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Research Article

A Comparative Study of 7 Ayurveda Interventions to Control Dyslipidemia Using Meta Data

Santosh Bhatted[1], Mahesh Vyas[2], Shiv Kumar Harti[3], Tanuja M Nesari[4], Anil Kumar[5*]

[1]Associate Professor, Department of PanchKarm, All India Institute of Ayurveda, Ministry of AYUSH, Sarita Vihar, New Delhi, India

[2]Professor, Department of Samhita & Siddhant, All India Institute of Ayurveda, Ministry of AYUSH, Sarita Vihar, New Delhi, India

[3]Associate Professor, Department of Swasth Vrita, All India Institute of Ayurveda, Ministry of AYUSH, Sarita Vihar, New Delhi, India

[4]Professor, Department of Dravyagun, All India Institute of Ayurveda, Ministry of AYUSH, Sarita Vihar, New Delhi, India

[5]Research Advisor, Translational Research & Biostatistics, All India Institute of Ayurveda, Ministry of AYUSH, Sarita Vihar, New Delhi, India

[*]**Corresponding author:** Anil Kumar, Research Advisor, Translational Research & Biostatistics, All India Institute of Ayurveda, Ministry of AYUSH, Sarita Vihar, New Delhi-110076, India

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Abstract

Dyslipidemia (medoroga) is characterized by disorder of lipoprotein metabolism due to abnormal production. The alteration in lipid parameters could largely be the result of life style changes like diet including its kala (Timing), quantitity, Frequency and its various combinations alongwith physical exercise and factors resulting in mental stress and factors related to digestive system. As a result, dyslipidemia could be responsible for several morbid conditions like obesity, hypertension, diabetes, cardiovascular disorders and metabolic syndrome etc. It is believed that abnormal levels of dyslipidemia may be the primary cause for atheroscieroic diseases especially coronary heart diseases among others.

Present paper is an attempt in continuation to define dyslipidemia and to measure the impact of various ayurvedic interventions on Total Cholesterol(Tch), Triglyceride (TGL), HDL, LDL and dyslipdemia as a single index defined jointly as Tch>200+Tch to HDL ratio>4.5.

The assessment of the impact suggests that Musta churna is highly effective in reducing dyslipidemia by 94.7% followed by Vaman with madanphal (77.8%), Triphala decoction (75%), Yavadi roti with Yog (44.4%), Basti with

Basti with Triphala decoction (41.7%) and Shaman with hardradwaya churna (14.3%). However, Pathya-apathya has shown no effect but somewhat negative effect on dyslipidemia.

Keywords: Agreement; Ayurveda interventions; Dyslipidemia; High density lipoprotein (HDL); Low density lipoprotein (LDL); Total Cholesterol(Tch); Total Cholesterol to HDL Ratio; Triglyceride (TGL)

Introduction

Dyslipidemia is characterized by a disorder of lipoprotein metabolism as a result of abnormal production of lipoprotein. This condition refers to alteration in plasma cholesterol mainly high

density lipoprotein (HDL), low density lipoprotein (LDL) and triglyceride (TGL)[1]. The alteration in lipid parameters could largely be the result of life style changes like diet, physical exercise and factors resulting in mental stress. As a result, dyslipidemia could be responsible for several morbid conditions like obesity, hypertension, diabetes, cardiovascular disorders and metabolic syndrome etc. It is believed that abnormal levels of dyslipidemia may be the primary cause for atheroscieroic diseases especially coronary heart diseases.

In India about 25-30% of urban and 15-20% rural population is currently suffering from dyslipidemia [2]. Although health problems associated with dyslipidemia are significant but even now this is ill-defined and therefore, emphasized the need to clearly define it. Such an attempt is recently made [3].

Dyslipidemia is defined as positive when one or more variable levels are elevated like Total Cholesterol level above 200 mg/dl, or Triglyceride ≥150 mg/dl or High density lipoprotein(HDL) <40 mg/dl or low density lipoprotein (LDL)≥140 mg/dl. The new dyslipidemia index [3] is based on composite values of Total Cholesterol level above 200 mg/dl and its ratio with HDL>4.5.

Although modern medicines like Atorvastatin have been a successful remedy but its long term use may results in side effects. On the other hands, Ayurveda believes that dyslipidemia is mainly due to *kapha Dosha* and *medo-dhatu* and deal with it in varieties of ways like langhan, Vaman, Virechan, Basti & Shaman and so on. However, various strategies [4] have variable effects on lipid parameters. It is therefore interesting to compare multiple intervention in view to examine which intervention has the best effect. Present attempt is made to answer this question.

Material and Methods

Source of data and Methodology

Present study is an outcome of the merger of data from 4 PG thesis done during 2020/2021, all were registered under CTRI. In these 4 studies, 7 types of ayurvedic intervention were given like Vaman with madanphal (15), Shaman with Haridra-Dwaya Churna (15), Triphala Decoction(14), Basti with Triphala decoction(15), Yavadi Roti with Yoga (17), Pathya-Apathya(13) and Musta Churna (30). Days of intervention is mentioned as 47 days to 60 days (Table 1). All the patients data is unpublished except in their thesis work[5-8].

GROUP	Intervention	N	Treatment Duration in Days	Mean Age (SD)	Percent Male	Percent on Veg Diet	Percent with Kurur Kostha	Percent with Samagni
1	Vaman with Madanphal	15	47	32.1 (6.6)	40.0	20.0	33.3	26.7
2	Shaman with Haridra-Dwaya Churna	15	47	45.3 (9.8)	60.0	40.0	26.7	40.0
3	Triphala Decoction	14	60	49.7 (7.3)	64.3	64.3	57.1	28.6
4	Basti with Triphala decoction	15	60	45.93 (6.6)	66.7	66.3	40.0	20.0
5	Yavadi Roti +Yoga	17	60	34.8 (8.7)	47.1	n/a	n/a	n/a
6	Pathya-Apathya	13	60	32.4 (6.9)	30.8	n/a	n/a	n/a
7	Musta Churna	30	60	32.3 (7.1)	80.0	10.0	3.3	3.3
		119		38.0 (10.2)	58.8	34.8	27.0	20.2

Table 1: Baseline Characteristics of Subjects included in the respective Treatment arms.

Data on demographic variables was collected using questionnaire, lipid profile (Total Cholesterol, Serum Triglyceride, HDL, LDL and VLDL) data comes from NABL approved laboratory.

Data Analysis: All the above data on lipid parameters was analyzed using pair t-test (pre -post) to see the related change, between group comparison was done using ANOVA and posthoc analysis using Tukey HSD. Related proportion were compared using McNemar Test. SPSS v.26 is used for data analysis.

Results

Baseline Characteristics of study subjects

The study includes 119 subjects from 7 ayurvedic interventions. The mean(SD) age of the subjects vary from 32.3(7.1) to 49.7(7.3). The duration of treatment is generally 60 days except 47 days in one study. The percent of male subjects vary from 30.8% to 80%. The consumption of veg diet only vary from 10% to 66.3%. The bowel symptoms are seen in 3.3% in the study with intervention of Musta to 57.1% wherein triphala decoction was given. The lowest percent subject reported samagni (normal hunger) as 3.3% and highest 40% in the group given Shaman with Haridra-Dwaya Churna as the intervention (Table 1).

Impact of Ayurvedic intervention on lipid parameters

The data analyzed is presented in Table 2 that shows the percent change in dyslipidemia based on mean levels of Total cholesterol (Tch>200 dl/mg), Serum Triglyceride (TGL>140), HDL<40, LDL ≥140 and VLDL . The impact of intervention namely Musta churna for 60 days has shown maximum effect 30.0% in Tch from its base level, TGL declined by 47.7%, HDL increased by 24.2% and LDL declined by 28% and this together resulted in 94.7% in index of dyslipidemia. This results is followed by the intervention namely Vaman with Madanphal showing decline of 16.8% in Tch, 14.2% in TGL,16.1% in LDL, 6.8% in VLDL beside 5.2% increase in HDL and 77.8% decline in dyslipidemia followed by. Triphala decoction at 3rd place with decline in dyslipidemia index 75% with decline of 16.3% in Tch, 21.9% in TGL, 21% in LDL, 20.3% in VLDL beside increase of 9.8%, followed by YavadiRoti with Yoga (44.4%), Bastikarma with triphala decoction (41.7%) and Shaman with Haridra Dwaya churna(14.3%). However, Pathya-Apathya has shown negative (increase of 33.3%) impact of dyslipidemia. In general, the intervention by Musta churna has shown significant improvement in all 4 (4 out of 4) parameters, Triphala decoction (4/5), Bastikarm with triphala decoction (3/5), Vaman witth madanaphala (2/5), Shaman with Haridra dwaya churna(2/5), Yavadi roti & Yoga (1/4) and none by Pathya-Apathya.

group	Inter-vention	Percent Change in mean levels of 5 parameters						Good Effect in	Persons with Dyslipidemia Index+ve		
		N	Tch	TGL	HDL	LDL	VLDL		BT	AT	Decline In %
1	Vaman with Madanphal	15	-16.8[c]	-14.2	+5.2	-16.1[c]	-6.8	2/5	9	2	77.8
2	Shaman with Haridra Dwaya Churna	15	-5.4	-21.9[b]	+9.5	-1.8	-21.4[a]	2/5	7	6	14.3
3	Triphala Decoction	14	-16.3[b]	-21.9[b]	+9.8	-21.0[b]	-20.3[b]	4/5	12	3	75.0
4	Basti with Triphala decoction	15	-8.2[b]	-16.6	+13.4[b]	-10.4[b]	-12.3	3/5	12	7	41.7
5	Yavadi Roti +Yoga	17	-15.0[b]	-11.7	+5.2	-16.5	n/a	1/4	9	5	44.4
6	Pathya-Apathya	13	-8.2	+14.8	-6.7	-16.6	n/a	-ve	3	4	+33.3
7	Musta Churna	30	-30.0[c]	-47.7[C]	+24.2[C]	-28.0[C]	n/a	4/4	19	1	94.7
	Total	119							71	28	60.6

Pair t-test [a]p<0.05; [b]p<0.01; [c]p<0.001; Serum Cholesterol(Tch); Serum Triglyceride(TGL); HDL-High density lipoprotein; LDL-Low density lipoprotein.

Table 2: Comparison (BT vs. AT) of Treatment Effect – parameters of dyslipidemia.

The observed change in percent of dyslipidemia based direct measures by definition of its cut-offs is presented in Table 3. The statistically significant decline/increase is found in Tch (66.7% to 20.0%, $p<0.05$), Total Cholesterol to HDL ratio-TCHDR (80% to 26.7%,$p<0.01$) with Dyslipidemia Index (60% to 13.3%, $p<0.001$) by Vaman with madanaphala. The change due to Yavadi roti & Yoga could bring in significant change in TCHDR (70.6% to 29.44%, $p<0.05$). The effect of intervention with Triphala decoction has induced a decline in total cholesterol(Tch) from 85.7% to 42.9%($p<0.05$), LDL (71.4% to 14.2%, $p<0.01$), TCHDR (92.9% to 42.9%, $p<0.05$) and Dyslipidemia index from 85.7% to 21.4%,($p<0.01$). However, Bastikarma with Triphala decoction could significantly affect only TGL from 86.7% to 46.7%, ($p<0.05$). The intervention by Musta churna has shown significant positive impact on all parameters like Tch (66.7% to 13.3%, $p<0.001$), TGL (80% to 36.7%, $p<0.001$), HDL(53.3% to 13.3%, $p<0.05$), LDL (23.3% to 3.3%,$p<0.05$), TCHDR (86.7% to 13.3%, $p<0.001$) with dyslipidemia index (63.3% to 3.3%,$p<0.001$).

Group of Intervention	Change in percent dyslipidemia											
	Tch		TGL		HDL		LDL		TCHDR		Dyslipidemia Index	
	BT	AT	BT	AT	BT	AT	BT	AT	BT	AT	BT	AT
Vaman with Madanphal	66.7[a]	20.0	66.7	53.3	26.7	26.7	20.0	6.7	80.0[b]	20.0	60.0[c]	13.3
Shaman: Haridra Dwaya Churna	60.0	46.7	86.7	73.3	40.0	20.0	26.7	13.3	60.0	53.3	46.7	40.0
Yavadi Roti +Yoga	52.9	29.4	58.8	52.9	47.1	23.5	23.5	5.9	70.6	29.4	52.9	29.4
Pathya-Apathya	38.5	38.5	38.5	53.8	53.8	23.1	23.1	0	46.2	38.5	23.1	30.8
Triphala Decoction	85.7[a]	35.7	85.7	50.0	28.6	35.7	71.4[b]	14.2	92.9[a]	42.9	85.7[b]	21.4
Basti with Triphala decoction	86.7	66.7	86.7[a]	46.7	40.0	20.0	71.4	50.0	93.3	66.7	80.0	46.7
Musta Churna	66.7[c]	13.3	80.0[c]	36.7	53.3[b]	13.3	23.3[a]	3.3	86.7[c]	13.3	63.3[c]	3.3
McNemar Non-parametric test($\chi 2$), [a]$p<0.05$, [b]$p<0.01$, [c]$p<0.001$, TCHDR-Tch to HDL Ratio												

Table 3: Comparison (BT Vs. AT) of Treatment Effect – parameters of dyslipidemia.

It is observed that dyslipidemia index is declined highest due to the intervention by Musta churna (64.8%), followed by Vaman with madanphal (77.8%), Triphla decoction (75.0%), Yavadi roti with Yoga (44.4%), Basti with Triphala decoction (41.6%), Shaman with Haridra dwaya churna (14.3%) whereas Pathya-Apathya has only resulted in negative results, (an increase of 33.3%).

Comparison of 7 interventions to search the best

The variability in the effect (BT-AT) of all lipid parameters that determines dyslipidemia reveals significant when analyzed using ANOVA (DF=6, F-test) i.e., for Total Cholesterol ($p<0.001$), Triglyceride ($p=0.001$), HDL ($p=0.011$), TCHDR ($p<0.001$) except LDL ($p=0.055$) and VLDL ($p=0.32$) suggesting not much variation in the LDL and VLDL between the 7 intervention under considerations.

The data was further analyzed using AANOVA with post-hoc comparison using Tukey HSD and presented in Table 3. The results shown are mean of difference (BT-AT) vs. treatment interventions and its 95% confidence interval. This analysis reveals that the effect of musta churna on Total cholesterol was significantly higher in comparison to shaman with Hridra dwaya churn (57.9,95%CI:17.6,98.1), Pathya-Apathya (52.9,95%CI:10.6,95.1) and Basti with Triphala decoction (49.7, 95%CI:9.5,89.9). The effect of Musta churna on Triglyceride has been highest in comparison to Pathya-Apathya (145.1,95%CI:43.1,247.2), followed by Yavadi roti & Yoga (99.5,95%CI:6.2,192.8), vaman with madanphal (97.6,95%CI:0.4,194.7). The significant difference effect was on HDL (12.4,95%CI:2.8,22.1) between Musta churna and Pathya-Apathya whereas significant effect on LDL (31.2, 95%CI:1.8,60.6) but effect of Musta churna on TCHDR (Total Cholesterol to HDL ratio) has been significantly highest in comparison to Pathya-Apathya (2.5.95%CI:1.1,3.9), followed by shaman with Haridra dwaya churn (2.0,95%CI:0.7,3.3), vaman with madanaphala (1.7, 95%CI:0.4,3.0), Yavadi roti & Yoga and Basti with Triphala

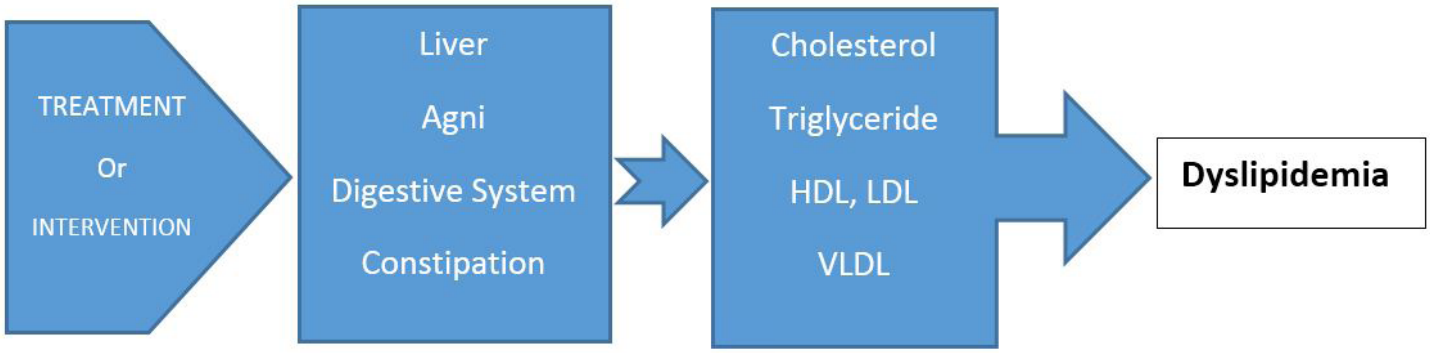
decoction (1.6,95%CI:0.3,2.9) and also with Basti with Triphala decoction (1.4,95%CI:0.03,2.7). In no other comparison, significant difference is observed (Table **4).**

G VS	Mean difference , 95% Confidence Interval					
	TCh	TGL	HDL	LDL	TCHDR	LDHDR
G vs A	33.5(-6.7,73.8)	97.6(0.4,194.7)[a]	6.9,(-2.2,16.1)	14.2,(-15.3,43.6)	1.7,(0.4,3.0)[b]	0.7,(-0.2,1.7)
G vs B	57.9(17.6,98.1)[c]	70.4(-26.7,167.9)	5.5,(-3.7,14.7)	31.2,(1.8,60.6)[a]	2.0,(0.7,3.3)[c]	1.0,(0.1,1.9)[a]
G vs C	37.5(-1.1,76.1)	99.5(6.2,192.8)[a]	7.2,(-1.6,16.0)	14.2,(-14.0,42.5)	1.6,(0.3,2.9)[b]	0.6,(-0.3,1.6)
G vs D	52.9(10.6,95.1)[b]	145.1(43.1,247.2)[c]	12.4,(2.8,22.1)[b]	14.8,(-16.1,45.7)	2.5,(1.1,3.9)[c]	0.9,(-0.1,1.9)
G vs E	30.1(-11.1,71.3)	78.0(-21.5,177.5)	5.3,(-4.1,14.7)	0.7,(-29.4,30.8)	1.4,(0.03,2.7)[a]	0.3,(-0.7,1.2)
G vs F	49.7(9.5,89.9)[b]	88.5(-8.7,185.6)	4.0,(-5.2,13.1)	17.2,(-12.2,46.6)	1.6,(0.3,2.9)[b]	0.5,(-0.4,1.5)

A(Vaman with Madanphal), B(Shaman withHaridra-Dwaya Churna), C(Yavadi Roti+Yoga), D(Pathya-Apathya), E(Triphala Decoction), F(Basti with Triphala decoction), G(Musta). Repeated ANOVA (posthoc comparison by Tukey HSD) [a]p<0.05, [b]p<0.01, [c]p<0.001.

Table 4: Comparison of differential effect between groups (Interventions) using Repeated ANOVA and Posthoc-Tukey HSD.

Mode of action of intervention



According to Ayurveda, body is a conglomeration of Dosha (mostly Functional entities) such as Vata, Pitta, Kapha, Dhatu (mostly Structural components like tissues) such as Rasa, Rakta, Mamsa, Meda, Asthi, Majja and Shukra, and Mala (Waste products of Digestion and Metabolism) such as Purisha, Mutra, Sveda. The state of homeostasis among all the constituents of the body are maintained by the appropriate functioning of Agni (Factors responsible for proper digestion and metabolism) and Srotas (Channels of all sorts of transportation). The interrelation between various components is an established factor such as close interrelation between Vata and Asthi, Pitta and Rakta, Kapha and Meda specifically and Rasa, Mamsa, Majja and Shukra in general. This interrelationship is used for treating the diseases of any Dhatu. Lipid refers to Meda in Ayurveda any kind of derangement or abnormalities in the Lipids can be considered as Medo Dushti (Abnormal Meda) or Medo Roga. The important factors involved in the Medoroga are increased Kapha Dosha, poor functioning of Agni (Weak Metabolism particularly liver metabolism) and abnormal movement of Vata Dosha. On the basis of similarities and close association between Meda and Kapha, diseases of Meda are treated by correcting the Kapha; The best treatment for Kapha is VamanaKarma (Therapeutic emesis), Though the Vamana Karma is best for Kapha Dosha it also have its effect on Pitta Dosha indirectly having its effect on Agni (Liver metabolism) because of close association between Pitta and Agni. Basti is the best Treatment for the regulation of movement of Vata Dosha- one of the major culprits in the pathogenesis of Medoroga. Abnormal movement of Vata also leads to malfunctioning of Agni on the other hand regulated movement and functions of Vata also regulates the functions of Agni in turn corrects the metabolism in general and Liver functions in particular. Further the specific selection of drugs like use of Krishna Tila Taila for Snehapana (internal oleation) during vamana Karma and use of Triphala decoction with other conventional drugs in the form of basti karma are known for hypolipidemic action provided much better effect in various components of Medoroga (Dyslipidaemia).

Haridra Dvaya Churna prepared from the the equal quantity of Haridra (Curcuma Longa and daruharidra (Berberis aristata) are known for its Medohara (Lipid lowering action). The various experimental researches proved their hypolipidaemic action.

As per the chikitsa sutra for Stoulya, the prescribed diet therapy should be of Guru Guna and should be Apatarpanajanya. Due to *Guru Guna* (heavy quality) digestion time is prolonged and it normalises the vitiated *Vata Dosha*. *Apatarpana* quality helps in reducing *Medadhatu* in the body. Foods dominant in Katu, Tikta and Kashaya Rasa, Ruksha Guna also help in reducing the *Kapha Dosha* thereby reducing Meda.

The Yavadi Rotika prepared from Yava, Amalakki, Maricha, Hingu, Haridra, Dhanyaka and Jeeraka. Yava is of Ruksha, Laghu Guna, which helps in reducing Kapha and Meda. *Amlakki* is *Sheeta Veerya*, and helps in suppressing the *Teekshna Agni.* It also acts on vitiated *Pachak- Pitta*[9]. Flavonoids (mainly Gallic acid) found in *Amla* having hypolipidemic activities. *Maricha* added in Yavadi Rotika is *Ruksha*, *Katu*, *Ushna*, *Laghu.* It is also mentioned in *Deepaniya Mahakasahya* and also possess *Pramathi* and C*heddan Guna*[10].These properties of the *Marich* helps in relieving the obstruction in the channels and increase the *Dhatuagni. Hingu* is *Ushna*, *Katu, Laghu, Pachacka* and reduces the aggravated *Vata* and *Kapha Dosha.* These properties help to break the*Samprapti* of the disease and decrease the symptoms[11]. *Haridra* is mentioned as *Lekhaniya Mahakasahya* and having *Tridoshaghana* property. It helps in reducing the excess of *Medodhatu* and balance the *Tridosha*[12]. *Dhanyaka* and *Jeeraka* both are having *Rochan, deepana, Vata – Kaphahara* and *Dourgandya Nashaka* Properties[13]. Similarly*, Musta* is *aam-pachak* and thus reduces creation of *dyslipidemia(medorog)*.

Discussion and Conclusion

Dyslipidemia being a result of disorder of lipoprotein could be responsible for causing several clinical conditions like hypertension, Diabetes, Cardiovascular disorders among others. Therefore, dyslipidemia is an important parameter and requires effective and sustainable treatment. Present Study suggest clearly that 6 out of 7 interventions had shown positive impact on atleast one parameter of lipid profile and thus on Dyslipidemia index. This also means that not all interventions are effective to change all the components of dyslipidemia, therefore each intervention must have a target to affect to get the maximum benefit in view of the existing situation of the patients. For example; Musta churna has the highest effect and on all parameters but Vaman with Madanphal, Triphala decoction could also be a choice to exercise to control dyslipidemia. Thus, it can be concluded that Musta churna could be an intervention of choice to control dyslipidemia. However, the sustainability of the effect needs to be studied as long term observations are not available and also its impact of resultant diseases. This gives opportunities for future research and to assess its impact.

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References

1. Chowdhary A, Vyas M, Bhojani MK, Pathak P. (2021) Practical application of langhana therapy in the management of dyslipidemia: A Case report. J Ayurveda Case Report 4:111-114.
2. Available on http://www.nhp.gov.in/dyslipidemia_mtl accessed on 21 Jan 2022.
3. Singh S, Bahute P, Chowdhary A, Rai A, Verma P,Nesari TM, Kumar A (2022) Defining dyslipidemia afresh, what measures it best? Communicated to National Med J India.
4. Pooja BA, Bhatted SK (2016) A standard controlled clinical study on *Virechana Karma* and *Lekhana Basti* in the management of dyslipidemia (*Medoroga*). AYU 37:32-37.
5. Bahute PD (2021) To evaluate the efficacy of Haridradwaya churna with/without Vaman karma in the management of Sthaulya w.s.r. to Dyslipidemia- A Randomzed Comparative Clinical Study. MD thesis done at All India Institute of Ayurveda, New Delhi, (CTRI/2020/03/023742).
6. Verma P (2020) A comparative Clinical Study to evaluate the efficacy of Triphalakwath with madhu administration orally and as kala basti in the management of medoroga (Dyslipidemia). MD thesis done at All India Institute of Ayurveda,New Delhi, (CTRI/2019/06/019560).
7. Rai A (2021) Effect of medoroga yavadi rotika and Yogic practices in the management of sthualya (Obesity). MD thesis done at All India Institute of Ayurveda,New Delhi, (CTRI/2020/06/025736)
8. Chaudhary A (2021) A study of dashavidha langhana to assess the role of Paachanamodality to cause autophagy in patients of medodusthi (Dyslipidemia). MD thesis done at All India Institute of Ayurveda,New Delhi, (CTRI/2020/04/024513).
9. Grover HS, Deswal H, Singh Y, Bhardwaj A (2015) Therapeutic effects of amla in medicine and dentistry: A review. J Oral Res Rev 7:65-68.
10. Duggal V, Sharma O, Garg N (2021) Significance of Pharmacokinetics and Pharmacodynamics of Piper Nigrum L. [MARICH]-Review. World J Pharmac and Medical Res 7:60-65.
11. Mishra Bhava, Bhava Prakash Nighantu, Haritkyadivarga; 101 .Commentary by Prof. K C Chunekar ed. Dr. G.S Pandey Chaukhambha Bharati Varanasi,2018 (Ed) p. 39.
12. Chakraborty S, Das A (2020) A Classical Ayurveda Review on Haridra. Intern J Res in AYUSH and Allied Systems AYUSHDHARA 7:147.
13. Mishra Bhava, Bhava Prakash Nighantu, Haritkyadivarga. Commentary by Prof. K C Chunekar edited Dr. G.S Pandey Chaukhambha Bharati Academy Varanasi,2018 (Ed) p. 33.