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Effect of Yoganidra on hypertension: a clinical study

Saroj Kumar Sahu

Department of Yoga & Naturopathy, North Orissa University, Sri Ram Chandra Vihar, Takatpur, Baripada, Mayurbhanj, Odisha, 757003

Corresponding author. Email-Id: drsarose@gmail.com

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ABSTRACT

The present study aims at finding out the effects of Yoganidra on hypertension. The study conducted at out-patient department of Bedapada PHC (N), Khajuriakata CHC, Dhenkanal District of Odisha. Type of study is comparative clinical study (clinical trial and comparative study). 200 patients of hypertension are selected which are divided into 2 groups each having 100 patients. Practice time was approximately 30 minutes, twice daily in morning and evening and the duration was six months. After completion of trial period, the clinical improvement was assessed following the subjective and objective sign and symptoms such as head reeling, headache, disturbed sleep, dizziness. The scrutiny of pre and post development after the trial period were done, separated and compared. Marked improvement : > 75%, moderate improvement: 50 – 75%, mild improvement: 25 – 50%, unsatisfactory: < 25%. In order to prove the effectiveness scientifically all the assessment has been statistically analyzed and the derived mean value is shown. In the statistical analysis the mean ± S.D. of SBP and DBP of CG and TG before treatment has been compared with mean ± S.D. with after treatment. The effect of the Yoganidra to SBP (systolic blood pressure) and DBP (diastolic blood pressure) has been assessed through the Z - test. The result showed a significant change as Yoganidra positively decrease the blood pressure (both systolic and diastolic) as well as pulse rate, respiration rate, stress, anger and fear. The practice of Yoganidra is safe and effective in the patients with hypertension.

INTRODUCTION

Blood pressure (BP) is the hydrostatic pressure exerted by blood on the walls of a blood vessel. It is a measurement of the force against the walls of our arteries as the heart pumps blood through the body. Hypertension means high pressure (tension)

in the arteries. The top number, the systolic blood pressure, corresponds to the pressure in the arteries as the heart contracts and pumps blood forward into the arteries. Blood pressure readings are measured in mm of mercury and usually given as two numbers for example, 120 over 80 (written as 120/80 mmHg). The bottom number, the diastolic pressure, represents the pressure in the arteries as the heart relaxes after the contraction. The diastolic pressure reflects the lowest pressure to which the arteries are exposed. Hypertension or persistently high blood pressure is defined as systolic blood pressure of 140 mmHg or greater and diastolic blood pressure of 90 mm Hg or greater (Rawal CC 1982; Tortora & Grabowski 1996).

Classification

Normal - Systolic<130mmHg/Diastolic<85 mm Hg.

High-normal - Systolic 130-139 mm Hg/Diastolic 85-89 mm Hg.

Hypertension - Systolic 140 or greater/Diastolic 90 or greater.

Stage 1-Systolic 140-159 mm Hg/ Diastolic 90-99 mm Hg.

Stage 2-Systolic 160-179 mm Hg / Diastolic 100-109 mm Hg.

Stage 3-Systolic 180-209 mm Hg / Diastolic 110-119 mmHg.

Stage 4-Systolic 210 or higher / Diastolic 120 or higher.

Normal Blood Pressure -120/80 mm Hg.

Pre-hypertension -Blood pressure between120/80 and 139/89 mmHg.

Hypertension- Blood pressure between 140/90mm Hg or above (Tortora & Grabowski 1996).

Prevalence of Hypertension: Hypertension is a trait as opposed to a specific disease and represents a quantitative rather than a qualitative deviation from the norm. In some industrial countries up to 25% of adult have diastolic pressure above 90mm Hg. Prevalence in the developing countries seems to be similar to that in European or other technically developed societies among the adults (Park 1997).

Hypertension in India: In India the prevalence is 59.9 and 69.9 per 1000 in males and females respectively in the urban population, and 35.5 and 35.9 per 1000 in males and females in the rural population. Reviews of studies on hypertension epidemiology in India have shown high prevalence in both urban and rural areas. Indian urban population studies from the midd1e 950s to late 1990s used the older WHO guidelines for diagnosis (known hypertension or BP 160 mm Hg systolic and/or 95 mm Hg diastolic). A significantly increasing adult prevalence of hypertension has been reported. Although there is a lower prevalence of hypertension in rural Indian populations, there has been a steady increase over time here as well. Prevalence of hypertension using the current criteria (known hypertension or systolic BP 140 mm Hg and/or diastolic BP 90 mm Hg) has been reported among some urban Indian populations. These findings are in consonance with many developed countries where it has been reported that at any given time almost half of all individuals have high BP (Park 1997).

Mortality: Hypertension and its complications are a leading cause of death in modern societies. It is a major risk factor for stroke, CHD, heart or kidney failure. The higher the pressure, the great the risk and lower the expectation of life. The bulk of mortality associated with hypertension is due to cardiovascular disease. In India death from stroke is more common. Hypertension is known as the "silent killer" because it can cause considerable damage to heart, brain and kidneys before a person notices symptoms. The antihypertensive drug therapy cause major side effects in many patients, who choose to discontinue therapy as a result, even

at the risk of dangerous consequences and a shortened life span (Park 1997).

*Types of Hypertension***:** Two forms of high blood pressure have been described.

A. Essential / primary/idiopathic hypertension: Most of the time, no cause is identified. This is called essential hypertension.

B. Secondary hypertension: High blood pressure that is caused by another medical condition or medication is called secondary hypertension (Davidson 1999).

Causes of secondary hypertension - The causes of hypertension are alcohol, pregnancy, renal disease, endocrine disease and drugs such as oral contraceptive pills, anabolic steroids, corticosteroids, NSAID (Davidson 1999).

Risk factors for hypertension: Risk factors for hypertension include age over 60 years, male sex, race, heredity (a family history of high blood pressure), salt sensitivity, obesity, inactive lifestyle, heavy alcohol consumption, use of oral contraceptives, stress or anxiousness, diabetes and smoking (Davidson 1999).

Symptoms of hypertension: Most of the time, there are no symptoms. Uncomplicated (essential) high blood pressure usually occurs without any symptoms and so hypertension has been labeled "the silent killer". It is called this because the disease can progress to finally develop any several potentially fatal complications such as heart attacks or strokes. Uncomplicated hypertension may be present and may remain unnoticed for many years. This happens when there are no symptoms and blood pressure screening. Some people with uncomplicated hypertension, however may experience symptoms such as headaches, dizziness, shortness of breath, blurred vision, nervousness, irritability, insomnia or wakefulness, head reeling, palpitation, nervous tension and fatigue, emotional upset, tiredness, pain in chest, frequent urination, aches and pains in the arms, shoulder region, leg, back etc. and pain towards the back of head and neck on walking in the morning (Davidson 1999).

Complications (Target Organ Damage- TOD): Hypertension is the most important risk factor for death in civilized and industrialized countries. The adverse effects of hypertension principally involve the blood vessels, the central nervous system, the retina, the heart, the kidneys and can usually detected by simple clinical means. Patients with hypertensive complications are at considerable risk and usually require specific antihypertensive treatment. The complications include heart disease, silent stroke, heart failure, retinopathy, nephropathy, hypertensive retinopathy. If blood pressure is very high hypertensive encephalopathy may result (Davidson 1999; Mandlik et al. 2001 Bhuvaneswaran 2009).

Investigations: This include- urine analysis for blood, protein and glucose, plasma urea and electrolytes, plasma creatinine, plasma cholesterol, ECG(electro cardio gram), B.P. measurement by sphygmomanometer (Swash 2000).

THE CONCEPT OF YOGNIDRA

Yoga is one pointed awareness and nidra is sleep. Yognidra belongs to higher stages of raja yoga, since it is essentially a method of pratyahara. It is one aspect of pratyahara which leads to higher stages of concentration and samadhi. The science of Yognidra is as old as the age of puranas where Lord Vishnu lies on a serpent Sesa in Yognidra. It is a powerful technique from the tantra yoga tradition. It is both a name of a state and of a practice which creates an altered state of consciousness allowing the practitioner to relax and heal their being, expand their faculty of imagination, enter the realm of subconscious & super conscious, effectively manifest seemingly magical changes in their life, certain karmic debris in their life clear and assist in reaching a state

called by some enlightenment It is derived from tantras. It is a systematic method of inducing complete physical, mental and emotional relaxation. It is often referred to as psychic sleep or deep relaxation with inner awareness (Satyananda 2005).

Synonyms of Yoganidra: The synonyms of Yoganidra are: yogic sleep, psychic sleep, sleepless sleep, meditative sleep, dynamic sleep, transcendental sleep, conscious sleep, deep relaxation and a scientific sleep with inner awareness, sleep with awareness, meditation sleep (Panda 2003).

Characteristic features of Yoganidra: A systematic rotation of consciousness in the body which originated from tantric practices of *nyasa* which means 'to place' or 'to take' the mind to that point (Satyananda 2005).

MANAGEMENT

In this light, the emergence of Yognidra relaxation as a safe, effective and inexpensive treatment for mild to moderate hypertension is most encouraging both for doctors and the community at large. In more severe or long standing cases Yognidra is a useful adjunct therapy, enabling a high proportion of patients to significantly reduce or even discontinue their medications. Hypertension is a stress-related psychosomatic disorder. Stress is the most frequent cause of hypertension which causes wide-spread damage to the heart, blood vessels, eyes, kidneys and brain which may occur after the prolonged elevation of blood pressure through the arterial network or months or years. As Yognidra is a complete relaxation method, it is the most suitable method to reduce stress (Goel 2001; Karamananda 2006).

Statement of the problem: Although blood pressure is easily measured, it had taken several decades to realize that arterial hypertension is a frequent, world-wide health disorder (Park 1997).

Rule of Halves: Hypertension is an "iceberg disease". It became evident in the early 1970s that about half of the hypertensive subjects in the general population of the most developed countries were aware of the condition, only about half of those aware of the problem were being treated and only about half of those treated were considered adequately treated. If this was the situation in the countries with highly developed medical services, in the developing countries, the proportion treat would be far too less. The several population based studies represent the following groups (Park 1997):

1. The whole community.
2. Normotensive subjects.
3. Hypertensive subjects.
4. Undiagnosed hypertension.
5. Diagnosed hypertension.
6. Diagnosed but untreated.
7. Diagnosed and treated.
8. Inadequately treated.
9. Adequately treated.

Purpose: The goal of this study is to achieve the primary prevention of hypertension and to overcome the difficulties with which patients of hypertension are living. It provides a new interpretation of clinical aspect of Yognidra.

Prevention of Hypertension: The low prevalence of hypertension in some communities indicates that hypertension is potentially preventable. The WHO has recommended the following approaches in the prevention of hypertension:

1. Primary prevention
2. Secondary prevention

Primary prevention: Although control of hypertension can be successfully achieved by medication (secondary prevention) the ultimate goal in general is primary prevention. Primary prevention has been defined as all measures to reduce the incidence of disease in a population by reducing the risk of onset.

a. Population strategy: The population approach is directed at whole population, irrespective of individual risk levels. This involves a multifactorial approach, based on the following non-pharmacotherapuetic interventions.

1. Nutrition: Dietary changes are of paramount importance. These comprise : i) reduction of salt intake to an average of not more than 5g per day, ii) moderate fat intake, iii) the avoidance of a high alcohol intake, iv) restriction of energy intake appropriate to body needs.
2. Weight reduction: The prevention and correction of obesity (Body Mass Index greater than 25) is a prudent way of reducing the risk of hypertension.
3. Exercise promotion: The evidence that regular physical activity leads to a fall in body weight, blood lipids and blood pressure goes to suggest that regular physical activity should be encouraged as part of the strategy for risk factor control.
4. Behavioral changes: Reduction of stress by Yognidra, yoga and transcendental meditation, reduction of smoking, modification of personal life style are very much profitable.
5. Health education: The general public requires preventive advice on all risk factors and related health behavior. The whole community must be mobilized and made aware of the possibility of primary prevention.
6. Self care: An important element in community based health programmes is patient participation. The patient is taught self care i.e., to take his own blood pressure and keep a log-book of his readings.

b. High-risk strategy: The aim of this approach is ‘‘to prevent the attainment of levels of blood pressure at which the institute of treatment would be considered”. This approach is appropriate if the risk factors occur with very low prevalence in the community.

Secondary prevention: The goal of secondary prevention is to detect and control high blood pressure in affected individuals. Modern antihypertensive drug therapy can effectively reduce high blood pressure and consequently, the risk of morbidity and mortality from coronary, cerebrovascular and kidney disease. The control measures comprise – i) early case detection, ii) treatment, iii) patient compliance (Park 1997; Bhusan 2001).

SIGNIFICANCE OF STUDY

The Following significances are noted:

i. This study is very much significant because it addresses a common problem of a larger part of both sex of urban and rural population. Hypertension and its complications are a leading cause of death in modern societies. It is a silent killer causing widespread damage to the heart, blood vessels, brain, kidneys and eyes.

ii. This study will be beneficial to avoid the complications and major side effects of prolonged use of antihypertensive drugs. The major side effects of antihypertensive drugs are as follows: 1. Sleep disturbance, 2. Depression, 3. Male impotency.

iii. Because Yognidra is a non-pharmacotherapeutic technique it will be more helpful to the poor section of the society.

iv. This study is also giving importance to life style changes to reduce hypertension.

The following life style changes are effective in managing hypertension - 1. Losing weight, 2. Limiting alcohol intake, 3. Doing *yoga* and exercise, 4. Reduce intake of sodium (salt), 5. Maintaining recommended dietary intake of potassium, calcium and magnesium, 6. No smoking, 7. Managing stress.

METHODOLOGY

Comparative clinical study: The comparative clinical study was done by the two methods, answering the questionnaire, direct clinical examination and blood pressure measurement and salt intake assessment.

Questionnaire: The patients are asked to answer the structured questionnaires. After verifying the questionnaire, I used to measure the blood pressure of each patient. The following information was collected from each patient through a validated questionnaire prepared by me - age, sex, occupation, income status, weight, height, pattern of salt intake, dietary pattern, history of diabetes, family history of hyper-tension, past history of any examination of blood pressure and hypertension, or any of its complications, any symptom referable to target organ dysfunction, previous and present treatment profile and addictions.

Direct clinical examination and Blood pressure Measurement: Author used to examine the patient clinically and measure the blood pressure for each patient, using the auscultator method with a standardized calibrated mercury column type sphygmomanometer and an appropriate sized cuff encircling at least 80% of the arm in the seated posture, with feet on the floor and arm supported at heart level. Following a standardized protocol, I made two separate measurements and recorded the average of the two measurements after proper rest and due explanation to the examined patient about the objective of the study. In some cases, where high blood pressure was recorded for the first time, I checked the blood pressure more than twice and took the average of the two close readings. Systolic BP is the point at which the first of 2 or more sounds is heard (phase I) and diastolic BP is the point before the disappearance of sounds (phase 5).

Salt intake assessment: Salt intake was assessed from the amount of salt used in cooking at home and extra salt used during meals by the patient.

Study area: The study was carried out at outpatient department of Bedapada PHC (N), Khajuriakata CHC, Dhenkanal District of Odisha.

Groups taken for present study: Control Group (CG) and Trial Group (TG).

Study design: The present clinical research work has been designed in the following manner. 200 patients are selected by multiphase random sampling method and divided into 2 groups - Group A / Control Group (100), Group B / Trial Group (100).

i) Single Group: 1) C G (BT) → CG (AT), 2) T G (BT) → T G (AT).

ii) Double Group (AT): 1) CG→ TG.

Population and sampling

i) Population: The population of the area covered by Bedapada PHC(N) is 23, 323.

ii) Sample design: 200 patients of hypertension are selected which are divided into 2 groups each having 100 patients. In Control group (CG) 100 patients were treated with only medicines. In Trial group (TG) 100 patients were treated with medicines and Yognidra. Duration of treatment 6 months for both the groups. The trial therapy is Yognidra. The control therapy includes Anti-hypertensive drugs. The recommended Diet is Low salt and low fat diet. The dose of trial therapy is approximately 30 minutes, twice daily in the morning and evening. The dose of control drug is once daily in the morning before taking food.

Selection criteria: The selection criterias are – 1) patients having age above 40 and below 70 years,

2) patient of both sex, 3) patients having clinical features of primary hypertension.

Exclusion criteria

The exclusion criteria are – 1) patients having age below 40 and above 70 years, 2) patient of both sex, 3) patients having clinical features of primary hypertension.

Study areas and survey

1) Tools of data collection
    1. Clinical observation.
    2. Semi structured interview.
2) Data collection procedure*:* Data is collected from the out-patient department of BedapadaPHC(N), Khajuriakata CHC, Dhenkanal District of Odisha.
3) Data analysis

Assessment of patients: After completion of trial period, the clinical improvement was assessed following the subjective and objective sign and symptoms such as head reeling, headache, disturbed sleep, dizziness.

Assessment of Results: The scrutiny of pre and post development after the trial period were done, separated and compared.

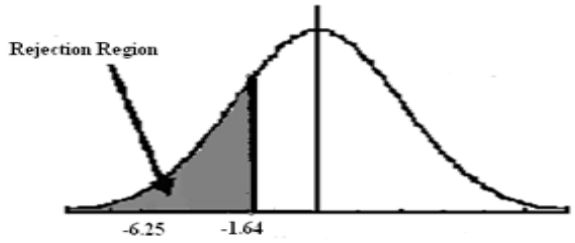
Marked improvement: > 75%, moderate improvement : 50 – 75%, mild improvement : 25 – 50%, unsatisfactory : < 25%.

Statistical Analysis: In order to prove the effectiveness scientifically all the assessment have been statistically analysed and the derived mean value is shown. In the statistical analysis the mean ± S.D. of SBP and DBP of CG and TG before treatment has been compared with mean ± S.D. with after treatment. The effectiveness of the *Yognidra* to SBP and DBP has been assessed through the Z – test (Kothari 2007).

Time frame: The duration of study was 6 months.

Null Hypothesis: there is no significance difference in average SBP in CG before and after the treatment.

Alternative Hypothesis: average SBP in CG after treatment is smaller than before treatment. Table 1 reveals that calculated value of 'Z' is less than the table value at 5 % level of significance. As calculated value of Z lies within the rejection region, the Null Hypothesis is rejected. It implies the observed difference in SBP is statistically highly significant. Thus average SBP of patients in CG has significantly decreased after treatment.



Left tailed test

Table 1 revealed that calculated value of 'Z' is less than the table value at 5 % level of significance. As calculated value of Z lies within the rejection region, the Null Hypothesis is rejected. It implies the observed difference in SBP is statistically highly significant. Thus average SBP of patients in TG has significantly decreased after treatment.

Table 1 revealed that calculated value of 'Z' is less than the table value at 5 % level of significance. As calculated value of Z lies within the rejection region, the Null Hypothesis is rejected. It implies the observed difference in SBP is statistically significant. Thus reduction in average SBP in CG after treatment is smaller than same in TG after treatment.

Table 2 revealed that calculated value of 'Z' is less than the table value at 5 % level of significance. As calculated value of Z lies within the rejection region, the Null Hypothesis is rejected. It implies the observed difference in DBP is statistically highly significant.

Thus average DBP of patients in CG has significantly decreased after treatment. Table 2 revealed that calculated value of 'Z' is less than the table value at 5% level of significance. As calculated value of Z lies within the rejection region, the Null Hypothesis is rejected. It implies the observed difference in DBP is statistically highly significant. Thus average DBP of patients in TG has significantly decreased after treatment. Table 2 revealed that calculated value of 'Z' is less than the table value at 5 % level of significance. As calculated value of Z lies within the rejection region, the Null Hypothesis is rejected. It implies the observed difference in DBP is statistically significant. Thus reduction in average DBP in CG after treatment is smaller than same in TG after treatment.

Discussion on sign and symptoms

a. Head reeling: CG had moderate improvement, TG had marked improvement.
b. Headache: CG had moderate improvement, TG had also marked improvement.
c. Insomnia: CG had moderate improvement, TG had marked improvement.
d. Dizziness: CG had moderate improvement, TG had marked improvement.

DISCUSSION

Control group patients had similar improvement, but management of trial group is better because medicines have always some adverse effects on the body and mind. Hence the *yoga* therapies are more preferable than medicines. But it is fact that the use of medicines is must in severe hypertension. But the use of medicines along with *yoga* therapies had much better effect on hypertension. One can control the blood pressure easily within a short period by this method. The adverse effect of medicines is minimized when it is combined with yoga therapies. Then after control of blood pressure, if one continues the *yoga* therapies the blood pressure can be maintained within its normal range.

The therapy of Yognidra is very easy to practice in house, at anywhere, at any time, without any help of others. It is practiced without any expenses. It is devoid of any adverse effect on the body and mind of the practitioner. It is a superbly effective system of meditation and for people who are sick or weak; it rejuvenates the nervous system, awakening prana and great healing power. It is especially useful in overcoming psychosomatic diseases (Chidananda 1999; Aurobindo 2010).

CONCLUSION

The result shows a significant change as Yognidra positively decrease the blood pressure (both systolic and diastolic) as well as pulse rate, respiration rate, stress, anger and fear. The practice of Yognidra is safe, effective in patients with hypertension and helps in reducing the risks of hypertension and the adverse effects of prolonged use of anti-hypertensive drugs. It is a state of relaxed awareness on the border between sleep and wakefulness, allowing contact with the subconscious and unconscious minds. It is the yogic tranquilizer, the natural means to establish harmony and wellbeing throughout the entire system.

RECOMMENDATION

Yognidra should be practiced regularly by patients with primary hypertension without any medications and by patients with secondary hypertension along with antihypertensive medications.

General Suggestion for the Practice of Yognidra

1) Duration of practice: It generally lasts for twenty to forty minutes.
2) Place of practice: Quiet, closed, semi dark room with closed doors and windows.

3) Time of practice: At the same time every day, either early in the morning or in the evening just before going to bed.
4) Best Position during practice: Lie down in *shavasana* on a thin blanket or thin mat, without pillow.
5) Don'ts during practice: Concentration, control over breath and sleep.
6) Food habit: In empty stomach in hypo acidic people and after food (tea, coffee, fruit juice, bread or a few biscuits) in hyperacid constitution.

Methods of practicing Yognidra

1. Following the instructions of an Acharya or instructor mentally initially.
2. Following the instructions through an audio CD after getting some perfection in the practice of Yognidra.
3. Following self-instructions when the practitioner has mastery over the practice of Yognidra (Satyananda 2005).

Outline of the practice of Yognidra

a. Preparation for the practice: Physical adjustment, appropriate posture and other necessary preparation.
b. Relaxation: Relaxation of the body, calm down the breath, body awareness.
c. Resolve (Autosuggestion): To take *sankalpa* (resolve) to uplift the personality, to do some positive work, to give up any negative thinking or bad habit etc.
d. Rotation of consciousness: Rotation of the awareness to each and every parts of the body.
e. Awareness of the breath: Awareness on the breathing process and breathing counting.
f. Feeling and sensations: Intense physical or emotional feelings are recalled or awakened, experienced fully, then removed. Usually this is practiced with pairs of opposite feelings, such as heat and cold, heaviness and lightness joy and sorrow, love and hate.
g. Sound management: Different sound heard from different near and far sources are observed and witnessed.
h. Visualization: Visualization of images named or described by the instructor.
i. Resolve: Once again remembering the earlier *Sankalp or* resolve.
j. Ending the practice: Finishing the practice and coming back to the normal activity (Swash 2000; Satyananda 2005).

Points to be remember in Yognidra

One should bear the following points in the mind when doing Yognidra:

- Relax, but do not sleep.
- Be aware, do not concentrate.
- Maintain the attitude of a witness - do not get lost in the mental reverie.
- Maintain awareness of the sound of the teacher's voice; do not lose contact.
- Do not move the body.
- Keep your eyes closed throughout the practice.
- Do not try to intellectualize or understand the process of Yognidra. Just follow and do the practice.

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Table 1: Z - test on differences in S.B.P in CG (BT and AT), S.B.P in TG (BT and AT) and S.B.P across the groups (AT)

S.B.P in CG (BT and AT)		**S.B.P in TG (BT and AT)**		**S.B.P across the groups (AT)**	
Characteristics	Values	Characteristics	Values	Characteristics	Values
$\overline{x}_1$	159.00	$\overline{y}_1$	163.23	$\overline{X}$	159.00

$\overline{x_2}$	173.50	$\overline{Y_2}$	172.70	$\overline{Y}$	163.23
n_{X_1}	65	n_{Y_1}	51	n_x	65
n_{X_2}	100	n_{Y_2}	100	n_Y	51
$S.D_{X_1}$	12.20	$S.D_{Y_1}$	11.31	$S.D_X$	12.20
$S.D_{X_2}$	17.57	$S.D_{Y_2}$	18.04	$S.D_Y$	11.31
Calculated Value of Z	- 6.25	Calculated Value of Z	- 3.92	Calculated Value of Z	- 1.91
Table Value of Z at 5 % l of significance	- 1.64	Table Value of Z at 5 % level of significance	- 1.64	Table Value of Z at 5 % level of significance	- 1.64
Null hypothesis	Rejected	Null hypothesis	Rejected	Null hypothesis	Rejected

Where,

$\overline{x_1}$ - Average SBP of patients in CG, after treatment.

$\overline{x_2}$ - Average SBP of patients in CG, before treatment.

n_{X_1} & n_{X_2} - Number of patients in CG.

$S.D_{X_1}$ - Standard deviation of SBP in CG after treatment.

$S.D_{X_2}$ - Standard deviation of SBP in CG before treatment.

Table 2: Z - test on differences in D.B.P in CG (BT and AT), D.B.P in TG (BT and AT) and D.B.P across the groups (AT)

D.B.P in CG (BT and AT)		**D.B.P in TG (BT and AT)**		**D.B.P across the groups (AT)**	
Characteristics	Values	Characteristics	Values	Characteristics	Values
$\overline{x_1}$	110.53	$\overline{Y_1}$	114.93	$\overline{X}$	110.53
$\overline{x_2}$	121.50	$\overline{Y_2}$	119.90	$\overline{Y}$	114.93
n_{X_1}	38	n_{Y_1}	27	n_x	38
n_{X_2}	100	n_{Y_2}	100	n_Y	27

$S.D_{X_1}$	10.19	$S.D_{Y_1}$	10.25	$S.D_X$	10.19
$S.D_{X_2}$	17.28	$S.D_{Y_2}$	17.46	$S.D_Y$	10.25
Calculated Value of Z	- 4.60	Calculated Value of Z	- 1.88	Calculated Value of Z	- 1.69
Table Value of Z at 5 level of significance	- 1.64	Table Value of Z at 5 % l of significance	-1.64	Table Value of Z at 5 % level of significance	- 1.64
Null hypothesis	Rejected	Null hypothesis	Rejected	Null hypothesis	Rejected