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## RESEARCH ARTICLE

# OUTCOMES OF GEMMO-MODIFIED PLANT COMBINATIONS AGAINST CHRONIC HYPERTENSION AND TACHYCARDIA

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**ABSTRACT**

Five common Pakistani plants *Allium sativum*, *Allium cepa, Zingiberofficinale*, *Terminaliaarjun a*and *Moringaoleifera* were used to prepare two polyherbal formulations 5G and 5N for the treatment of chronic hypertension and tachycardia. Both the treatment combinations were applied on the healthy rabbits in the phase-I. Histopathology of rabbits organs revealed no side effect by any of the two combinations. DPPH assay indicated the superiority of 5G combination over 5N due to its higher antioxidative potential. Hence, the 5G combination (alone and in combination with inderal) was applied on 33 humans facing chronic hypertension and 36 chronic tachycardia patients in the phase-II of the study. Findings revealed the greater medicisnal potential of 5G + inderal as compared to inderal and 5G alone. 5G + inderal lowered the mean diastolic blood pressure to 74.36±3.21 mm Hg from 94.24 ± 1.66 mm Hg and mean systolic blood pressure to 128.79±3.17 mm Hg from 194.44±2.07 mm Hg. Mean pulse rate was reduced from 115.00±1.04 beats/min to 75.58±4.36 beats/min after treatment with 5G + inderal.



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## INTRODUCTION

Herbalism has now become the highly researched area even in the advanced countries (Kennedy and Wightman, 2011). In Pakistan, there are hundreds of plant species to be identified for their pharmacological aspects (Afzal *et al*., 2014a). It is one of the therapeutic approaches that two or more plants are being mixed to get better results against a disease since the older times (Anjum *et al*., 2014). Plant combinations and polyherbal formulations are the topics of ancient hakims which in the advanced form are being employed against several ailments in almost all areas of the world (Arshad *et al*., 2014). Five common plants used in the daily Pakistani foods, meals and pharmaceutics having cardioprotective and therapeutic efficacy have been used in this study. Onion and Garlic has been found as hypotensive by several authors (Asdaq and Inamdar, 2011). Ginger has also been identified for its antioxidant properties. The role of ginger in cardiovascular diseases is also clear from several studies as it prevent heart from oxidative damage (Budoff and Qureshi, 2013).

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Ginger also acts as natural agent to reduce hypertension (Mahdaviroshan *et al*., 2014). *TerminaliaArjuna* is one of best cardioprotective plants as it has been explored to have strong antioxidant nature. Its bark powder has been reported to impose hypocholesterolaemic and antioxidant effects (Maulik and Katiyar, 2010; Parveen *et al*., 2011; Afzal *et al*., 2014c). *Moringaoleifera* has been proved to possess a strong blood pressure lowering potential as it reduces pulmonary hypertension. Leaves of *Moringaoleifera* have been proved to have hypotensive effects due to its hypocholesterolemic nature. Thus *Moringaoleifera* extract attenuates the pulmonary hypertension development by vasodilation and increases the antioxidant activity potentially (Chen et a., 2012). Gemmotherapy is the way to form herbal medicine by use of newly emerging plant parts (Ayesha *et al*., 2013). These embryonic tissues are actually the potential bombs of energy against any particular disease and help in the elimination of toxins. At the time of germination these plant parts are the rich source of secondary metabolites as vitamins, various nutrients, enzymes and hormones that are sometimes present in the plants at the spring season only (Jahan *et al*., 2011). About 7.1 million people die each year due to hypertension (Erem *et al*.,

2009). A similar scenario is seen in Pakistan. According to report of NHS (National Health Survey), about 18% young people and 33% people above the age of 45 years are facing high blood pressure in Pakistan (Julius *et al*., 2010). Tachycardia should be recognized as a clinically related and potent cardiovascular risk factor as heart rate is often neglected during the course of diagnosis of heart related problems (Julius *et al*., 2010). Literature proves that high beating rate of heart at rest may be a risk factor for development of high blood pressure thus enhancing the rates of cardiac diseases and mortality (Mampuya, 2012). In 2025, the number of hypertensive patients may raise up to 1.56 billion (Elkum *et al*., 2014).There is a dire need of finding the natural strategies to overcome the situation by using the available resources (Rehman and Sophie, 2014).

## MATERIALS AND METHODS

### Phase-I

### Plant Collection

Freshly growing parts (shoots, leaves, flowers and buds) of *Allium cepa*, *Allium sativum*, *Zingiberofficinale*, *Terminaliaarjuna* were taken from Ayub Agriculture Research Institute, Jhang Road, Faisalabad, Pakistan. Same parts of all the four plants were also collected from the same institute when they were in the mature stage. Both the young as well as mature parts of *Moringaoleifera* were taken from the Department of Crop Physiology, University of Agriculture, Faisalabad, Pakistan and identified by an authenticated texonomist.

### Native extracts

*Terminaliaarjuna*(adult bark), *Allium cepa, Allium sativum, Zingiberofficinale* (mature bulbs) and *Moringaoleifera* (mature roots) were collected and washed with distilled water and processed to prepare native extracts by using the procedure of Bhatia *et al*., 2013 (Bhatia *et al*., 2013).

### Gemmomodified extracts

Newly growing embryonic tissues of *Allium cepa*, *Allium sativum*, *Zingiberofficinale*, *Terminaliaarjuna* and *Moringaoleifera* were collected in actively growing phase and gemmomodified extracts were prepared according to procedure used by Pauliuc and Dorica, 2013(Pauliuc and Dorica, 2013).

### Experimental protocols

Fifteen Male, healthy rabbits (age: 8-10 months; Wt: 1- 1.5 kg) were purchased from the local market of Gojra, Pakistan. Rabbits were acclimatized by keeping them at 25 ± 6 °C and providing them with same fodder. Rabbits were placed in three groups and treated with native and gemmomodified plant extracts. 80 mg extract of each plant was added in both the cases whether that was native or gemmomodified plant combination. Thus, total 400 mg each of 5N and 5G combinations were orally fed to the rabbits. Blood samples were collected at the start and at the end of the study to get the post treatment effects of plant combinations of both types.

**Control:** rabbits those were not fed with plant combinations

**5G:** rabbits fed with 5G combination twice a day for seven days

**5N:** rabbits fed with 5N combination twice a day for seven days

Five rabbits were placed in each of the three groups.

### Histopathology/microscopic examination

All animals were slaughtered at the end of the trial after one week to examine the histo pathological features of heart, liver, kidneys and lungs. Cardiac as well as all other tissues were immediately fixed in neutral formalin solution and studied by using the protocols of Filho *et al*., 2011.

### Phase-II

Both the native as well as gemmo modified combinations (5N and 5G) composed of five plants *Allium sativum*, *Allium cepa, Zingiberofficinale*, *Terminaliaarjuna* and *Moringaoleifera* were subjected for the DPPH assay prior to their application in human trial. Protocols of Jahan*et al*., 2012 and Noor *et al*., 2014 were used to perform DPPH assay (Jahan *et al*., 2012; Noor *et al*., 2014). % Inhibition of DPPH= Absorbance of blank-Absorbance of sample X 100/Absorbance of blank

### Phase-III

### Application of herbal combination with maximum cardio protective potential on human volunteers

About 36 male patients with chronic tachycardia were selected by screening them out of several with the help of history questionnaires filled by the patients. We have screened only those patients for this study which had history of tachycardia but no high blood pressure to avoid the confusion of hypertension related tachycardia (Julius *et al*., 2010). Owing to this selection the number of available patients under study was further reduced. Patients registered in private clinics and hospitals of Gojra, Toba Tek Singh and Faisalabad, Pakistan were the subjects of our study. The plant combination 5G (gemmo modified combination *Allium cepa, Allium sativum, Zingiberofficinale, Terminaliaarjuna*and *Moringaoleifera*) was used to treat the humans with hypertension and tachycardia. The 33 human, male volunteers (Age: 45-55 years) with strong history of high blood pressure and 36 male volunteers with chronic tachycardia (Age: 40-57) were selected on the basis of availability of subjects according to need of our experiment.

Total 11 patients were put in each of the three selected groups (5G alone, Inderal alone, Mix of both) for investigating the effects of herbal product on blood pressure. Out of 36 tachycardia patients, 12 were placed in each of three groups to monitor tachycardia. Dose of the plant medicine was prepared by combining 200 mg of each the gemmo modified plant extracts of *Allium cepa*, *Allium sativum*, *Zingiberofficinale*, *Terminaliaarjuna* and *Moringaoleifera* and so making the capsules containing 1g of the 5G plant combination. About 40 mg of the inderal in tablet form was used alone as well as in combination with 1g of 5G. In the case of blood pressure, each treatment was given thrice a day to every patient kept under the three categories. While only one dose of each treatment was administered after taking the zero reading of pulse rate to every patient in all the three categories.

### Monitoring of blood pressure and cardiac rhythm

We have screened and selected only those hypertensive cases out of several which had diastolic pressure ≥ 90 having no strong history of any disease other than high blood pressure (Rodrigues *et al*., 2014). A blood sugar level test was performed of all the selected patients to avoid the diabetes related hypertension. Only the patients with normal blood sugar level were chosen for further study. Before starting the treatment, blood pressure and pulse rate of all the patients were measured (zero sampling). Blood pressure was taken with digital blood pressure monitor (CE 0483, Germany) and pulse rate was calculated manually as beats per 60 seconds. Both parameters were measured at regular intervals as pulse rate was recorded at the start of experiment, after ½ hour, 1 hour and after 2 hours. Pulse rate of each subject was recorded thrice each time and mean values were calculated to compare. Blood pressure (mm/Hg) was also calculated at specific intervals as at the start, at 12 hours, 24 hours and 48 hours. Each person's blood pressure was recorded three times at each interval and mean values were calculated to lessen the error chances.

### Statistical Analysis

Means of all studied categories were calculated and data so obtained was arranged as Mean ± SD). SPSS 15 software was used for the analysis of data (Steel *et al*., 1997).

## RESULTS

Natural products and alternative treatments proved to be a better and safer cure against many cardiac ailments including hypertension (Naseer *et al*., 2013). Plant extracts and herbal formulations are getting more considerations being safe antioxidants and free radical protectors (Landete, 2013). The incidence of cardiovascular diseases can be decreased with the consumption of fibrous foods as vegetables and fruits. The fact has been evidenced from several epidemiological findings (Alaje *et al*., 2014). Numerous studies have been conducted to investigate the medicinal effects of many plants as hypotensive but the different combinations of these five plants in this study were selected with the idea to get another important alternative way for the treatment of high blood pressure and chronic tachycardia in humans. In this project, gemmomodified plant extracts of specific parts of each plant have also been selected. This way of treatment is folk and has been in use since ancient times but the way of combining them is innovative that is not found in previous literature. Plant combinations 5G and 5N were prepared by combining the *Allium sativum*, *Allium cepa, Zingiberofficinale*, *Terminaliaarjuna* and *Moringaoleifera* in gemmomodified and native format respectively. Prior to the use of 5G and 5N on human patients of tachycardia and hypertension, both the combinations were applied to the rabbits placed in different treatment groups to confirm their non toxic effects.

### Phase-I

### Histopathology of rabbits

All the organs of rabbits in both the 5N and 5G groups exhibited normal architecture. It indicates that both the combinations have no side or harmful effects on the heart, liver, lungs and kidneys

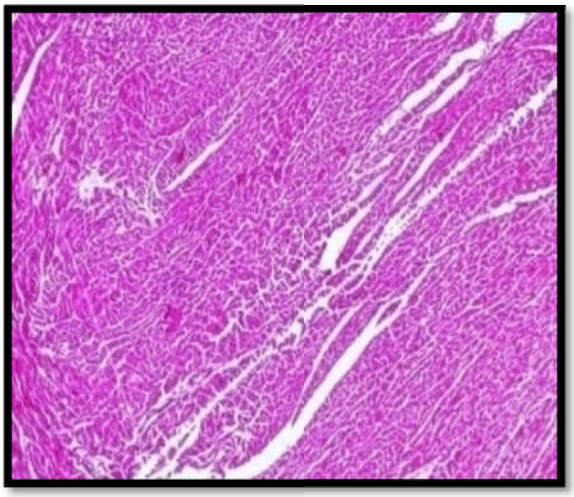

**Fig. 1. Normal appearance of myocardial fibers in the photomicrograph of heart. The central nuclei (arrow) and fibers are arranged homogeneously along with the intercalated discs. 5G (rabbit I). (H and E stain) X-100**

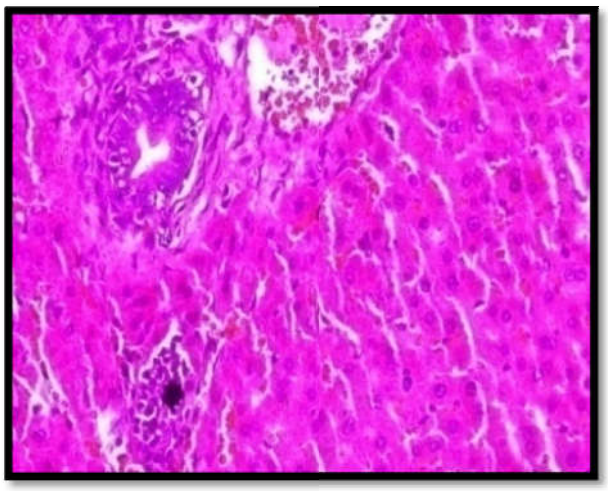

**Fig. 2. Normal arrangement of hepatocytes in cord like fashion with healthy nucleus (arrow) in the photomicrograph of liver. 5G (rabbit II). X-400 (H and E stain)**

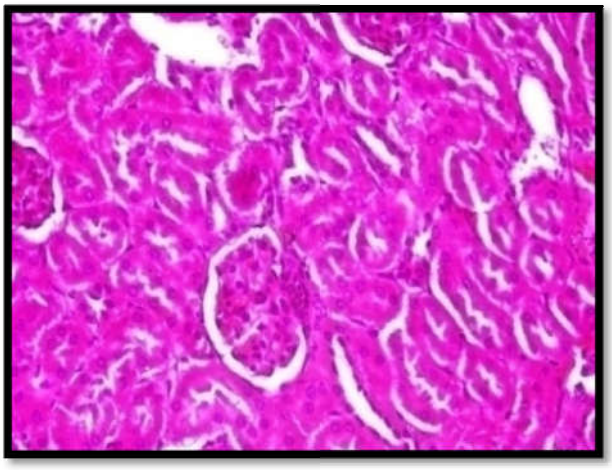

**Fig. 3. Normal tubular epithelial cells (arrow) and glomeruli (circle) in the photomicrograph of kidney. 5G (rabbit I). X-200 (H and E stain)**

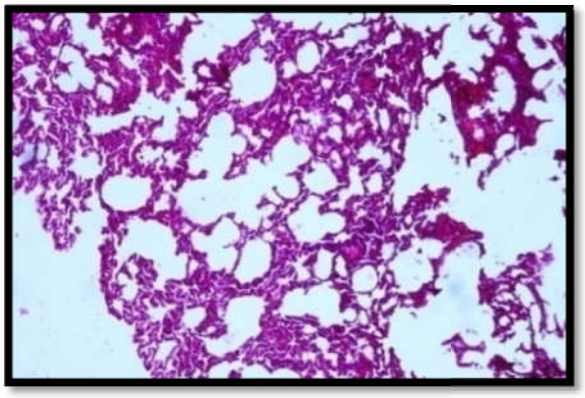

**Fig. 4. Normal air sacs (arrows) and alveolar walls in the photomicrograph of right lung. 5G (rabbit I). (H and E stain) X-400**

**Phase-II**

**Antioxidant Activity**

Owing to greater importance of plant phytocomponents having the roles as antioxidants the project has been designed to test the selected compounds for their potential as free radical scavengers. DPPH radical scavenging assay was selected as test method (Gzella et al., 2012), because it is the base of a usual antioxidative assay (Patel and Natvar, 2011). An antioxidant is considered best if it shows maximum capability to scavenge free radicals. DPPH radical scavenging assay was selected due to its broad applicability and sensitivity for the detection of antioxidants in 5G and 5N combinations prepared by combining the gemmo and native extracts of *Allium sativum*, *Allium cepa, Zingiberofficinale*, *Terminaliaarjuna* and *Moringaoleifera* respectively. It is quite simple and less time consuming method. A free electron is present in DPPH that gives maximum absorption at 517 nm. The color of DPPH changes to yellow from purple when it is reduced by sharing its free electron to the hydrogen of free radical capturing antioxidants (Jahan *et al*., 2011). Different concentrations of plant combinations were prepared and % inhibition was noted by DPPH standard method. The % inhibition was lower at all concentrations in the case of 5N as compared to 5G indicating the greater antioxidative potential of 5G. Highest radical scavenging activity was found at the concentration of 25µL in the case of 5G (60.98±0.991) followed by 5N (54.1 ± 0.701). BHT was used as the standard antioxidant that showed 73.34±0.522 % inhibition. The % inhibitions ± S.D at different concentrations for both of the studied samples have been given in the table I.

**Table I. DPPH inhibition exhibited (%) by 5G and 5N at different concentrations**

| Concentration (µg/mL) | 5G | DPPH Inhibition (%) | 5N | DPPH Inhibition (%) |
|---|---|---|---|---|
| 5 | 1 | 25.62 ± 0.313 | 1 | 14.61 ± 0.928 |
| 10 | 2 | 32.29 ± 0.881 | 2 | 23.80 ± 1.269 |
| 15 | 3 | 42.95 ± 0.436 | 3 | 33.14 ± 0.685 |
| 20 | 4 | 48.10 ± 1.33 | 4 | 39.41 ± 0.582 |
| 25 | 5 | 60.98 ± 0.991 | 5 | 54.10 ± 0.701 |

Comparison of DPPH radical scavenging activity of different concentrations of 5N and 5G containing native and gemmomodified combination of *Allium cepa*, *Alliumsativum*, *Zingiberofficinale*, *Terminaliaarjuna* and *Moringaoleifera.* Each value is an average of triplicate experiments and given as mean±SD.

**Phase-III**

**Effect of 5G on chronic tachycardia patients**

Out of 36 tachycardia patients, 12 patients were kept in each of the three categories. Pulse rate was recorded as zero time data at the start of the trial before the medications. There was no change in pulse rate in the patients who were treated with the gemmo modified plant combination (5G) of *Allium cepa*, *Allium sativum*, *Zingiberofficinale*, *Terminaliaarjuna* and *Moringaoleifera* alone when recorded after half hour time period. The mixture (inderal+5G) exhibited greater decrease in pulse rate within half hour time period as compared to inderal alone. After 1 hour, again the pulse rate was maximally reserved in the case of patients who received treatment of mixture (inderal+5G) followed by the patients in inderal alone category. The 5G plant combination comprising of gemmomodified extracts of five plants exhibited minimum decrease in the pulse rate when administered alone. After 2 hours, a dramatically sharp decline conserving the normal rate of heart beat was found in the case of patients who were dealt under mixture category. Inderal alone also showed rapid decrease in pulse rate but at the end of the trial, inderal's effect on the pulse rate was lower than mixture but higher than 5G alone. The percent decrease in pulse rate was maximum in the case of patients treated with mixture (inderla+5G) followed by inderal alone. The lowest effect of 5G alone has been observed on chronic tachycardia patients. After 2$^{nd}$ hour, about 83.3 % (10 out of 12) patients were recovered by mixture while 66.7% (8 out of 12) patients showed normal pulse rate in inderal alone category. Only 41.7% cases in plant alone category exhibited normal rate of pulse at 2$^{nd}$ hour. It was found that the pulse rate of patients in mixture as well as inderal alone category decreased to the normal level gradually. Thus the % of recovery was also higher in mixture category.

The pulse rate for all the subjects studied under different categories at specific time periods has been indicated in Fig V(a). At the start of experiment; patients in all the three categories exhibited higher mean pulse rates (inderal: 114.89±1.63 beats/min, 5G: 115.58±1.55 beats/min, inderal+5G: 115.00±1.04 beats/min) than normal range of pulse rate in humans The mean pulse rate was reduced to 95.51±3.02 beats/min in the patients treated with inderal alone after ½ hour while it was 92.13±2.53 beats/min in the case of Mixture. After ½ hours, 5G alone showed the pulse rate of 112.90±1.42 beats/min. After 1 hour, pulse rate was reduced to different extents in the patients of all the three categories (inderal: 85.25±2.98 beats/min, 5G: 102.11±2.92 beats/min) but the maximum decrease was observed in the patients treated with Mixture (inderal+5G: 78.64±2.71 beats/min). There was a significant difference in pulse rates in all the three categories (inderal: 81.44±5.72 beats/min, 5G: 98.85±5.04 beats/min, inderal+5G: 75.58±4.36 beats/min) when recorded after 2 hours. After the 2$^{nd}$ hour, again the maximum decrease in pulse rate was observed in the case of patients who were treated by Inderal+5G followed by patients treated with inderal alone. All the values are given as mean ± SD. Each individual value is a mean of 3 values taken at each time period for 12 patients.

**Effect of 5G on chronic hypertensive patients**

Out of 33 hypertensive male patients selected for the trial, 11 patients were kept in each of the three categories.

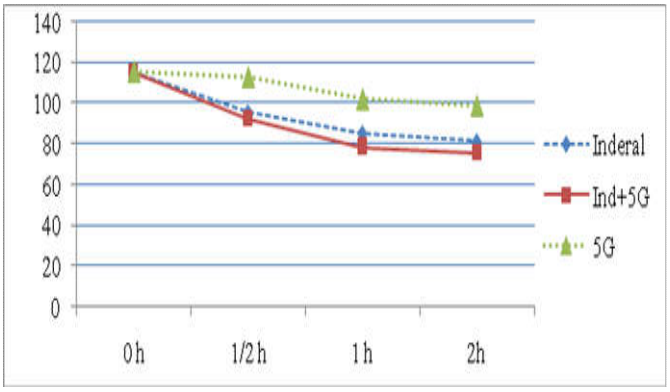


**Fig 5(a). Pattern of pulse rate per 60 seconds in chronic tachycardia patients after treatment with 5G alone and in combination with inderal**

The therapeutic effects of all the three kind of treatments (inderal alone, inderal+5G and 5G alone) were observed on both the systolic as well as diastolic blood pressure of the selected patients at specific time intervals. After 12 hours time period, systolic blood pressure was not decreased significantly in the patients treated with 5G alone. Whereas, the patients who has been treated by inderal alone, presented a rapid decrease in blood pressure as compared to patients in the mixture category at 12 hours. At 24 and 48 hours, maximum effect was observed on the patients treated with mixture (inderal+5G) followed by the patients treated with inderal alone. 5G alone showed minimum positive effects on systolic blood pressure. At the start of experiment, mean systolic blood pressure was observed as, inderal: 196.39 ±2.50 mm Hg, 5G: 196.25±1.74 mmHg, inderal+5G: 194.44±2.07 mmHg (Fig. V(b)). Which was reduced (inderal: 163.06±10 mmHg, 5G: 191.95±11.76 mmHg, inderal+5G: 172.58±9.99 mmHg) at 12 hours time period. So the maximum reduction in systolic blood pressure was found in the patients treated with inderal+5G but a sharp decrease in blood pressure was observed in the case of patients treated with inderal alone. At 24 hours, maximum reduction in mean systolic blood pressure was recorded in the inderal+5G category followed by inderal alone. Minimum effect on systolic pressure was observed in the patients treated with 5G alone (inderal: 142.65±5.23 mmHg, inderal+5G: 135.87±3.90 mmHg, 5G: 173.00±7.09 mmHg). There was a further reduction in systolic blood pressure after 48 hours in all the categories. inderal+5G showed maximum reduction in blood pressure (128.79±3.17 mmHg) which was exactly near to normal levels of the blood pressure in healthy humans. Inderal (139.65±4.24 mmHg) and 5G (168.45±5.82 mmHg) showed comparatively less reduction in blood pressure as compared to mixture of both.

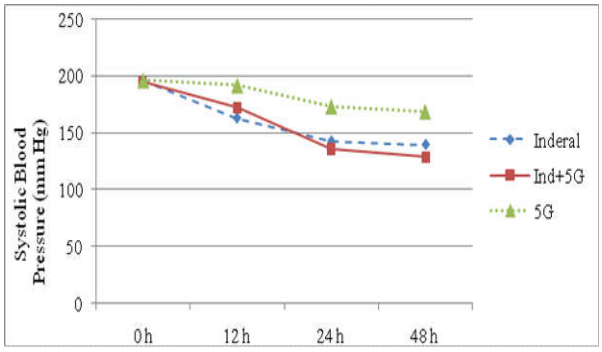


**Fig 5(b). Systolic blood pressure (mm Hg) in chronic hypertensive patients after treatment with 5G alone and in combination with inderal**

All the values are given as mean ± SD. Each individual value is a mean of 3 values taken at each time period for 11 patients. Mean diastolic blood pressure was found as, inderal: 96.51±1.57 mm Hg, 16G: 95.42±1.05 mm Hg, inderal+5G: 94.24±1.66 mm Hg at the start of experiment. Which was reduced (inderal: 85.83±2.80 mm Hg; 5G: 95.72±3.48 mm Hg; inderal + 5G: 88.33±3.54 mm Hg) after 12 hours of the treatments administered to the patients. Fig V(c) indicates the maximum decrease in mean diastolic blood pressure in the case of patients who were treated with inderal+5G. Whereas a sharp decline in diastolic blood pressure was observed as in the case of systolic pressure in the patients getting the treatment of inderal alone. The general trend of reduction in blood pressure is same in the case of systolic as well as diastolic blood pressure (Fig V (b and c). After 24 hours a further decrease was observed in diastolic blood pressure for all the categories (inderal: 82.19±2.92 mm Hg, inderal + 5G: 76.48±2.91 mm Hg, 5G: 92.37±5.19 mm Hg). After 48 hours, the diastolic blood pressure was maximally reduced (74.36±3.21 mm Hg) in the patients dealt under Mixture category followed by the inderal alone (81.09±4.27 mm Hg) while lowest decrease in diastolic blood pressure was found in the case of patients treated by 5G alone category (88.72±4.83 mm Hg). Overall after 48 hours, the findings of chronic hypertensive patients were as: Inderal+5G showed 81.9 % recoveries (9 out of 11 patients). About 63.7 % (7 out of 11) patients recovered in the case of inderal alone. While only 36.4 % (4 out of 11patients) were recovered in the 5G category that were treated with plant combination alone.

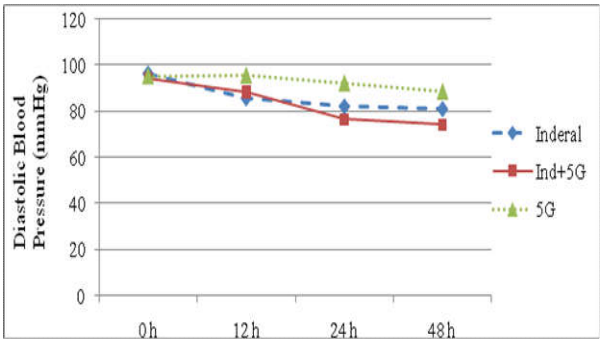


**Fig 5(c): Diastolic blood pressure (mmHg) in chronic hypertensive patients after treatment with 5G alone and in combination with inderal**

All the values are given as mean ± SD. Each individual value is a mean of 3 values taken at each time period for 11 patients.

## DISCUSSION

Chronic hypertension is a strong factor to increase the risk of strokes, heart diseases as failure and attack (Rodrigues *et al*., 2014; Skurkovich and Skurkovich, 2014; Pankaj *et al*., 2013; Podila *et al*., 2014). The reactive oxygen or nitrogen species are generated during the energy production process of the cells as by products. Another source to produce the free radicals is the environment polluted with dangerous chemical materials and the free radicals generation in the course of heavy exercise. Production of ROS in heavy amounts can lead to the oxidative damage to the proteins, lipids and DNA (Farhadi *et al*., 2013). One of the leading reasons of higher death rates is greater incidence of cardiovascular ailments. One third of all the mortalities in world are due to CVDs. About 53% of deaths caused by cardiovascular diseases are in the patients

with the age less than 70 years. More antioxidants should be recommended to take through diet to get protection from CVDs, but antioxidants if taken irrationally and non judicially will enhance the chances to get hidden toxicities (Kumar *et al*., 2010). Excessive free radical species in the biological system leads to degenerative diseases (Jahan *et al*., 2012; Selvakumar *et al*., 2011; Farhadi *et al*., 2013). It is evident from many studies that antioxidants can protect the biological system form damage by reactive species of oxygen and nitrogen. Higher the use of phytochemicals as diet, greater will be the antioxidants in body. Plant based antioxidative compounds have gained much importance in these days. Actually the antioxidants are a natural asset found in the fruits, natural fibres, plants and vegetables (Goyal *et al*., 2010). Each of the five plants has been recorded in literature for their antioxidative properties (Ramudu *et al*., 2011).The greater % inhibition (free radical scavenging potential) of 16GP strengthens our view that gemmomodified plants extracts have a greater curing potential as compared to native extracts of the same plants (Jahan *et al*., 2011; Hina *et al*., 2010; Dogar *et al*., 2012).

Since older times, the secondary products of plants have been used as phytomedicines against several ailments (Salimeh *et al*., 2010). Any tissue of the plant can be used as medication such as leaves, buds, roots, shoots, barks and seeds etc. owing to their bioactive compounds. Alternative medicines are more efficient in the treatment of several ailments because they have lesser side effects and are easily accessible (Afzal *et al*., 2014c). Several bioactive compounds have been isolated and identified from the plants for their medicinal properties[45]. It explored a range of very efficient drugs with higher therapeutic values. It is essential to know about the chemicals present in a plant to synthesize complex medicinal substances. There are many studies regarding the photochemical screening of the plants (Nishaa *et al*., 2013; Efferth *et al*., 2011). Onion acts as a strong antioxidant (Ashwini *et al*., 2013). Garlic is cardioprotective and hypotensive as indicated by several studies (Ashraf *et al*., 2013). Numerous authors documented the blood pressure and pulse lowering effects of ginger. It is also helpful to treat the cardiac ischemia as it has ability to lower the LDL cholesterol (Ramudu *et al*., 2011). *Terminalia Arjuna* has been explored to have strong antioxidant nature. Its bark powder has been reported for its antioxidant and hypertension reducing effects (Maulik and Katiyar, 2010; Parveen *et al*., 2011). *Moringaoleifera* has been proved to possess a strong antioxidative potential as it reduces pulmonary hypertension. *Moringaoleifera* have been proved as hypotensive by its hypocholesterolemic effects. It has been reported to attenuate the pulmonary hypertension by vasodilation. There are also evidences of potential increase in the antioxidant activity by the use of *Moringaoleifera* extracts (Chen et al., 2012).

**Conclusion**

The decrease in blood pressure and heart rate in the present study may be due to synergistic effects of gemmomodified extracts of five plants having well defined cardioprotective potential. All the selected plants have been documented as hypocholesterolemic, antioxidative and cardioprotective to different extents in previous literature. *Allium cepa, Allium sativum, Zingiberofficinale, Terminaliaarjunaand Moringaoleifera* are all well known as cardioprotective as well as hypotensive varying in mechanism of action. The cumulative antihypertension property of 5G herbal product may be exploited in future to design a drug at the commercial level.

**Acknowledgement**

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**Conflict of interest**

The authors declare the project as free of any potential conflict of interest.

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