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Comparison of lasuna with atorvastatin & its investigation of hydrogen sulfide release in obese and/or hyperlipidemic cases

F.S. Shah[1*], Gaurang B. Shah[1]

[1]*Department of Pharmacology, K.B.I.P.E.R., Kadi Sarva Vishwavidyalaya, Gandhinagar*

ABSTRACT

Medicinal Use of garlic is established since ages in different forms against various disorders. However, its efficacy against a marketed, well-known allopathy therapy is hardly been dealt with. The aim of this study was to use a standardized market preparation of Garlic, Himalaya's herbal preparation, Lasuna capsules available in the market as Over the counter product, for comparison with the standard groups of Atorvastatin (10 mg) as well as a third combined group (comprising of both formulations) in Hyperlipidemic and/or Obese patients. A 12 weeks non-randomized, open, parallel group clinical study was carried out to confirm these findings in patients having Hyperlipidemia and/or Obesity. Recently, hydrogen sulfide has emerged as a potential novel gaseous molecule with a promising role in protective mechanism against damage to the heart. The consumption of garlic is inversely correlated with the progression of cardiovascular disease, although the responsible mechanisms remain unclear. A study showed that human RBCs convert garlic-derived organic polysulfides into hydrogen sulfide (H_2S), an endogenous cardioprotective vascular cell signaling molecule [1]. One of the study objectives was to study the release of hydrogen sulfide, the novel gastro-transmitter from this standardized, marketed formulation. The study also aimed to establish safety of the garlic formulation versus the statin therapy alone and in combination and whether the side-effects observed are tolerable. The statistical evaluation of data showed that lasuna was unable to deliver statistically significant results in a span of treatment for three months. However, it can be prescribed as a supporting regimen with Atorvastatin therapy which may be helpful in preventing an increase in dose of allopathy drug. Also, Lasuna capsules showed a marked increase in the levels of hydrogen sulfide from baseline to three months treatment, thus confirming release of H_2S inside the body probably after metabolism of its active constituents.

Keywords: Garlic, Atorvastatin, Hyperlipidemia, Obese, Lasuna

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INTRODUCTION

Heart diseases are rising in Asian Indians 5–10 years earlier than in other populations around the world. The mean age for first presentation of acute myocardial infarction in Indians is 53 years. Coronary artery disease (CAD) that manifests at a younger age can have devastating consequences for an individual, the family, and society [2]. Projections show that CVD has reached epidemic proportions in many developing countries. In India, mortality attributable to CVD is expected to rise by 103% in men and by 90% in women from 1985 to 2015 [3].

Garlic (Allium sativum) is one of the most traditionally used plants as a spice and herb. Garlic has been using for a variety of reasons which most of them has been approved scientifically: anti atherosclerosis, anti microbal,

hypolipidemic, anti thrombosis, anti hypertension, anti diabetes and etc. [4]. Cholesterol is required for the structure of cell walls, must be available for the body to produce vitamin D, is essential for the production of digestive juices; insulates nerve fibres and is the basic building block for many hormones. Elevated cholesterol is associated with a greater-than normal risk of atherosclerosis, high BP, and excessive clotting. Any of these problems may lead to coronary heart disease. [5] The cardiovascular protective effects of garlic have also been evaluated extensively in recent years. In animal experiments, garlic extracts have been shown to lower plasma lipid and cholesterol in rats [6], [7], [8], [9], [10] rabbits [11], [12], chickens [13], [14] and swine [15]. Morover, a number of interventional studies have similarly shown that garlic and garlic preparations significantly reduced plasma lipids, especially total cholesterol and LDL cholesterol in humans [16-21]. It was estimated from five randomized clinical trials that hypercholesterolemic patients treated with garlic had a mean plasma cholesterol concentration that was 9% lower than that of patients treated with placebo [22]. Different formulations of garlic have been time tested and have shown varied results when undertaken. Garlic (Allium sativum) is one of the most traditionally used plants as a spice and herb [23]. Clinical studies show that AGE and S-allyl cysteine can help reduce the risk [24], [25], [26]. The LDL of patients taking AGE showed resistance to oxidation, compared to LDL from controls. [26]

Results from two meta-analysis conducted in 1993 and 1994 of garlic's effect on total cholesterol show a significant reduction in total cholesterol levels (9 to 12 percent) compared with placebo. A meta-analysis published in 2000 that included these trials concluded that garlic is superior to placebo in reducing total cholesterol levels, but that the extent of the effect is modest (4 to 6 percent). A European trial comparing garlic with a commercial lipid-lowering drug (benzafibrate) found them to be equally effective in decreasing lipids to a statistically significant extent [27].

Most of these pre-clinical, clinical studies and/or meta-analysis evaluated the effect of garlic against placebo or a fibric acid derivative. It was reported that the consumption of garlic extract as a dietary supplement improves blood lipid profile, strengthen the anti-oxidants capacity and also causes a decrease in blood levels of oxidants [28] . The present study aimed to investigate effect of Lasuna capsules (Himalaya's herbal product) against the widely marketed Atorvastatin (10 mg fixed dose) in clinically diagnosed hyperlipidemic and/or obese patients. The rationale for utilizing an already marketed formulation of garlic was to assure standardized preparation from a reputed Herbal company for counseling and convincing the patients to take the product for the total study duration.
H_2S is produced in substantial amounts by mammalian tissues and exerts many physiological effects suggesting its potential role as a regulatory mediator. Their cellular effects may or may not be mediated by second messengers, but should have specific cellular and molecular targets [29]. In the cardiovascular system, H_2S is produced in the myocardium, fibroblasts, and blood vessels from L-cysteine by the enzyme cystathionine-_-lyase (CSE). Most importantly, H_2S executes the physiological functions of vasorelaxation, cardioprotection and inhibition of vascular remodeling. It is also brought into context with a variety of cardiovascular diseases such as spontaneous hypertension, hypoxia-induced pulmonary hypertension, and high pulmonary blood flow-induced pulmonary hypertension. [30]. Most of the studies carried out till date have administered H_2S source from outside and the studies have been undertaken in animals or isolated tissues. There is hardly any finding of a reported study in which Garlic formulation has been used to measure in-vivo release of Hydrogen sulfide clinically from the collected plasma specimen. The present study was to evaluate the release of Hydrogen sulfide in-vivo in all three treatment groups. Thus, also investigating the fact that whether there is an enhanced release of gas in case of Atorvastatin therapy in patients.

MATERIALS AND METHODS

Study Sites for enrollment

The Sites/Centers were selected based on their patient flow, the availability of Doctors for discussion of study related aspects, the cooperation of Clinicians and thus, the patients for the disease under consideration. Complete Health Check Up Department (CHC), Dr. Jivraj Mehta Smarak Health Foundation, Ahmedabad was the main center for screening and enrolling patients for study. Written Permission to conduct the study was taken from the Director, Research & Development Department, Jivraj Mehta Hospital. Clinics of private practitioners, Out Patient Departments of M.D, Physicians were also included as Centers to accelerate the patient recruitment rate. The Doctors were approached and explained the study aims, objectives and procedures. The patients were screened as per the Inclusion Exclusion criteria by Clinicians and sent to Jivraj Mehta Hospital for further study procedures.

Independent Ethics Committee Approval
The Independent Ethics Committee approval was sought from Jagruti Independent Ethics Committee (JIEC), registered under U.S Department of Health and Human Services. The scientific aspects of the study were explained to the Committee members.

Permission/Approval was also obtained from Jivraj Mehta Hospital Executive Committee that sits annually to review and approve the Research Projects undertaken at Research & Development Department, Jivraj Mehta Hospital.

Patient enrollment & Study procedures
The completed Health Check up files in CHC department were scrutinized for higher than normal values of Total Cholesterol (more than 210 mg/dL) and/or Low Density Lipoprotein (LDL More than 130 mg/dL) along with age and other medical history. Those patients with age 18 or above and showing at least one of the lipid parameters (either Total Cholesterol or LDL) in higher than normal range were considered eligible for enrollment. Patients showing history or presence of any clinically significant Respiratory system disorders, Central nervous system disorders, Reproductive system disorders, Gastro intestinal disorders having problems in swallowing or digesting or any other major diseases were considered in exclusion criteria. The subjects were contacted in person when they came for collecting the CHC files and taking counseling from Health Check up Physician. The patients who were willing to participate in study were explained all the procedures to be performed, visits for follow ups, risks and discomforts during the study as well as all other criteria explained in informed consent form. The patients were enrolled once they thoroughly understood and were ready to sign the informed consent form. Since a higher dose of Atorvastatin may mask the efficacy of Lasuna capsules (if any), minimal fixed dose of Atorvastatin i.e., 10 mg was prescribed to patients.

The measurement of Hydrogen Sulfide was carried out using Double beam UV Spectrophotometer, Shimadzu Model, 1700 at FRIGE Center, Ahmedabad using the method demonstrated in a study published by Utpal Sen et al. Standard curve of Hydrogen sulfide was measured in nanogram range and its reproducibility was checked inter-day as well as intra-day. The chemicals required for processing and analysis were procured from Purvi Chemicals, Ahmedabad.

Study visit schedule
The study included total three visits including the baseline visit. The other two visits were conducted at an interval of six weeks i.e., the total study duration was of three months. The demography details, height, weight, BMI and WHR were measured in each visit along with blood pressure using the digital B.P instrument. The systolic and diastolic BP measurement was undertaken thrice and an average of the three reading was taken as documented reading. The details of subject's data and clinical parameters as well as medical and surgical history (if any) were recorded in a pre-designed proforma/Case Record Form approved by Independent Ethics Committee (Jagruti IEC).

Blood collection parameters
The blood samples were collected from subjects by the Hospital phlebotomist or by home visits of phlebotomist, stored and analyzed. The laboratory parameters were measured at baseline and later at follow-up visits to evaluate the clinical efficacy of investigational product. Total cholesterol, LDL, HDL, Triglycerides, VLDL, LDL/HDL ratio, and hs-CRP were measured at each of the three visits using the facility of in-house Laboratory at Jivraj Mehta Hospital. Homocysteine, one of the independent risk factors for cardiovascular diseases, was measured at baseline and later in the last visit, if and only if the baseline values were found out of normal range, on a higher side. As the test is very expensive, it was measured only twice, for cost saving. Similarly, hs-CRP being an inflammatory marker, its higher values may indicate the possibility of cardiac problems in long run. High sensitivity C reactive protein was measured at baseline visit and later in second and third follow-up visits, if found out of reference lab range.

Patient Compliance & Safety Reporting
The patient compliance was recorded using a Patient Medication form which was maintained by subjects and shown in each subsequent visit. The bottles of Lasuna capsules were submitted by subjects after they were empty. During each visit and by giving random phone calls to subjects between visits, any occurrence of adverse events, discomfort was noted in case record form.

RESULTS AND DISCUSSION

Table 1: Demography data & Characteristics of study groups

Demography Characteristics	Group 1 (N = 33)	Group 2 (N = 33)	Group 3 (N = 26)	Statistical Significance
Male	20 (60.61 %)	13 (39.39 %)	7 (26.92 %)	
Female	13 (39.39 %)	20 (60.61 %)	19 (73.08 %)	
Age	49.33 ± 10.11	51.48 ± 8.06	51.65 ± 7.71	NS
Body Weight	70.05 ± 13.99	64.03 ± 9.04	64.68 ± 9.92	NS
Body Mass Index	27.24 ± 3.88	24.37 ± 3.70	24.94 ± 3.88	0.0079
Waist Hip Ratio	0.94 ± 0.04	0.95 ± 0.03	0.94 ± 0.03	NS
Systolic BP	122 ± 7.2	117.13 ± 8.34	117.88 ± 9.07	NS
Diastolic BP	82 ± 6.92	77.80 ± 6.55	76.04 ± 9.43	NS

Where, Group 1 = Lasuna, Group 2 = Atorvastatin, Group 3 = Atorvastatin + Lasuna, NS – Not Significant

Total of sixteen subjects (twelve from Lasuna group, four from Statins group) did not complete the study because of personal reasons (n = 11) or due to adverse events (n = 5). Five of these subjects did contribute to statistical analysis as they provided the data till 1-mo assessment. Demography and other characteristics of study population are listed in Table 1. Mainly, no significant differences were observed between populations of the three study groups with respect to demographic characteristics. The male and female subjects in Lasuna group accounted for 20 and 13 respectively, reversely so in Atorvastatin group whereas the combined treatment group had 7 male and 19 female subjects. The average age in years of the subjects was 49.33 yrs, 51.48 yrs and 51.65 yrs which was statistically not significant. Also, the average body weight of the population was 70.05 kg, 64.03 kg and 64.68 kg respectively in lasuna, atorvastatin and lasuna with atorvastatin treatment groups. The Mean body mass index was 27.24, 24.37 and 24.94 while the Waist to Hip ratio was 0.94, 0.95 and 0.94 respectively for lasuna, atorvastatin and lasuna with atorvastatin treatment groups. The difference between means of three groups was found to be not significant (NS) for average body weight and WHR but found very significant (0.0079) for BMI. The systolic and diastolic blood pressure was also statistically insignificant and hence, the sample size is considered to belong to the same population.

The data was collected and analyzed using Graph pad Instat software, Version 3.10. The cut off for p value was 0.05 and the confidence interval was 95%.

The adverse events observed were mainly acidity. There were no any complaints of foul smell due to the lasuna capsules. Table 2,3 and 4 show One way Anova within group with post Tukey's test (if p value is <0.05) whereas Table 5 shows between group Anova for the parameters under consideration across three visits.

Table 2: One way ANOVA within group (Lasuna Group)

Parameters	Baseline (Visit 0)	6th Week (Visit 1)	12th Week (Visit 2)	Overall p value	Visit	Individual p value
Total Cholesterol	245.36 ± 38.45	236.70 ± 43.21	229.79 ± 35.07	NS	-	-
LDL	161.88 ± 35.42	157.85 ± 33.16	163.0 ± 36.63	NS	-	-
Triglycerides	190.13 ± 82.35	174.97 ± 80.15	176.75 ± 75.27	NS	-	-
HDL	48.86 ± 13.90	45.39 ±13.14	43.04 ± 10.30	NS	-	-
VLDL	36.97 ± 16.82	34.31 ± 15.46	35.08 ± 15.20	NS	-	-
LDL/HDL ratio	3.47 ± 0.82	3.67 ± 0.99	3.89 ± 0.88	NS	-	-
hs-CRP	3.08 ± 3.29	3.42 ± 2.50	5.44 ± 4.41	NS	-	-
Hydrogen sulfide	355.68 ± 445.46	375.54 ± 503.05	520.55 ± 518.10	0.0371	1,3	<0.05

Where NS – Non-significant, # Paired t test was applied to Homocysteine for comparison of means at baseline & 12th week visits. Where, Visit 1-Baseline, Visit 2-6th week, Visit 3-12th week

As shown in Table 2, the Anova with post test (Tukey test) was carried out for all the laboratory parameters. The comparison was done between baseline, 6th week values and 12th week values of lab parameters. As tabulated, the parameters included lipid profile (Total Cholesterol, LDL, Triglycerides, VLDL, HDL, LDL/HDL), high sensitivity-CRP and Hydrogen sulfide. The paired t test for homocysteine was used to compare means as the measurement of Homocysteine was carried out in laboratory at baseline and 12th week visit. There was no significant difference between means of all laboratory parameters except for hydrogen sulfide. The p value was <0.05 for hydrogen sulfide indicating that there is a significant difference between the means of three visits. This may indicate that the release of hydrogen sulfide in the body has increased after intake of garlic up to three months i.e., there is a substantial rise

in the hydrogen sulfide from baseline to 12th week post lasuna treatment. Another study carried out using a commercial garlic preparation, 500 or 1000 mg of dehydrated garlic powder/day found similar results as ours i.e., no significant differences were observed. Similar to our study, this double blind, placebo controlled, parallel treatment trial concluded that the garlic powder preparation used in this study among moderately hypercholesterolemic adults did not significantly affect plasma lipid levels. [31]. This study was also supported by finding from another study done by giving garlic supplement to see if it alters the plasma lipoproteins, post prandial lipemia, LDL size and HDL sub class distribution. Results of this study confirmed to our findings such that garlic treatment for three months resulted in no significant change in total cholesterol, LDL cholesterol, HDL cholesterol, post prandial triglycerides, apolipoprotein B, Lipoprotein A, LDL peak particle diameter etc. This investigation confirms that garlic therapy has no effect on major plasma lipoproteins [32]. These findings contradict the result from two meta-analyses conducted in 1993 and 1994 of garlic's effect on total cholesterol showing a significant reduction in total cholesterol levels (9 to 12 percent) compared with placebo. Another meta-analysis published in 2000 that included these trials concluded that garlic is superior to placebo in reducing total cholesterol levels, but that the extent of the effect is modest (4 to 6 percent).) [29]

Table 3: One way ANOVA within group (Statins Group)

Parameters	Baseline	6th Week	12th Week	Overall p value	Visit	Individual p value
Total Cholesterol	248.34 ± 13.66	201.35 ± 9.86	189.83 ± 11.25	<0.0001*	1,2	<0.001
					1,3	<0.001
					2,3	<0.001
LDL	156.01 ± 17.73	112.12 ± 11.09	108.29 ± 9.88	<0.0001*	1,2	<0.001
					1,3	<0.001
Triglycerides	158.35 ± 53.05	151.46 ± 51.90	149.50 ± 51.11	NS	-	-
HDL	49.98 ± 11.68	52.77 ± 11.40	49.23 ± 10.33	NS	-	-
VLDL	31.67 ± 10.61	30.70 ± 10.28	29.90 ± 10.22	NS	-	-
LDL/HDL ratio	3.28 ± 0.92	2.22 ± 0.56	2.28 ± 0.66	<0.0001*	1,2	<0.001
					1,3	<0.001
hs-CRP	5.34 ± 3.86	6.31 ± 3.05	6.15 ± 2.58	NS	-	-
Hydrogen sulfide	130.90 ± 98.02	98.14 ± 70.57	75.18 ± 36.38	0.0172	1,3	<0.05

*Where, Visit 1-Baseline, Visit 2-6th week, Visit 3-12th week, * = extremely significant,*

Table 3: One way ANOVA within group (Lasuna + Statins Group)

Parameters	Baseline	6th Week	12th Week	Overall p value	Visit	Individual p value
Total Cholesterol	263.86 ± 31.19	200.21 ± 27.65	191.25 ± 21.10	<0.0001*	1,2	<0.001
					1,3	<0.001
LDL	168.0 ± 27.26	104.90 ± 18.08	106.76 ± 17.21	<0.0001*	1,2	<0.001
					1,3	<0.001
Triglycerides	151.80 ± 40.63	134.44 ± 35.13	131.36 ± 32.26	NS	-	-
HDL	51.62 ± 11.76	54.17 ± 13.25	54.80 ± 14.07	NS	-	-
VLDL	30.33 ± 8.14	26.93 ± 6.97	26.27 ± 6.45	NS	-	-
LDL/HDL ratio	2.92 ± 1.30	1.83 ± 0.66	2.11 ± 0.78	0.0003*	1,2	<0.001
					1,3	<0.01
hs-CRP	5.84 ± 4.30	4.73 ± 2.38	4.53 ± 2.51	NS	-	-
Hydrogen sulfide	336.42 ± 298.65	354.18 ± 308.09	505.46 ± 454.0	NS	-	-

Where, Visit 1-Baseline, Visit 2-6th week, Visit 3-12th week

One way ANOVA statistics was used to find out difference between means of three visits for Atorvastatin group. Table 3 shows that p values for total cholesterol, LDL and LDL/HDL ratio are extremely significant (<0.0001) with the difference being significant (<0.001) between baseline and visit 2 as well as baseline and visit 3. Total cholesterol showed significant difference also between visit 2 (6th week) and 3 (12th week; i.e., <0.001). The hydrogen sulfide values were found significant (0.0172) between baseline and visit 3 (<0.05). Triglyceride, HDL, VLDL, hs-CRP and homocysteine; all other parameters showed no significant differences within group. Another Korean study of eight week treatment of Atorvastatin reported a significantly reduced high sensitivity CRP level [30] . Atorvastatin therapy has proven to be safe and effective in treating dyslipidemia [31]. Another review stated that Statins have been shown to decrease CRP, and studies are under way to evaluate if targeting patients with high sensitivity CRP and low low density lipoprotein cholesterol will have any impact on future cardiovascular events and survival and whether changes in CRP correlate to event reduction. [32]. Our study includes only those patients hs-CRP in 6th week and 12th week treatment who showed out of range hs-CRP baseline values. Thus the total

number of hs-CRP values in 6th week and 12th week visits respectively are on a lower side and hence the mean hs-CRP require further confirmation in a larger sample size. A Collaborative Atorvastatin Diabetes Study (CARDS) of atorvastatin 10 mg daily in the primary prevention of cardiovascular disease in type 2 diabetes support indicated that ApoB and Apob:ApoA-I ratio were only marginally better than LDLC:HDLC in predicting cardiovascular risk in type 2 diabetes.[33]

As was the case with Atorvastatin within group comparison using One way Anova, the combined treatment groups also showed similar significance for Total cholesterol, LDL and LDL/HDL values for baseline versus 6th week and baseline versus 12th week treatment respectively. Table 3 shows overall extremely significant p values along with individual p values for within group comparison. In another small study where Aged garlic extract (AGE) was given in addition to statins, incremental benefit over statin therapy was substantial [34]. However, the study had a limitation of being a small pilot study. Though there are few studies of garlic preparations with statin class of drugs, European trial comparing garlic with a commercial lipid-lowering drug (bezafibrate, a fibric acid derivative) found them to be equally effective in decreasing lipids to a statistically significant extent. [29]

Table 4: One way ANOVA between parameters of three groups

Parameters	L	S	SL	Overall p value	Visit	Individual p value
Total Cholesterol	√ 245.36 ± 38.45	-	√ 263.86 ± 31.19	0.0431	1	<0.05
	√ 236.70 ± 43.21	√ 201.35 ± 9.86	-	<0.0001*	2	<0.001
	√ 236.70 ± 43.21	-	√ 200.21 ± 27.65		2	<0.001
	√ 229.79 ± 35.07	√ 189.83 ± 11.25	-	<0.0001*	3	<0.001
	√ 229.79 ± 35.07	-	√ 191.25 ± 21.10		3	<0.001
LDL	√ 157.85 ± 33.16	√ 112.12 ± 11.09	-	<0.0001*	2	<0.001
	√ 157.85 ± 33.16	-	√ 104.90 ± 18.08		2	<0.001
	√ 163.0 ± 36.63	√ 108.29 ± 9.88	-	<0.0001*	3	<0.001
	√ 163.0 ± 36.63	-	√ 106.76 ± 17.21		3	<0.001
Triglycerides	-	-	-	0.0404	1	-
	√ 174.97 ± 80.15	-	√ 134.44 ± 35.13	0.0382	2	<0.05
	√ 176.75 ± 75.27	-	√ 131.36 ± 32.26	0.0172	3	<0.05
HDL	√ 45.39 ±13.14	-	√ 54.17 ± 13.25	0.0155	2	<0.05
	√ 45.39 ±13.14	-	√ 54.80 ± 14.07	0.003**	3	<0.01
VLDL	√ 34.31 ± 15.46	-	√ 26.93 ± 6.97	**0.0614 - NS**	2	<0.05
	√ 35.08 ± 15.20	-	√ 26.27 ± 6.45	0.0226	3	<0.05
LDL/HDL ratio	√ 3.67 ± 0.99	√ 2.22 ± 0.56	-	<0.0001*	2	<0.001
	√ 3.67 ± 0.99	-	√ 1.83 ± 0.66		2	<0.001
	√ 3.89 ± 0.88	√ 2.28 ± 0.66	-	<0.0001*	3	<0.001
	√ 3.89 ± 0.88	-	√ 2.11 ± 0.78		3	<0.001
hs-CRP	√ 3.08 ± 3.29	-	√ 4.53 ± 2.51	0.0165	1	<0.05
	√ 3.42 ± 2.50	√ 6.31 ± 3.05	-	0.0275	2	<0.05
WHR	-	-	-	0.0438	3	-
BMI	√ 27.24 ± 3.88	√ 24.37 ± 3.70	-	0.0079**	1	<0.01

	√ 26.84 ± 3.92	√ 23.56 ± 5.75	-	0.0181	2	<0.05
	√ 27.26 ± 3.84	√ 22.58 ± 5.87	-	0.0096**	3	<0.01
Hydrogen sulfide	-	√ 130.90 ± 98.02	√ 336.42 ± 298.65	0.0057**	1	<0.01
	√ 375.54 ± 503.05	√ 98.14 ± 70.57 √ 98.14 ± 70.57	- √ 354.18 ± 308.09	0.0003*	2 2	<0.05 <0.001
	√ 520.55 ± 518.10 -	√ 75.18 ± 36.38 √ 75.18 ± 36.38	- √ 505.46 ± 454.0	<0.0001*	3 3	<0.01 <0.001

** Extremely Significant, ** Very Significant, L- Lasuna Treatment Group, S – Statins Treatment Group, SL – Statins+Lasuna Treatment Group*

Table 4 shows One way Anova between groups with different lab parameters compared for all the three groups for each of the three Visits. Table 4 indicates the overall p value for each parameters as well individual visit wise difference between groups (Tukey's test). All of the parameters show a significant difference between group's esp. for 6th week and 12th week visits. This indicates that there is a significant difference between the parameters post-treatments in each of the three groups.

CONCLUSION

Lasuna capsules, used as a formulation in patients with mild to moderate hyperlipidemia and/or obesity was unable to affect the lipid parameters, inflammatory marker (hs-CRP) or the independent risk factor (Homocysteine) to a statistically significant level, except for hydrogen sulfide which was enhanced significantly at the end of 12th week of lasuna treatment. As hydrogen sulfide recently has emerged as a promising gastro transmitter with multiple mechanisms for a diseased heart, further studies into investigation of its role clinically in cardiovascular disorders is indispensable. This study has shown a substantial release of hydrogen sulfide after three months of lasuna treatment at a predefined dose. However, in combination with Atorvatstatin (10 mg) therapy, lasuna capsules could act as a supportive therapy in showing statistically significant reductions in lipid profile, hs-CRP, the inflammatory marker and an elevation in hydrogen sulfide, the much talked about third gaseous transmitter against the Allopath treatment alone. This could also be helpful in retarding the statin doses and thus prevent the unwanted adverse reactions occurrence at a lower dose regimen. However, the study was carried out only for 12 weeks. Another study with a longer duration of treatment could be evaluated to compare the long term sustenance of combined therapy compared to only HMG-CoA reducatase inhibitiors class of drugs.

The safety of Himalaya's Lasuna formulation is evident as no patients of those who enrolled and completed the study reported intolerable, severe side effects during the treatment. Mainly, Acidity in few cases and one ulceration case was reported. Ulcers were a rare occurrence (observed in 1 patient of Lasuna group) and thus whether result of any side effect or deficiency needs to be reported further with treatment in population.

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