT ON THE ARM UNDER THE AUSCULTATOR MANOMETER CUFF AMONG PRIMIGRAVIDAE

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## ABSTRACT

**Introduction:** Although perinatal guidelines recommend blood pressure (BP) should be measured on bare arms among pregnant women, BP is measured over garments in Primary Health Care settings among prenatal women.

**Aim:** To identify the discrepancies in BP measurements with garments under the manometer cuff versus bare arm among normotensive primigravidae.

**Setting & design:** An exploratory study was conducted among n=95 normal low risk normotensive primigravidae at mid trimester attending antenatal clinic at rural Primary Health Center (PHC).

**Methods & Materials:** With the auscultator sphygmomanometer, BP was measured thrice with garments versus bare arms to rule out differences. Results were compared with Paired t-test. SPSS version 20 was used for analysis.

**Results:** There were insignificant differences in mean Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) between the garments covered versus bare arm. The mean garments thickness was less than 5 mm and it was not a significant predictor for mean differences of BP in garments versus bare on arm.

**Conclusions:** Measuring blood pressure on arms with garments violates long-established perinatal guidelines and the decision to measure accurate BP with sleeves on among pregnant women depends on the discretion of the clients and the professionals.

**Keywords:** *Garment, Bare arm, Blood pressure, Primigravidae*

## INTRODUCTION

BP monitoring is the most important and frequent screening test of the antenatal period and should be undertaken by healthcare professionals, on all women regularly as small inaccuracies in blood pressure measurement can have considerable consequences (Amadasun & Isa, 2005). There are numerous factors that currently lead to inaccuracies in BP measurement, including lack of back support, crossed legs full bladders and measurements taken over clothing or with tight clothing rolled over the arm (Cantwell *et al.*, 2011). Hence accurate BP measurement is vital to rule out pregnancy induced hypertension. Perinatal Practice evidence assessment strongly recommends that the blood pressure cuffs and stethoscope should be placed on bare skin to minimize errors in blood pressure recording in pregnancy among pregnant women (De Gialluly *et al.*, 2006).

Moreover, studies on effect of clothing on BP recordings among population yield conflicting results. A few studies found no significant effect of clothing on blood pressure recordings among general population (Elliott *et al.*, 2007). Whereas very few studies reported significant difference in BP measurement with and without sleeves among hypertensive population (Kahan *et al.*, 2003; Ki, Oh & Lee, 2013). Efforts are continuously made to standardize the procedure, but it remains difficult to reach an agreement between the official guidelines and daily clinical practice in the primary health care setting for Measurement. Health care personnel at Primary Health care Centers-PHC should be able to screen for hypertension, map diagnosed cases, set up a community-based follow-up system. It treats hypertension and undertakes relevant emergency management to prevent maternal and perinatal morbidity and mortality. In conservative

and conformist attitudinal outlook of rural populations of India this procedure is difficult to be implemented at PHC especially among pregnant women due to established socio-cultural and religious issues. Most of the times it is difficult to roll up the sleeves of their garments due to the type of clothing and the constricting effect of it above the blood pressure cuff tourniquet effect (De Gialluly *et al.*, 2006) and effect of weight gain in pregnancy. Hence it is a common practice among the reproductive health personnel to measure the blood pressure with the cuff placed over the garments. In reality, there is a marked discrepancies exist between perinatal guidelines on measurement of BP among pregnant women and the actual clinical practice at the PHC. Failure to detect variation may lead to undesirable outcome and referral to tertiary care which would cause a disproportionate burden on health care services and consumers. So far, research has been confined to general population with or without hypertension. Till date, no studies have been published on the effect of garments on auscultator BP measurement among pregnant women. The purpose of the present study is therefore, to ascertain the effect of garments on upper arm under the auscultator sphygmomanometer cuff among normotensive primigravidae during second trimester to provide evidence to influence governing attitudes among the perinatal health care providers to measure blood pressure in bare arms.

## METHODS

As there is paucity of information on impact of clothes on BP measurements among pregnant women, this study examined the effect of garments on upper arm under auscultator manometer BP measurements among normotensive primigravidae to provide evidence to obstetric health personnel to measure the BP in bare arms among pregnant women.

This exploratory study was conducted at a Rural Primary Health Care setting, Arekare, Bangalore, Karnataka, India. The enrollment of pregnant women occurred continuously between March 2015 to April 2016. A total of n=108 women were recruited according to the inclusion criteria of being more than 12-weeks pregnant with singleton fetus at enrollment, being 20 to 34 years old and being free from any medical, surgical, gynecological and obstetrical factors complicating pregnancy and

BMI being 18.5-24.9 Kg/m<sup>2</sup> by purposive sampling technique. Women with family history of hypertensive disorders complicating pregnancy, infertility, abortion, elderly primigravidae above 35 years of age, baseline BP above 120/80 mm Hg, BMI >25, BP over 120/80 mm HG and gestation above 24 weeks were excluded. No problems were encountered while recruiting them to participate in the study, although 13 of them refused to remove their sleeves to measure BP in their bare arms. They were excluded from the study and no replacements were done.

## Measurements

Systolic BP (SBP) and diastolic BP (DBP) were measured using a calibrated mercury sphygmomanometer with the standard adult cuff size with bladder measuring 16x 34cm for mid arm circumference of 27- 34 cm to ensure near- complete encirclement of each primigravidae's upper arm as per Perinatal Practice Guidelines. Inter rater reliability of the BP measurements by the trained mid wife and the principal researcher were computed by Karl Pearson product Moment correlation coefficient and the "r" was 0.98.

Blood pressure was measured after the women had emptied their bladder, rested for at least ten minutes and were seated comfortably with their back supported, their legs uncrossed and their feet flat on the floor. The arm was supported at heart level, with the palm facing up and the elbow slightly flexed. The women were advised not to speak during the procedure. The arm circumference was measured with the garments versus bare arms to determine the clothes thickness with the non-stretchable measuring tape at the midpoint between the acromion process and the olecranon process (between the shoulder and the elbow). Blood pressure was measured thrice with an approximate of 10-15 minutes interval between measurements with garments and then with bare arms. The first readings of garments versus bare arms BP was discarded and the average of the second and third readings of garments versus bare arms BP was used for comparison.

## Statistical Analysis

Statistical analysis was performed using SPSS version 20 (SPSS Inc., Chicago, IL, USA). Differences were considered statistically significant when the *p*-value was <0.05.

**Ethical Approval**

The study protocol was approved by the District Maternal & Child Health and Family Welfare, Department of Bangalore city and the Medical Superintendent the PHC setting. The study follows the ethical regulations and conforms the Declaration of Helsinki. The participants were given both oral information and written about the study purpose, procedure, encouraged to ask questions and discuss with their family members. The participants were assured that their decision to participate or to decline is purely voluntary with no consequences on their care. They were guaranteed that findings would not be linked to any individuals and that all study events and materials would maintain strict confidentiality. The participants were not considered to be at risk of harm. They were informed that the duration of the intervention would be approximately 30 to 40 minutes.

**RESULTS**

A total of n=108 normal low risk primigravidae was approached to participate in the study, n=13 (12.03 %) of them reused to remove their sleeves to measure BP in their bare arms. Overall n=95 primigravidae were selected for the study.

**Participants' characteristics**

The sample characteristics did not differ according to their age, gestational age in weeks, maternal weight, BMI, sleeve thickness and hemoglobin as analyzed by Chi square/Fishers Exact Probability Test which indicated that there were no selection bias and the samples were homogenous. Their mean average was 20.8 ± 2.09, mean gestational age was 18.4 ± 2.01, Hemoglobin 10.3 ± 1.01 and the mean BMI was 21.51 ± 2.31. Among the overall sample, the mean circumference of arm with sleeves was 26.13 ± 2.36 cm versus bare arms was 25.61 ± 2.12 cm with the mean difference of 0.52 ± 0.24 cm sleeve thickness.

**Differences in BP Measurements**

The mean systolic pressure (SBP) values (95% CI) with sleeve were 109.2 ± 4.71 with the range of 96 -120 mmHg versus bare arm values (95% CI) were 108.3 ± 3.84 (107.51-109.08) with the range of 82-116. The mean diastolic pressure (DBP) values (95% CI) with

sleeve were 63.37 ± 3.26 (62.70-64.04) with the range of 62 -78mm Hg and without sleeve values (95% CI) were 62.73 mmHg ± 3.11 (61.77-63.05) with the range of 52 -72mmHg. The mean difference in SBP values (95% CI) were 0.9 ± 3.11mmHg (0.747-1.133) and the DBP values (95% CI) were 0.64 ± 2.97mmHg (0.626-0.654) were neither clinically and nor statistically significant difference with p-values of 0.05.

**Table 1: Mean differences in BP measurements with garments versus bare arms among primigravidae**

N=95			
Mean BP±SD (CI) BP mmHg			
Garments on arm	Bare arm	Mean difference	
Systolic	109.2 ± 4.71 (108.23 -110.17)	108.3±3.84 (107.51-109.08)	0.9±3.11 (0.747-1.133)
Diastolic	63.37±3.26 (62.70-64.04)	62.41±3.11 (61.77-63.05)	0.64 ± 2.97 (0.626-0.654)

*P*<sub>95</sub> >0.001 = 3.290; Insignificant

**DISCUSSION**

There has been much controversy as to whether the blood pressure should be measured with garments on the arm under manometer or in bare arms. It must be recognized that blood pressure is a variable hemodynamic phenomenon, which is influenced by many factors, not least by measuring the BP with sleeves (Liebl *et al.*, 2004). Particular attention must be paid to blood pressure measurement in pregnancy because of the important implications for patient management, as well as the fact that it associated with higher risks of adverse perinatal outcomes (De Gialluly *et al.*, 2006)

This present study had evaluated the effect of garments versus bare arms under auscultator sphygmomanometer BP measurements among low risk mid trimester normotensive primigravidae. The findings revealed that there were neither clinical nor statistical significant differences with garments on versus bare arm BP measurements among normotensive primigravidae. In addition, the insignificant differences in BP with garments on upper arm versus bare arms were not influenced by maternal characteristics. These findings are analogous to that of non-pregnant normotensive population study findings (Ma, Sabin & Dawes, 2008). Congruent findings were reported by Ki Hoon (2013)

who evaluated the differences in blood pressure measurements with clothes versus bare arms using an automatic oscillometric sphygmomanometer among 141 male and female adult patients who were assigned to three different groups: the sleeve group, rolled sleeve group, and the bare arm group. Following a comparison of blood pressure measurements using a repeated measure ANOVA, it was found that there were no significant differences among the three groups. However, the authors also noted that based on the age, sex, past or current history of hypertension or diabetes mellitus, the thickness of sleeve, weight, a drinking history, and a smoking history, there were no significant differences in SBP and DBP among the three groups (Pinar, Ataalkin & Watson, 2010). Similar findings were reported by Liebl *et al.*, (2004) evaluated the effects of sleeves versus bare arms on BP measurements among participants with risk factors that the difference found in blood pressure with and without sleeve was not clinically significant.

In the present study the mean garment thickness under the sphygmomanometer cuff was less than 5mm and it was not a significant predictor for indifference in BP measurements as measured by Chi square test/ Fishers Exact probability test. Supportive findings were reported by Kahan *et al.*, (2003) who conducted a study using an automatic sphygmomanometer in 201 patients, who were assigned randomly to three different groups with their age ranging from 16-88 years : the bare arm group, below a rolled up sleeve group and over a sleeve group , revealed that the differences in mean blood pressure readings between the clothed with the mean thickness varying from 0.2–8.0 cm and bare arm were 0.5 mmHg (SD 7.5) for systolic pressure and 1 mmHg (SD 5) for diastolic pressure were not significant. These highlight the fact that the degree of clothing does not have a clinically important effect on the blood pressure measurement. Similar findings were reported by Liebl *et al* who measured blood pressure using both a mercury sphygmomanometer and an automatic sphygmomanometer inpatient whose sleeves with a thickness of < 2 mm. They measured SBP and DBP using both devices and then compared the results between the sleeve group and the bare arm group. As a result, there were no significant differences between the two different settings. Ma, Sabin & Dawes (2008) compared blood pressure measurement over a sleeved arm versus a bare arm among 376 patients between

18 and 85years of age reported that that thickness of the clothes did not affect measurement of blood pressure. In fact, the sleeves act as BP cuff protector and barrier covering the patient's arm allowing to take a blood pressure reading without the cuff ever coming in contact with the patient's skin and thus provide an effective, convenient way to minimize the risk of transmitting infections (Skirton *et al.*, 2011)

### Measurement Device

The study findings should be interpreted within the context of its limitations that the garments versus bare arms BP measurements were carried out by calibrated mercury sphygmomanometer as per Perinatal Guidelines. Data from the study revealed a proportionately minimal mean difference in SBP 0.9 and DSP 0.64 mmHg which may be attributed to measurements by manual device, than the automatic oscillometric device Research findings (Brown, *et al.*, 2000) and evidence assessment (South Australian Perinatal Practice Guidelines (2013) revealed that auscultator BP measurements are more accurate than oscillometric readings. Discrepancies in the mean differences between oscillometric and auscultator readings ranged from +5.4 to -11.2 mm Hg systolic and from 0.5 to -8.3 mm Hg for diastolic.

Although auscultator BP measures are considered to be more accurate than oscillometric, studies auscultator BP measurement obtained by using the sphygmomanometer to audibly detect Korotokoff sounds demonstrated that oscillometric and auscultator readings of both systolic and diastolic BPs in hospitalized adults were highly correlated. Systolic BP correlations ranged from 0.98-0.73 mm Hg and from 0.94-0.51 mm Hg for diastolic pressures (Williams *et al.*, 2004)

Similar findings were reported by Kahan *et al.*, (2003) and Ma, Sabin & Dawes (2008) who measured blood pressure using a commercially automatic oscillometric device and mercury sphygmomanometer that oscillometric blood pressure measurements showed no difference from a classic mercury sphygmomanometer. However it is unlikely that this could be the only cause of minimal difference in garments versus bare arms BP measurements. This needs further investigations in larger samples across various geographical areas. In the present study none of the maternal characteristics such as age, BMI, hemoglobin, and gestational age

and sleeves thickness were not associated with the indifference in BP measurements with garments versus bare arms. Supportive findings were reported by Ki, Oh & Lee (2013) measured BP with sleeves and bare arms that the participants socio demographic variables had no correlation with the mean differences in BP in both the groups.

### Implications for Practice

Primary Health Centers (PHC) are the cornerstone of rural healthcare and are supposed to meet the health care needs of rural population. In the hurried milieu of PHC antenatal clinic, auscultator sphygmomanometers may not be routinely sanitized or replaced with clean cuffs between patient use. Research (Skirton *et al.*, 2011) revealed that nondisposable sphygmomanometer cuffs harbor frequent bacterial colonization and serve as potential vectors of pathogenic bacteria among patients. These study findings provide relevant point for health professionals that BP measurement with garments yield a small indifference in BP measurement among pregnant women. Beside that this technique offering an hygienic protection, saves time from cleaning and disinfecting cuff after each use and peace of mind for staff and protect patients privacy while creating a professional examination environment.

### Limitations

As the study data were from normal low risk primigravidae at mid trimester of pregnancy of one rural geographical location, the generalization of the study findings to pregnant women with hypertensive complicating pregnancy and other medical disorders are limited and hence further validation of studies with larger samples size with risk factors complicating pregnancy is recommended.

### CONCLUSION

In summary, this study demonstrated a very minimal differences in auscultator BP measurements with garments on upper arm under BP cuff versus bare arms that were neither statistically nor clinically significant among low risk normotensive primigravidae. Measuring blood pressure on arms with garments violates long-established perinatal guidelines. Small inaccuracies in blood pressure measurement can have considerable consequences in pregnancy. The

knowledge on impact of garments on accurate measurement of blood pressure in pregnancy may give tracks for prevention in this population. It is the responsibility of all the health professionals to ensure that every BP reading taken in pregnant women is accurate if hypertension is to be diagnosed and treated. Therefore, the decision to measure accurate BP with sleeves on among pregnant women depends on the discretion of the clients and the professionals.

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