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ORIGINAL RESEARCH ARTICLE

COMPARATIVE STUDY OF GOGHRITA AND ARJUN-GHRITA ON BIOLOGICAL PARAMETERS IN HEALTHY HUMAN VOLUNTEERS

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ABSTRACT

Introduction: *Ayurveda* classified the *vaya* (age) into three *avastha* (stages) - *Baalyavastha*, *Madhyamavastha* and *Vaardhakyavastha*. In *Vardhakyavastha*, predominance of *Vata* causes *Shoshana* and *Kshaya* of different *Dhatu*. In modern medicine, Dyslipidemia and Cardiovascular disease (CVD) are specifically described in relation to aging. Heart is one of the vital organs which is found to be commonly affected in old age. In India, there has been an alarming increase in the prevalence of CVD over the past two decades. According to *Ayurveda*, origins of diseases are classified into *Santarpana* and *Apatarpanajanya vikar.* In *Charak Samhita*, *Hridayavyatha* is described under *Aptarpanjanyavikar*. In *vruddhavastha,* degenerative changes are prominent*, Bruhan* chikitsa is recommended. *Goghrita* is known as best *Bruhan, Rasayan* and *Vayasthapan. Arjun ghrita* is mentioned in *Ayurveda* classics for all types of Hridroga. But in modern medicine, due to increased prevalence of CVD, it is suggested to avoid consumption of *ghee*. These things are found to be paradoxical. **Aim & Objective**: This study is aimed to explore the Efficacy of *Go-ghrita* and *Arjun-Ghrita* on biological parameters in healthy human volunteers. **Methodology:** This was a Randomized clinical study. Total 15 volunteers were selected by Cluster Random Sampling method. They were categorized as high, medium and low socioeconomic group. *Go-ghrita* and Arjun-*ghrita* was given in the dose of 10 ml once a day in the morning on empty stomach with lukewarm water for continuous 60 days. **Results**: No significant change was found in biological parameters because Ghee is a good source of short chain saturated fatty acids which are easier to digest. **Conclusion**: The consumption of *Go* and *Arjun-ghrita* is good for health in the quantity of 10 gm daily in healthy people. It might be helpful for improvement in cardiac function. Further study can be conducted in large number of healthy volunteers for longer duration for confirmation of result.

Keywords:-*Santarpana, Aptarpana, Hridayavyatha*, *Go-ghrita*, *Arjun-ghrita*, *Brumhana.*

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INTRODUCTION

Ayurveda classified the *vaya* (age) into three *avastha* (stages) - *Baalyavastha*, *Madhyamavastha* and *Vaardhakyavastha* in which there is predominance of *Kapha*, *Pitta* and *Vata Dosha* respectively.[1-4] In *Vardhakyavastha*, predominance of *Vata* causes *Shoshana* and *Kshaya* of different *Dhatu* because of its *ruksha*, *laghu* and *khara* properties.[5,6]Hence the process of ageing is related to predominance of *Vata.*

According to modern medicine, aging is a normal process caused due to progressive alteration of the body's homeostatic adaptive responses. It is a general response that produces observable changes in structure and function of body. [7, 8]

In present situation, improper dietary habits, life style, excessive stress and lack of exercise may have an effect on the process of ageing. There are specific diseases related to aging in that Dyslipidemia and Cardiovascular disease (CVD) are prominent. Dyslipidemia is closely linked to the patho-physiology of CVD and is a key independent modifiable risk factor. [9, 10]

CVD is the leading cause of death worldwide, and the mortality is higher in low and middle-income countries. [11, 12] In India, there has been an alarming increase in the prevalence of CVD over the past two decades. It accounts for 24% of all deaths among adults aged 25–69 years. [13]

According to *Ayurveda*, origin of diseases and treatment principle are based on *Santarpana* or *Apatarpana* only. [14]In the context of treatment, it is clearly mentioned that *Apatarpanothha vyadhi* should be treated by means of *Santarpana chikitsa* and vice versa.[15]

In old age, there are degenerative changes in all organs. These changes can be considered under *Apatarpanjanya vikar*. In *Charak Samhita*, *Hridayavyatha* is described as one of the types of *Aptarpanjanya vikar*.[16].The treatment principle for *Aptarpanjanyavikar* is *Bruhanchikitsa*. *Bruhan* therapy can be given in old age to prevent geriatric diseases or to delay aging. Many *Bruhan dravya* are described in *Charak Samhita* in which *ghrita* is known as *'Sreshthabruhan'*, *Rasayan* and *Vayasthapan.* [17-19]

Heart is one of the vital organs. It is found to be commonly affected in old age. In *Ayurveda*, *Arjuna* (*TerminaliaArjuna*) is described as *'Hridya'*.[20]*Arjun ghrita* is also mentioned in *Ayurveda* classics for all types of *Hridroga*.[21-24]

In current era, due to increased prevalence of Dyslipidemia & CVD, it is suggested to avoid consumption of *ghee*. In previous studies, *ghee* is found to have 60-70% saturated fat.[25,26]There has been concern about the possibility of *ghee* contributing to an increased risk of cardiovascular disease due to its high percentage of saturated fatty acids

Need of Study – In *Ayurveda*, *Goghrita* is known as best *Bruhan, Rasayan* and *Vayasthapan* but in Modern medicine, ghee is usually avoided to prevent CVD. These two things are found to be paradoxical. Hence this study was designed to assess the effect of *Goghrita* and *Arjun-ghrita* on lipid levels & other parameters related to heart in healthy individuals.

AIM

Comparison of efficacy of *Goghrita* and *ArjunGhrita* on biological parameters in healthy human volunteers.

OBJECTIVES

- To observe the difference in the lipid levels in different socio-economic group of healthy human volunteers
- To compare efficacy of *Goghrita* and *Arjun-Ghrita* on biological parameters in healthy human volunteers.

Material & Method

Study design – This was a Randomized clinical study.

Ethical committee approval - After approval from institutional ethical committee (vide reference no. DMIMS (DU)/ IEC/2015-16/1325), informed consent was taken from each volunteer.

Study population – Total 30 healthy human volunteers.

Sampling: All the volunteers were selected by Cluster Random Sampling method.

Sample size: Total 30 healthy human volunteers.

Study setting: All the volunteers were categorized as high, medium and low socioeconomic group. The volunteers were divided into group A & group B by lottery method in such a way that each group had 15 volunteers including 5 of each socioeconomic status (low, medium & high). The written consent was taken from all the volunteers.

Group A & B was given *Go-ghrita* and *Arjunghrita* respectively in the dose of 10 ml once a day in the morning on empty stomach with lukewarm water. It was given for continuous 60 days.

Trial drug details

Goghrita was procured from the *Go-Ras Kendra*, Wardha and was authenticated by analytical laboratory of *Rasashala*, MGAC.

The raw material of *Arjun* was procured from field and authenticated by Department of *Dravyaguna*. *Arjun-ghrita* was prepared in *Dattatraya Rasashala* of MGACH& RC, Salod.

Material of *Arjun-ghrita*: *Arjun-kalka, Goghrita and Arjun-quath*.

Method of preparation[27] - *Arjun, Terminali arjuna* Roxb*.,* powder in Coarse form for *quath*(decoction) and fine form for *kalka*(paste) was made. The *kalka* was made by adding sufficient quantity of water into fine powder and *quath* was made by adding coarse

powder of *Arjun* in water in the ratio of 1:8, which was heated at medium temperature, till it reduced to one fourth.

The *kalka* and *quath* of *Arjun* was mixed with *Go-ghrita*. The mixture was heated on medium flame till the water contents evaporated. After confirmation of *sneha siddhi lakshan*, it was preserved in airtight containers.

Methodology

Inclusion criteria-

- Healthy volunteers of different socio-economic group[28]

- Age group between 40 – 70 years of either sex.

Exclusion criteria –

- Known case of any systemic diseases like Diabetes mellitus and Hypertension**.**

All the volunteers were selected by Cluster Random Sampling method from Wardha and its periphery. They were categorized as high, medium and low socioeconomic group. The volunteers were divided into group A & group B by lottery method in such a way that each group had 15 volunteers including 5 of each socioeconomic status (low, medium & high). The written consent was taken from all the volunteers. Group A & B was given *Go-ghrita* and *Arjun-ghrita* respectively in the dose of 10 ml once a day in the morning on empty stomach with lukewarm water. It was given for continuous 60 days. All the volunteers were assessed on day 0, 30th and 60thon following parameters

Subjective parameters – *Agni*

Malapravritti

Table 1: Gradation of Agni and Mala

Agni	**Gradation**
Mandagni	1
Vishamgni	2
Tikshnagni	3
Samagni	4
Mala	**Gradation**
Asamyak	0
Samyak	1

Objective parameters – Weight
Pulse rate
Blood pressure
VO2 max * by Six Minute Walk Test (SMWT)* *
Lipid profile

*VO2max[29](Measurement of maximum oxygen uptake) – It is a common method of evaluating the capacity of cardiovascular system. SMWT is a simple and less expensive tool to assess the cardio-respiratory fitness.

**Six-Minute walk test(SMWT)[30]– Every volunteer was instructed to walk for continuous six minutes as fast as his/her capacity in the distance of 30 meter. The numbers of rounds (each of 30 meter.) were noted. The pulse rate measured manually and blood pressure was measured by sphygmomanometer before and after performing this test.

Observations and Result

This study entitled "Comparative Study of *Goghrita* and *Arjun-ghrita* on Biological Parameters in Healthy Human Volunteers" was conducted in Mahatma Gandhi Ayurved College, Hospital & Research center, Salod (H), Wardha.

Total 30 Healthy volunteers were included in the study.

The data obtained was coded and entered into Microsoft Excel Worksheet. The data was analyzed by using frequency distribution, descriptive statistics, chi square test, analysis of variance and t-statistic with the help of statistical software SPSS 17.0 version and tabulated as below,

- P<0.05 & P<0.02 Significant improvement
- P<0.01 Significant improvement
- P<0.001 Highly significant improvement

Total 30 volunteers of age group between 40 to 70 years were selected for the study. Out of that 86.67% were between age group of 40 to 50 years and 13.33% were between 51 to 60 years of age group.

Total 30 volunteers were selected (15 in each group). Out of that 53.33% were male and 46. 67% were female.

Comparison of Baseline Lipid Levels in Different Socio-Economic Groups

The mean total cholesterol on 0 day in low, medium and high socioeconomic group was 148.5, 159.6 and 157.7 respectively; it's 'p' value is 0.001 i.e. the difference in these groups was statistically significant.

The mean HDL on 0 day in low, medium and high socioeconomic group was 41.8, 42.3 and 40.0 respectively; it's 'p' value is 0.124 indicating non-significant difference.

The mean LDL on 0 day in low, medium and high socioeconomic group was 74.9, 82.8 and 84.2 respectively; it's 'p' value is 0.006 i.e. difference in these groups is statistically significant.

The mean Triglycerides on 0 day in low, medium and high socioeconomic group was 157.0, 171.6 and 169.5 respectively; it's 'p' value is 0.001 which shows significant difference.

The mean VLDL on 0 day in low, medium and high socioeconomic group was 31.4, 34.2 and 33.9 respectively; it's 'p' value is 0.001 i.e. difference is statistically significant.

Graph no. 1: Comparison of baseline lipid levels in different socio-economic groups

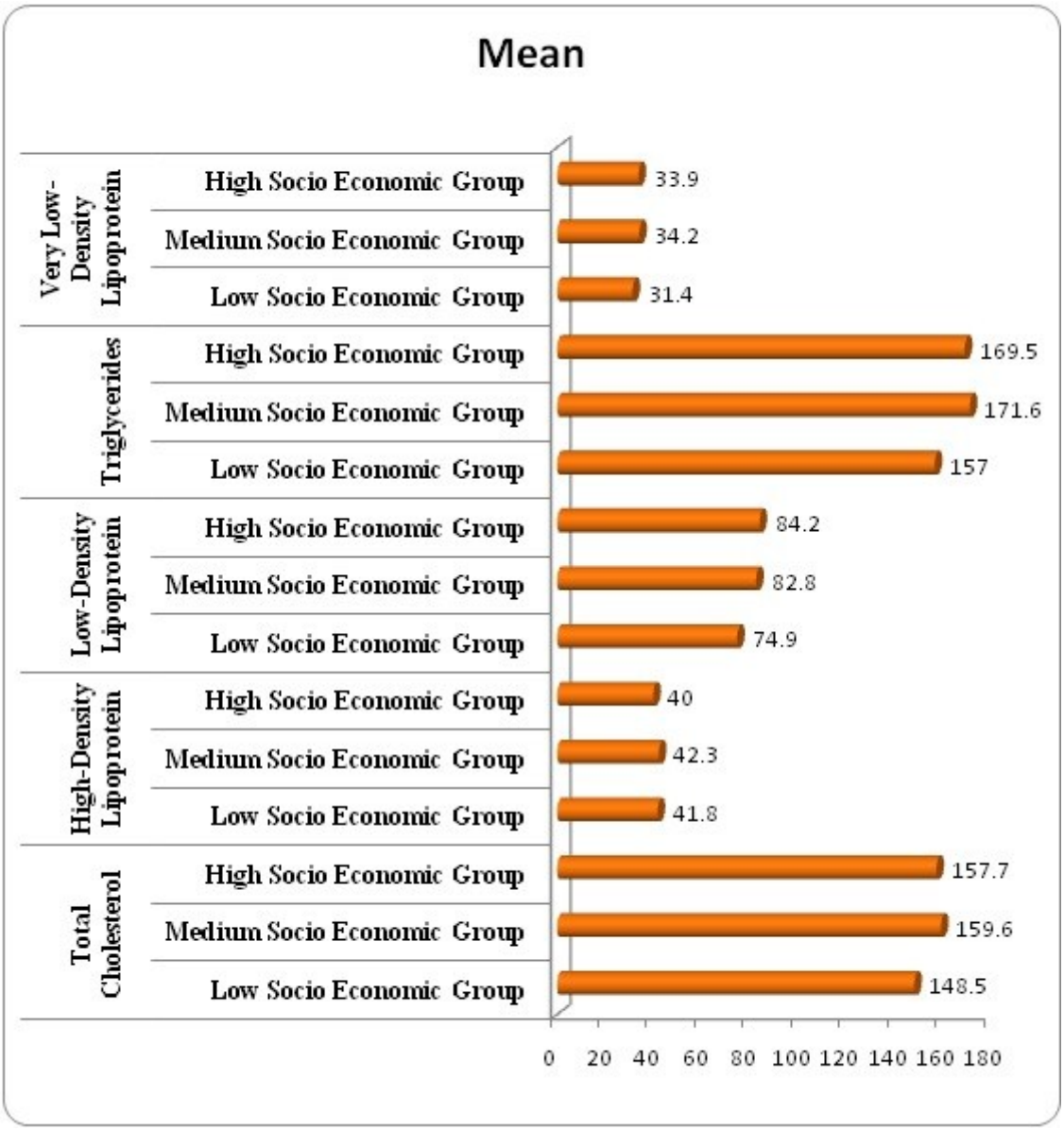


Table No.1 Showing the statistical result of parameter of Group A

Parameters	0 Day	30th Day	60th Day	S.D	Std. Error Mean	F-statistic	P value
Weight	63.44	63.57	63.66	9.663	2.495	0.002	0.998, NS
Pulse rate(B)	72.53	72.93	72.80	3.392	0.8755	0.053	0.949, NS
Pulse rate(A)	78	75.47	74.00	3.221	0.831	5.711	0.006, S
SBP (B)	120.00	119.47	118.93	7.820	2.019	0.069	0.933, NS
SBP (A)	125.07	122.80	120.67	7.626	1.969	1.245	0.298, NS
DBP (B)	78.67	79.20	78.13	5.235	1.351	0.156	0.856, NS
DBP (A)	82.93	79.73	78.93	6.976	1.801	1.375	0.264, NS
VO2max	19.78	20.34	20.50	1.712	0.442	0.726	0.490, NS
TC	154.07	154.87	154.20	9.470	2.429	0.031	0.969, NS
HDL	41.53	42.60	42.80	4.096	1.057	0.414	0.664, NS
LDL	79.47	79.47	78.80	10.281	2.654	0.021	0.979, NS
Triglycerides	165.33	164.20	162.93	12.001	3.098	0.150	0.861, NS
VLDL	33.00	32.80	32.60	2.418	0.624	0.102	0.903, NS

Table No.2 Showing the statistical result of parameter of Group B

Parameters	0 Day	30th Day	60th Day	S.D	Std. Error Mean	F-statistic	P value
Weight	61.87	61.88	61.91	6.591	1.702	0.001	1.00, NS
Pulse rate(B)	72.40	73.20	73.73	3.535	0.912	0.530	0.592, NS
Pulse rate(A)	80.93	79.20	74.53	5.152	1.330	5.709	0.006, S
SBP (B)	117.87	115.07	118.00	10.772	2.781	0.346	0.709, NS
SBP (A)	126.67	121.47	119.20	9.881	2.551	0.207	0.123, NS
DBP (B)	77.20	76.00	78.27	6.331	1.627	0.478	0.623, NS
DBP (A)	83.93	79.73	78.93	6.976	1.801	1.375	0.264, NS
VO2max	19.30	19.54	20.26	1.519	0.462	1.169	0.320, NS
TC	156.47	154.27	153.07	12.542	3.238	0.283	0.755, NS
HDL	41.20	42.33	43.40	3.994	1.031	1.129	0.333, NS
LDL	81.80	79.27	78.13	13.091	3.379	0.307	0.737, NS
Triglycerides	166.73	163.73	161.67	15.020	3.878	0.429	0.654, NS
VLDL	33.33	32.67	32.27	3.028	0.782	0.474	0.626, NS

B- Before SMWT, A- After SMWT, SBP- Systolic Blood Pressure, DBP- Diastolic Blood Pressure, TC- Total Cholesterol, HDL- High-Density Lipoprotein, LDL- Low-Density Lipoprotein, VLDL- Very Low-Density Lipoprotein.

Comparison of Effect on Weight in Group A & B

In group A, the mean weight on 0 day was 63.44, on 30th and 60thday, it was 63.57 and 63.66 respectively. It's 'p' value is 0.998 that is statistically non-significant.

In group B, the mean weight on 0 day was 61.87. On 30th and 60th day, it was 61.88 and 61.91 respectively. It's 'p' value is 1.0 that is also statistically non-significant.

Effect on Pulse Rate (Before SMWT) in Group A&B

In group A, on 0 day, the mean pulse rate before SMWT was 72.53, on 30th and 60th day; it was 72.93 and 72.80 respectively. It's 'p' value is 0.949 that is statistically non-significant.

In group B, on 0 day, the mean pulse rate before SMWT was 72.40, on 30th and 60th day; it was 73.20 and 73.73 respectively. It's 'p' value is 0.592 that is statistically non-significant.

Effect on Pulse Rate (After SMWT) in Group A &B

In group A, on 0 day, the mean pulse rate after SMWT was 78.00, on 30th and 60th day; it was 75.47 and 74.00 respectively. It's 'p' value is 0.006 that is statistically significant.

In group B, on 0 day, the mean pulse rate after SMWT was 80.93. On 30th and 60th day, it was 79.20 and 74.53 respectively. It's 'p' value is 0.006 that is statistically significant.

Effect on Systolic Blood Pressure (Before SMWT) in Group A&B

In group A, on 0 day, the mean systolic blood pressure Before SMWT was 120.00. On 30th and 60th day, it was 119.47 and 118.93 respectively. It's 'p' value is 0.933 that is statistically non-significant.

In group B, on 0 day, the mean systolic blood pressure Before SMWT was 117.87. On 30th and 60th day, it was 115.07 and 118.00 respectively. It's 'p' value is 0.709 that is statistically non-significant.

Effect on Systolic Blood Pressure (After SMWT) in Group A&B

In group A, on 0 day, the mean systolic blood pressure after SMWT was 125.07. On 30th and 60th day, it was 122.80 and 120.67 respectively. It's 'p' value is 0.298 that is statistically non-significant.

In group B, on 0 day, the mean systolic blood pressure after SMWT was 126.67. On 30th and 60th day, it was 121.47 and 119.20 respectively. It's 'p' value is 0.123 that is statistically non-significant.

Effect on Diastolic Blood Pressure (Before SMWT) in Group A &B

In group A, on 0 day, the mean Diastolic Blood Pressure before SMWT was 78.67, on 30th and 60th day; it was 79.20 and 78.13 respectively. It's 'p' value is 0.856 that is statistically non-significant.

In group B, on 0 day, the mean Diastolic Blood Pressure before SMWT was 77.20, on 30th and 60th day; it was 76.00 and 78.27 respectively. It's 'p' value is 0.623 that is statistically non-significant.

Effect on Diastolic Blood Pressure (After SMWT) in Group A&B

In group A, on 0 day, the mean diastolic blood pressure after SMWT was 82.93. On 30th and 60th day, it was 80.93 and 79.20 respectively.

It's 'p' value is 0.152 that is statistically non-significant.

In group B, on 0 day, the mean diastolic blood pressure after SMWT was 82.93. On 30th and 60th day, it was 79.73 and 78.93 respectively. It's 'p' value is 0.264 that is statistically non-significant.

Effect on Maximal Oxygen Consumption (VO2max) in Group A&B

In group A, on 0 day, the mean VO2 Max was 19.78. On 30th and 60th day, it was 20.34 and 20.50 respectively. It's 'p' value is 0.490 indicating statistically non-significant.

In group B, on 0 day, the mean VO2 Max was 19.30. On 30th and 60th day, it was 19.54 and 20.26 respectively. It's 'p' value is 0.320 which is statistically non-significant

Effect on Total Cholesterol in Group A&B

In group A, on 0 day, the mean total cholesterol was 154.07. On 30th and 60th day, it was 154.87 and 154.20 respectively. It's 'p' value is 0.969 that is statistically non-significant.

In group B, on 0 day, the mean total cholesterol was 156.47. On 30th and 60th day, it was 154.27 and 153.07 respectively. It's 'p' value is 0.755 showing statistically non-significant

Effect on High-Density Lipoprotein in Group A&B

In group A, on 0 day, the mean HDL was 41.53. On 30th and 60th day, it was 42.60 and 42.80 respectively. It's 'p' value is 0.664 that is statistically non-significant.

In group B, on 0 day, the mean HDL was 41.20. On 30th and 60th day, it was 42.33 and 43.40 respectively. It's 'p' value is 0.333 that is also statistically non-significant

Effect on Low-Density Lipoprotein in Group A&B

In group A, on 0 day, the mean LDL was 79.47. On 30th and 60th day, it was 79.47 and 78.80 respectively. It's 'p' value is 0.979 that is statistically non-significant.

In group B, on 0 day, the mean LDL was 81.80. On 30th and 60th day, it was 79.27 and 78.13 respectively. It's 'p' value is 0.737 that is statistically non-significant

Effect on Triglycerides in Group A&B

In group A, on 0 day, the mean Triglycerides was 165.33. On 30th and 60th day, it was 164.20 and 162.93 respectively. It's 'p' value is 0.861 that is statistically non-significant.

In group B, on 0 day, the mean Triglycerides was 166.73. On 30th and 60th day, it was 163.73 and 161.67 respectively. It's 'p' value is 0.654 that is statistically non-significant.

Effect on Very Low-Density Lipoprotein in Group A&B

In group A, on 0 day, the mean VLDL was 33.00. On 30th and 60th day, it was 32.80 and 32.60 respectively. It's 'p' value is 0.903 that is statistically non-significant.

In group B, on 0 day, the mean VLDL was 33.33. On 30th and 60th day, it was 32.67 and 32.27 respectively. It's 'p' value is 0.626 that is statistically non-significant.

Distribution of Volunteers According to *Agni* in Group A

In group A, total volunteers having *mandagni* were 33.3% on 0 day which were decreased to 6.7% on 60th day.

The volunteers having *vishamagni* were 46.7% on 0 day and on 60th day it was 40%. 20% volunteers of *tikshnagni* were decreased to 6.7% and no any volunteer of Samagni was there on 0 day but it was 46.7% on 60th day. The p value indicates significant improvement in *agni*.

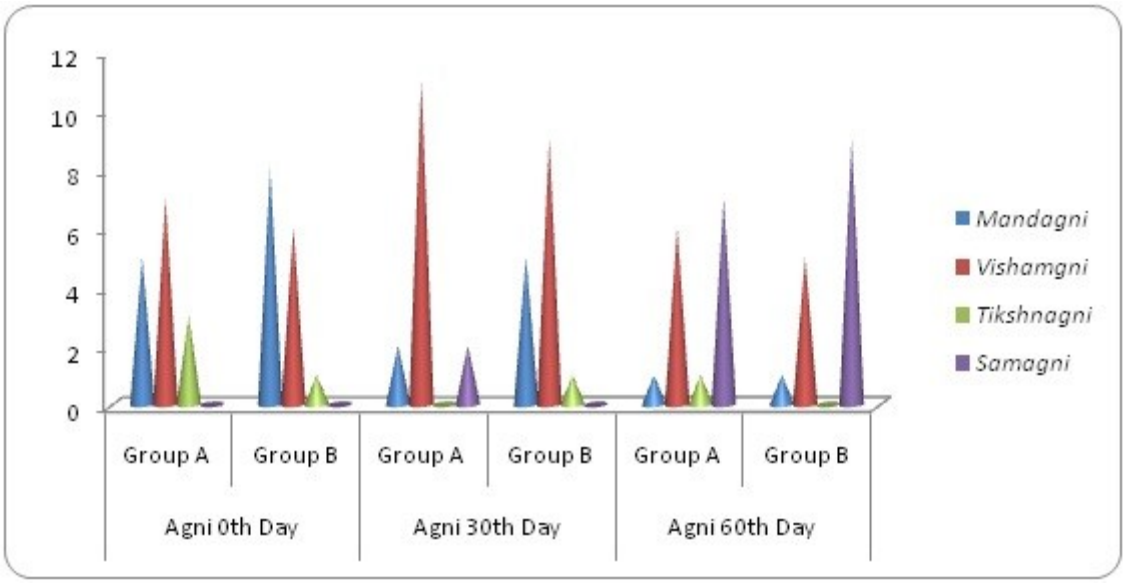
Distribution of Volunteers According to *Agni* in Group B

In group B, total volunteers having *mandagni* were 53.3% on 0 day which were decreased to 6.7% on 60th day.

The volunteers having *vishamagni* were 40.0% on 0 day and on 60th day it was 33.3%.

6.7% volunteers of *tikshnagni* were decreased to 0 % and no any volunteer of *Samagni* was there on 0 day but it was 60.0% on 60th day. The p value indicates significant improvement in *agni*.

Graph no. 2: Distribution of Volunteers According to Agni in Group A & B



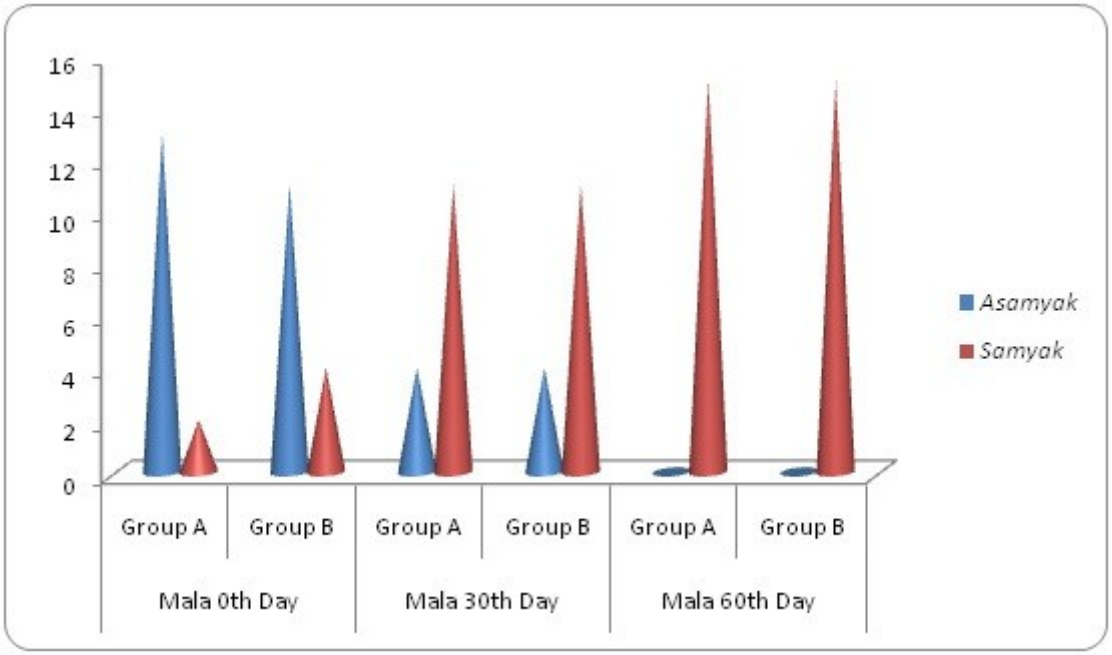
Distribution of Volunteers According to *Malapravritti* in Group A

In group A, 86.7% volunteers were having *Asamyak malapravritti* (Irregular bowel habits). On 60th day, there was improvement in *Malapravritti* in all volunteers.

Distribution of Volunteers According to *Malapravritti*in Group B

In group B, 73.3% volunteers were having *Asamyak malapravritti* (Irregular bowel habits). On 60th day, there was improvement in *Malapravritti* in all volunteers.

Graph no. 3: Distribution of volunteers according to *Malapravritti* in Group A & B



DISCUSSION

Ghrita is very commonly used in daily life in human beings. In routine dietetics, *ghrita* is advised either in pure form or medicated or mixed with food articles. However, being animal fat, it is the most averted substance by the physicians of modern medicine due to its property of increasing serum cholesterol. On the contrary, according to *Ayurveda*, *Ghrita* is known as best *bruhan*, *rasayan* and *nitya-sevaniyadravya*. The present study was undertaken to address this controversy by administering *Go-ghrita* and *Arjun-ghrita* for longer duration to know and compare their effect on various biological parameters in healthy human volunteers.

In this study, age groups between 40 to 70 years was selected because *Sushruta* described that during this age there is *Hani*(decline) of individual.[31] *Vagbhat* also described *madhyamavastha* is an appropriate time for consumption of R*asayana dravya*.[32]

The comparison of lipid levels in socioeconomic status was done at baseline. It was comparatively on higher, middle and lower side in medium, high and low socioeconomic groups respectively. It might be due to dissimilar life style and different dietary habits.

The association between socio-economic status and cholesterol level has been less consistent.[33] Several studies have observed inverse relationships between socio-economic status and cholesterol levels[34-36],

others have reported higher cholesterol levels among those with higher education or higher-grade of employment [37-39] while some found no association at all.[40] In developing countries the association is often positive with those in higher socio-economic status having higher levels of serum lipids[41-43]. In most of these studies, socio-economic status was usually measured using only one indicator of socio-economic status, mainly educational level. However, in order to capture the full extent of the influence of socio-economic status, the use of several measures of socio-economic status may be more appropriate. This is because different indicators of socio-economic status measure different dimensions, which may influence health status differently [37-44].

In the observation of weight, no significant change was found in both the groups. This finding was in contrast to the animal study conducted by Aziz H. et al. who reported significant increase in weight of mice with the consumption of cow ghee for 60 days.[45] But the study of Yogita Karandikar et al.[46] showed reduction in weight of animals in Cow Ghee group.

This unchanged effect in both the groups may be related to medicinal value of *Go-Ghrita* which aids in fast absorption and digestion of food. Ghee stimulates the secretion of stomach acids to aid in digestion, while other fats and oils, can slow down the body's digestive process and sit heavy in the stomach. Ghee interferes the absorption of essential nutrients from the gastrointestinal tract, increase in the metabolic rate unlinking it from energy formation mechanism (e.g., uncoupling of oxidative phosphorylation) and stimulation of the satiety canter in the hypothalamus.[47]

The pulse rate was assessed before and after performing Six Minute Walk Test (SMWT).

In group A, before medication, there was significant increase in pulse rate after SMWT, but on consumption of *Go-ghrita*, the pulse rate was not significantly increased after SMWT. Similar findings were also observed in group B.

It indicates the effect of *Go-ghrita* and *Arjun-ghrita* on cardiac activity. No previous study on *Go-ghrita* or *Arjun-ghrita* was found in this regard. But in one study, *Arjuna* improved cardiac efficiency like increased strength of contraction, improved ejection fraction and reduced heart rate.[48]

No significant change in blood pressure was found in both the groups before and after SMWT.

Maximal Oxygen Consumption (VO2max) in group A & B was assessed with the help of SMWT. It is a common method of evaluating the capacity of the cardiovascular system.[49]

There was no significant change after consumption of *ghrita* in both the groups. But in the study of Jaspal Singh Sandhu et al., they

found significant increase in maximum oxygen consumption capacity in the volunteers receiving treatment with *Terminalia arjuna.*[50]

In the assessment of lipid profile, in group A, the total cholesterol was near about constant and in group B, it was decreased but not statistically significant. High density cholesterol was increased in both the groups but the difference was not significant. The findings of the study are in supported with Kathirvelan who reported increase in HDL as a result of CLA enriched ghee feeding vs soybean oil control .[51]The low density cholesterol, triglycerides and very low density lipoprotein were insignificantly decreased in both the groups.

In one study of *Terminalia Arjuna*, hypocholesterolemic effects of bark was found.[52]

An open study of Terminalia use in stable and unstable angina demonstrated a 50-percent reduction of angina in the stable angina group after three months also significant reduction was also found in systolic blood pressure in these patients. During treadmill testing, both the onset of angina and the appearance of ST-T changes on ECG were significantly delayed in the stable angina group, indicating an improvement in exercise tolerance. The unstable angina group did not experience significant reductions in angina or systolic blood pressure. Both groups showed improvements in left ventricular ejection fraction. A double-blind, placebo-controlled trial conducted in severe refractory heart failure treatment with Terminalia was also associated with significant improvements in stroke volume and left ventricular ejection fraction, as well as decreases in end-diastolic and end-systolic left ventricular volumes compared to placebo.[54] In one study it was also found that the rats receiving *Terminalia arjuna* had a marked reduction in total cholesterol[55, 56], triglycerides, LDL cholesterol[57], and VLDL cholesterol. Treated rats showed a significant prevention to the risk of coronary heart disease.[58] Thus, *Terminalia arjuna* was observed to be the most potent hypolipidemic, hypotriglycemic agent and also raised high density lipo-cholesterol.

In a study conducted by Reddy AM et al. on *Go-ghrita,* they found no effect on LDL and HDL cholesterol.[59]

Ghee is a good source of short chain saturated fatty acids which are easier to digest. [60]Ghee also increases the excretion of dietary cholesterol and bile acids from gastrointestinal tract. This might be the reason for non increase of serum cholesterol and LDL cholesterol levels.

Another theory suggests that Ghee is rich in Antioxidants including Vitamin A, Vitamin E and carotenoids which may be helpful in preventing lipid peroxidation.[61]

The assessment of *Agni* was done with the help of *Kshudha-Pravritti*. Significant

improvement was found in *Agni* in both the groups.

All though *Ghrita* has opposite character than *Agni*, when it gets digested, it serves as a fuel and kindles the Agni. This kindled Agni has more power to digest even more quantity of *Ghrita*.

Ghrita is known for *Agni Deepana* by its *Prabhava*.[62]

In the effect of *ghrita* on *malapravrutti*, there was improvement in *malapravrutti* in the volunteers who were having irregularity in bowel. This effect was similar in both groups.

Ghrita might acts on the large intestine by its snigdha property.

Overall observation showed that there was no significant difference in weight, blood pressure, VO2 max and lipid levels but there was significant change in pulse rate in both the groups. Group of *Arjunghrita* was not found any dissimilar effect from *Go-ghrita* in all parameters. *Arjun* is well known as '*Hridya* and *Arjun-ghrita* is known for all types of *Hridroga*. In this study, volunteers were not assessed on all cardio-specific parameters. This might be the reason of similarity in results.

Limitations

As mentioned above we had used a minimum dose of *ghrita* in both groups and the *ghrita* was not given for longer duration. We had not measured the biomarkers of atherosclerosis or other cardio-specific parameters in our study.

Recommendation

There is a need to conduct similar kind of studies in a large number of healthy populations by taking specific biological parameters. Still no study on *Arjunghrita* is conducted; future work can be done to assess its effect on cardiac function by using other specific parameters.

CONCLUSION

This study was conducted to assess the effect of *Goghrita* and *Arjun-ghrita* on biological parameters in healthy human volunteers. It can be said that there is relationship in socio-economic status and lipid levels. From the observations, it can be concluded that the consumption of *Goghrita* and *Arjun-ghrita* are good for health in the quantity of 10 gm daily in healthy people. As there is misunderstanding in society regarding consumption of *ghrita* that it increases lipids in blood. But this research study has shown no significant difference in weight, blood pressure, VO2 max and lipid levels. There was significant change in pulse rate before and after six minute walk test in both the groups which indicates improvement in cardiac function. There was also significant improvement in *Agni* and *Malapravrutti* in both groups. Group of *Arjun-ghrita* was not found any dissimilar effect from *Goghrita* in all parameters. In this study, volunteers were not assessed on all

cardio-specific parameters. This might be the reason of similarity in results.

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