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A comparative observational study of Ayurveda bloodletting procedure and blood donation with special reference to RBC indices in healthy individuals

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Abstract

Blood is the pillar of the entire body. Acharya Susruta has explained blood as the fourth humour. Vitiating of blood leads to varying pathologies. There are several procedures mentioned in Ayurveda that are applicable today by making a few technological modifications to traditional use and bloodletting is one of them. The present study is aimed at studying the effect of bloodletting on RBC indices in a healthy individual. Two group observational studies with 60 individuals fulfilling the inclusion criteria were selected from O.P.D., L.N. Ayurveda Hospital, Bhopal, Madhya Pradesh. One group of individuals was given oleation, sudation, followed by bloodletting. For another group of individuals, bloodletting was done directly. The research work was undertaken to evaluate the internal environment and RBC indices change, based on haemato-physiological parameters to ascertain the probable non-pharmacological action in the correction of underlying pathology of the disease. However, when assessed biochemically and statistically, it shows insignificant results.

1. Introduction

Blood is the pillar of the entire body (Ambikadatta, 1997 a), vitiation of blood (rakta) leads to varying pathologies. There are several procedures mentioned in ayurveda that are applicable today by making a few technological modifications to traditional use and bloodletting is one of them.

In this regard, a comparative observational study is undertaken to evaluate the effect of bloodletting and blood donation on the RBC indices. In this study in one group, after proper oleation therapy internally (samyaka snehana), and intake of slimy food (picchila ahara sevana), 300 ml blood will be let out in the second group only, blood donation is advocated and RBC indices will be assessed. A correlation will be made in light of modern parameters between ayurvedic and contemporary concepts of bloodletting.

The present study enlightens the scientific practice of these procedures on moderate parameters. No doubt, donating blood can do a lot of good. Donating just one pint of blood can save more than one person's life. Nausea and physical weakness are commonly occurring side effects just after the procedure of blood donation. In some people, it lasts for a few minutes to hours, on the other hand an act of complete and successful is followed by a feeling of lightness and a sense of cheerfulness which can not be possible by the act of blood donation (Ambikadatta, 1997b).

If, any minute vitiated constitution of an individual (dosha dushti) is present in the body and if we perform bloodletting after doing proper foremost action (purva karma), oleation (snehana), sudation (swedana), intake of slimy food (Ambikadatta, 1997c), then there will be the chance of not getting affected by the vitiated constitution of an individual as the principle constituents of the body are let out before producing any diseased effect also. The side effects which occur due to act of blood donation will be lessened by the procedure of bloodletting. Bloodletting is an old principle of ayurveda although less accredited to it. It needs to be explored for the well-being of the entire human race.

2. Materials and Methods

2.1 Study design

A Comparative Clinical study on 60 individuals of 20 to 50 years with more than 11g% of hemoglobin irrespective of sex, religion, socio-economic status, were selected from O.P.D., and I.P.D, L.N. Ayurveda College and hospital, Bhopal, Madhya Pradesh. The study has been reported as per the consolidated standards of reporting trials (CONSORT) statement. Ethical clearance was obtained from IEC (LNA/IECHR/2023-2024/SHALYA/005) and this study was registered in the Clinical Trial Registry of India (CTRI/2023/09/008389).

2.2 Methodology

Totally 60 individuals were made into two groups, containing 30 individuals in each. Group A was given oleation, sudation followed by bloodletting and Group B was directly taken for blood donation.

2.3 Criteria of inclusion

- Individuals of 20 to 50 years of age were selected for study.
- Male and Female individuals were considered irrespective of religion, caste and region.

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- Individuals having Hb% more than 11 g% were considered for the study.

2.4 Criteria of exclusion

- The individual less than 20 years and above 50 years of age.
- Individuals suffering from diseases like anemia, hemorrhagic disorders, diabetes mellitus, cancer, and other severe complicated systemic disorders.
- Serum bilirubin levels of more than 1.8 gm/dl were not considered.
- Pregnant females were not considered.
- Individuals on anticoagulant drugs were not considered.

2.5 Treatment procedure

2.5.1 Intervention in Group A: Bloodletting

30 individuals were given cow ghee orally for five days starting with 30 ml, 50 ml, 80 ml, 110 ml, and 150 ml along with sesame oil massage (tila taila abhyanga), followed by sudation therapy (nadi swedana). On the day before the bloodletting, individuals were asked to intake unctuous food (snigha drava ahara) on the previous night as well as the next morning (Ambikadatta, 1997d). The individuals were made to sit in a comfortable position (Ambikadatta, 1997e), a cubital vein was selected on the left hand and the tourniquet was tied above 6 cm away from the site of bloodletting. Under all aseptic precautions, vein was punctured by needle (size 16 No.), and allowed for bloodletting 300 ml (approx. ½ prastha) (Ambikadatta, 1997f). They are in sterile blood-preserving bags and then collected blood sent to the blood bank. The tourniquet was removed and the tight bandage was applied. The individual was advised to take unctuous (snigdha), and liquid food (drava aahara) orally after the bloodletting procedure (Singh, 2000). A blood sample was collected.

2.5.2 Intervention in Group B: Blood donation

The individual was asked to sit down on the backrest chair in a comfortable position. The cubital vein was selected. The tourniquet was applied 6 cm away from the site. Under all aseptic precautions, vein was punctured by needle (size 16 No.), and allowed for bloodletting (300 ml) in sterile blood preserving bags and then collected blood was sent to blood bank. The tourniquet was removed and the tight-pressure bandage was applied. The individual was advised to rest for 15 min and refreshment was given. The blood sample was collected.

2.6 Criteria for assessment

The improvement in the individuals was assessed mainly based on of subjective as well as objective criteria.

2.6.1 Subjective parameters

- Nausea
- Physical weakness
- Cheerfulness
- Lightheadedness

2.6.2 Objective parameters

- Changes in the Hb%
- RBC count
- MCV
- MCH
- MCHC

3. Results

A total of sixty three individuals were registered for this study. Among them, three individuals were excluded, as they did not fulfil the inclusion criteria. Sixty individuals fulfilling the inclusion criteria were selected for the procedure.

Maximum individuals belonged to the 20-25 years of age group (86.67%), Hindu religion (93.33%); Males (80%); Students (100%); maximum individuals having Vegetarian (60%); moderate appetite (52.33%).

The changes observed during the clinical study were noted after every follow-up and represented by statistical method. For multiple comparisons, One-way repeated measure ANOVA test, Friedman ANOVA test, and Wilcoxon rank sum test were applied and the results were given in Tables and Figures.

3.1 Comparison of objective parameters between the groups

Table 1 shows the suggestive of significant results for mean hemoglobin at different follow in Group A (as the *p-value* is 0.0327 which is significant) whereas non-significant (ns) results for Group B (as the *p-value* is 0.078 which is non-significant). Table 2 is suggestive of non-significant results for the comparison of mean RBC at different follow-ups in Group A and Group B. Table 3 is suggestive of non-significant results for the comparison of mean MCV at different follow-ups in Group A and Group B. Table 4 is suggestive of non-significant results for the comparison of mean MCH at different follow-ups in Group A and Group B. Table 5 is suggestive of non-significant results for the comparison of mean MCHC at different follow-ups in Group A and Group B.

Table 1: Comparison of mean hemoglobin between the groups

Hb%	Bloodletting		Blood donation	
	Mean	SD	Mean	SD
O day	12.97	1.97	13.73	1.77
1 day	12.86	1.88	13.47	1.75
7 day	12.91	1.90	13.71	1.71
14 day	13.03	1.93	13.54	1.65
21 day	13.07	1.93	13.68	1.63
30 day	13.09	1.97	13.75	1.61
F-value	2.24	2.03		
<i>p-value</i>	0.0327, significant	0.078, ns		

Table 2: Comparison of mean RBC between the groups

RBC	Bloodletting		Blood donation	
	Mean	SD	Mean	SD
O day	4.78	0.82	4.93	0.65
1 day	4.80	0.89	4.69	0.70
7 day	4.78	0.84	4.77	0.54
14 day	4.68	0.83	4.88	0.49
21 day	4.71	0.81	4.86	0.56
30 day	4.84	0.77	4.96	0.70
F-value	1.83	2.00		
<i>p</i> -value	0.110, ns	0.081, ns		

Table 3: Comparison of mean MCV between the groups

MCV	Bloodletting		Blood donation	
	Mean	SD	Mean	SD
O day	85.96	13.63	93.01	8.39
1 day	86.27	12.90	93.51	8.54
7 day	86.07	13.33	92.37	9.27
14 day	87.02	13.01	90.08	8.15
21 day	87.87	12.78	93.14	9.58
30 day	86.87	12.78	93.56	9.68
F-value	2.01	0.82		
<i>p</i> -value	0.081, ns	0.540, ns		

Table 4: Comparison of mean MCH between the groups

RBC	Bloodletting		Blood donation	
	Mean	SD	Mean	SD
O day	28.47	3.24	28.83	4.42
1 day	28.57	3.17	29.06	4.39
7 day	28.67	3.20	29.06	4.37
14 day	28.7	3.22	28.88	4.26
21 day	28.71	3.22	28.90	4.29
30 day	28.69	3.23	28.88	4.30
F-value	1.98	0.96		
<i>p</i> -value	0.0836, ns	0.3426, ns		

Table 5: Comparison of mean MCHC between the groups

MCHC	Bloodletting		Blood donation	
	Mean	SD	Mean	SD
O day	35.72	2.72	35.58	2.99
1 day	35.79	2.69	35.69	2.99
7 day	35.78	2.72	35.51	3.02
14 day	35.63	2.67	35.48	2.98
21 day	35.74	2.69	35.66	3.01
30 day	35.66	2.71	34.67	3.42
F-value	1.15	2.09		
<i>p</i> -value	0.2594, ns	0.070, ns		

3.2 Comparison of subjective parameters between the groups

Table 6 is suggestive of non-significant results for comparison of the presence of nausea at different follow-ups in Group A and Group B. Table 7 is suggestive of significant (s) results for the presence of lightheadedness after the bloodletting (as the p -value is 0.0390 which is significant) whereas non-significant results for Group B (as the p -value is 0.7479 which is non-significant). Table 8 is suggestive of non-significant results for the presence of physical weakness after

the bloodletting (as the p -value is 0.1111 which is not significant) whereas highly significant (hs) results for Group B (as the p -value is 0.0055 which is highly-significant). Table 9 is suggestive of highly significant results for the presence of cheerfulness after the bloodletting (as the p -value is 0.0013 which is highly significant) whereas non-significant results for Group B (as the p -value is 0.1508 which is non-significant). Table 10 is suggestive of non-significant results for the comparison of presence of lightness at different follow-ups in Group A and Group B.

Table 6: Comparison of presence of nausea between the groups

Follow-up	Bloodletting			Blood donation			p -value
	Mild (1)	Moderate (2)	Severe (3)	Mild (1)	Moderate (2)	Severe (3)	
0 day	2	0	0	1	0	0	0.554, ns
Day 1	1	0	0	1	0	0	1.000, ns
Day 7	0	0	0	0	0	0	—
Day 14	1	0	0	0	0	0	0.313, ns
Day 21	1	0	0	1	0	0	1.000, ns
Day 30	1	0	0	1	0	0	1.000, ns
*F-value	0.4203			0.4361			
p -value	0.8340, ns			0.8228, ns			

Table 7: Comparison of the presence of light headedness between the groups

Follow-up	Bloodletting			Blood donation			p -value
	Mild (1)	Moderate (2)	Severe (3)	Mild (1)	Moderate (2)	Severe (3)	
0 day	2	0	0	0	0	0	0.150, ns
Day 1	6	0	0	2	0	0	0.129, ns
Day 7	4	0	0	1	0	0	0.161, ns
Day 14	4	0	0	1	0	0	0.161, ns
Day 21	4	0	0	1	0	0	0.161, ns
Day 30	3	0	0	1	0	0	0.301, ns
F-value	2.4126			0.5370			
p -value	0.0390, s			0.7479, ns			

Table 8: Comparison of the presence of physical weakness between the groups

Follow-up	Bloodletting			Blood donation			p -value
	Mild (1)	Moderate (2)	Severe (3)	Mild (1)	Moderate (2)	Severe (3)	
0 day	3	0	0	0	0	0	0.076, ns
Day 1	4	0	0	6	0	0	0.488, ns
Day 7	2	0	0	5	0	0	0.228, ns
Day 14	2	0	0	4	0	0	0.389, ns
Day 21	2	0	0	4	0	0	0.389, ns
Day 30	1	0	0	3	0	0	0.301, ns
F-value	1.8268	3.4627					
p -value	0.1111, ns	0.0055, h					

Table 9: Comparison of the presence of cheerfulness between the groups

Follow-up	Bloodletting			Blood donation			p-value
	Mild (1)	Moderate (2)	Severe (3)	Mild (1)	Moderate (2)	Severe (3)	
0 day	0	0	0	0	0	0	—
Day 1	5	0	0	1	0	0	0.085
Day 7	6	0	0	2	0	0	0.129, ns
Day 14	6	0	0	2	0	0	0.129, ns
Day 21	4	0	0	2	0	0	0.389, ns
Day 30	4	0	0	2	0	0	0.389, ns
F-value	4.2321	1.6504					
p-value	0.0013, h	0.1508, ns					

Table 10: Comparison of the presence of lightness between the groups

Follow-up	Bloodletting			Blood donation			p-value
	Mild (1)	Moderate (2)	Severe (3)	Mild (1)	Moderate (2)	Severe (3)	
0 day	3	0	0	0	0	0	0.076, ns
Day 1	6	0	0	2	0	0	0.254, ns
Day 7	6	0	0	2	0	0	0.254, ns
Day 14	5	0	0	2	0	0	0.228, ns
Day 21	3	0	0	1	0	0	0.307, ns
Day 30	3	0	0	1	0	0	0.307, ns
F-value	2.2108	1.2609					
p-value	0.0563, ns	0.2840, ns					

3.3 Comparison of change in objective parameters between the groups after treatment at different follow-ups

Table 11 is suggestive of highly significant results for the comparison of change in Hb% on day 1st, non-significant results on day 7th, and significant results on days 14, 21, and 30 at different follow in Group A and Group B. Table 12 is suggestive of non-significant results for the comparison of change in RBC on all days 1st, 7th, 14th, 21st, and 30th at different follow-in Group A and Group B. Table 13

is suggestive of non-significant results for comparison of change in MCV on all days 1st, 7th, 14th, 21st, and 30th at different follow-ups in Group A and Group B. Table 14 is suggestive of non-significant results for the comparison of change in MCH on all days 1st, 7th, 14th, 21st, and 30th at different follow in Group A and Group B. Table 15 is suggestive of non-significant results for the comparison of change in MCHC on all days 1st, 7th, 14th, 21st, and 30th at different follow in Group A and Group B.

Table 11: Comparison of change in hemoglobin after treatment at different follow-ups between the groups

Follow-up day	Group	Mean	SD	Median	Z-value	p-value
Day-1	Bloodletting	0.10	0.22	0.10	2.740	0.0061, h
	Blood donation	0.26	0.30	0.30		
Day-7	Bloodletting	0.056	0.27	0.10	0.676	0.4989, ns
	Blood donation	-0.018	0.68	-0.10		
Day-14	Bloodletting	-0.063	0.27	-0.10	2.371	0.0177, s
	Blood donation	-0.19	0.60	-0.10		
Day-21	Bloodletting	-0.10	0.26	-0.10	2.174	0.0297, s
	Blood donation	-0.05	0.57	0		
Day-30	Bloodletting	-0.12	0.33	-0.10	2.20	0.0278, s
	Blood donation	0.016	0.64	-0.05		

Table 12: Comparison of change in RBC after treatment at different follow-ups between the groups

Follow-up day	Group	Mean	SD	Median	Z-value	p-value
Day-1	Bloodletting	-0.027	0.26	-0.055	1.840	0.086, ns
	Blood donation	0.012	0.24	-0.01		
Day-7	Bloodletting	0.002	0.39	-0.03	1.221	0.2222, ns
	Blood donation	-0.16	0.48	0		
Day-14	Bloodletting	0.092	0.28	0.095	1.353	0.1759, ns
	Blood donation	-0.25	0.46	-0.055		
Day-21	Bloodletting	0.068	0.29	0.095	0.296	0.7674, ns
	Blood donation	-0.071	0.34	-0.11		
Day-30	Bloodletting	-0.065	0.32	-0.06	0.229	0.8187, ns
	Blood donation	0.032	0.27	0.005		

Table 13: Comparison of change in MCV after treatment at different follow-ups between the groups

Follow-up day	Group	Mean	SD	Median	Z-value	p-value
Day-1	Bloodletting	-0.32	2.80	-0.40	0.511	0.6094, ns
	Blood donation	-0.42	1.45	-0.08		
Day-7	Bloodletting	-0.11	1.37	-0.70	0.666	0.5056, ns
	Blood donation	-0.71	4.13	-0.065		
Day-14	Bloodletting	-1.06	1.84	-1.3	1.716	0.0862, ns
	Blood donation	-0.10	2.64	0.07		
Day-21	Bloodletting	-0.90	3.50	-1.1	2.151	0.0314, ns
	Blood donation	0.94	4.60	1.32		
Day-30	Bloodletting	-1.39	4.08	-1.65	0.739	0.4597, ns
	Blood donation	-0.47	5.07	0.25		

Table 14: Comparison of change in MCH after treatment at different follow-ups between the groups

Follow-up day	Group	Mean	SD	Median	Z-value	p-value
Day-1	Bloodletting	-0.96	0.29	-0.10	1.896	0.0579, ns
	Blood donation	-0.22	0.15	-0.20		
Day-7	Bloodletting	-0.19	0.31	-0.20	0.067	0.9465, ns
	Blood donation	-0.23	0.23	-0.20		
Day-14	Bloodletting	-0.22	0.29	-0.20	0.783	0.4335, ns
	Blood donation	-0.05	0.43	0		
Day-21	Bloodletting	-0.23	0.25	-0.20	1.506	0.1320, ns
	Blood donation	-0.066	0.30	-0.05		
Day-30	Bloodletting	-0.21	0.36	-0.20	0.429	0.6680, ns
	Blood donation	-0.05	0.26	0		

Table 16: Comparison of change in MCHC after treatment at different follow-ups between the groups

Follow-up day	Group	Mean	SD	Median	Z-value	p-value
Day-1	Bloodletting	-0.073	0.19	0	0.210	0.8334, ns
	Blood donation	-0.09	0.32	-0.05		
Day-7	Bloodletting	-0.053	0.16	0	0.892	0.3723, ns
	Blood donation	-0.093	0.25	0.10		
Day-14	Bloodletting	-0.086	0.25	-0.05	0.253	0.8004, ns
	Blood donation	-0.016	0.27	0		
Day-21	Bloodletting	0.023	0.27	0	0.357	0.7212, ns
	Blood donation	-0.07	0.40	-0.05		
Day-30	Bloodletting	-0.063	0.24	-0.10	0.764	0.4450, ns

4. Discussion

Blood and its structural component are considered the most important constituent of the body. Blood is specialized connective tissue that circulates in a closed system of blood vessels. Respiration, excretion of metabolic waste, nutrition, maintenance of normal acid-base balance, and thermoregulation of water balance are the main functions of blood.

Vitiation of blood ends in several diseases like skin diseases (kushtha), bullous disorder (visarpa), and other skin diseases (Tekade, 2018), ulcers, hemorrhoids, *etc.* While explaining treatment for all these diseases, bloodletting is suggested as the best moderate treatment. Similarly, acharya sushruta in his documentation sushruta samhita has mentioned performing bloodletting in the autumn season (sharad rutu) in healthy individuals.

According to his study, he has mentioned that regular bloodletting minimizes the chances of skin diseases, tumors, swelling, inflammation, hematological disorders, *etc.*, proving the best moderate treatment for these diseases.

On the account of the statement mentioned in sushruta samhita, while explaining the merits of bloodletting in diseased as well as healthy individuals in the autumn season. The topic was undertaken to evaluate internal environmental changes and changes in RBC indices based on haemato-physiological parameters. Multiple research work has been done on bloodletting, but no research has been done in evaluating the alteration in RBC indices as well as moderate dynamic changes in consideration of haemato-physiological parameters. Hence, to evaluate these changes, the present study was undertaken. The scope of the study was limited to Hb% and RBC indices as the evaluation of the entire parameters would have not been possible in a short period and with limited resources (Raut *et al.*, 2013).

The present study was carried out on 60 healthy individuals in two groups, bloodletting and blood donation. Bloodletting is performed after adequate oleation, and sudation is done for 5 days. Appropriate oleation and sudation withdraw the vitiated physical constituents into circulation leading to the elimination of vitiated constituents from the body. Then bloodletting was performed in the quantity of 300 ml. The quantity of 300 ml was decided in context to the quantity mentioned by dalhana's commentary on sushruta samhita which

was ½ prastha, *i.e.*, approx. 300 ml which is a median effective dose (madhyam matra) for letting out the blood and the therapy was assessed for Hb%, RBC count, MCV, MCH, MCHC, and subjective parameters like nausea, presence of physical weakness, cheerfulness, lightheadedness, and lightness on 1st, 7th, 14th, 28th and 30th day after bloodletting and blood donation.

According to acharya vagbhata, pitta has similitude with blood, and therefore bloodletting is considered the best therapy for blood-borne diseases (Tripathi, 2009). Bloodletting has also provided improvement in collateral blood circulation, anti-inflammatory effect, and immune stimulation. Also, skin diseases are more prevalent in wetlands (anupa desha) as compared to other lands (Kashya *et al.*, 2019). If, bloodletting is performed at regular intervals, then the chances of affection of diseases in the future will be less and this will be the advice for that particular wetlands people will lessen the chances of occurrence of skin diseases.

Bloodletting ends up in the purification of blood by removing the vitiated material. It helps in improving the circulation by maintaining its proper viscosity. It helps relieve pressure on the liver and spleen. Thus maintaining the proper functioning of blood. Bloodletting initiates proper supply to tissues and organs thus, leading to the appropriate functioning of all systems which ultimately helps in reducing all hematological diseases.

5. Conclusion

The research work was undertaken to evaluate the internal environment and RBC indices change, based on haemato-physiological parameters to ascertain the probable non-pharmacological action in the correction of underlying pathology of the disease. However, when assessed biochemically and statistically, it shows insignificant results.

The reason behind the insignificant results could be due to the quantity of bloodletting was 300 ml (approx. ½ prastha) which is less than 10% of the total volume of blood and the time required for proper follow-up was less.

Thus there is a horizon of hope that the procedure could show significant changes if done in larger quantities, *i.e.*, more than 15% of total volume, *i.e.*, good effective dose (pravara matra) and repeated frequency as per the requirement of principle constituents of the

body predominance as mentioned in classics. Also, there were no changes found in the parameters selected for the present study, but subjective parameters like cheerfulness, lightheadedness, and lightness show positive effects due to performing proper oleation, sudation, cleaning the channels which results in proper utilization like cheerfulness, lightheadedness, and lightness.

Thus, further study could be undertaken to evaluate the changes in these parameters by increasing the quantity, *i.e.*, poor quantity (heena), moderate quantity (madhya), and proper quantity (uttama matra) based on body weight, body constituents (prakruti), strength (bala), Hb, *etc.*, mentioned in classics.

Conflict of interest

The authors declare no conflicts of interest relevant to this article.

References

- Ambikadatta S. (1997a)**, Sushruta Samhita, Nibandha sangraha commentary of Dalhanacharya published by Chaukhamba Sanskrit Sansthan Varanasi, Eleventh edition, Sutrasthana, Shonitavarniya Adhyaya, Verse 3, pp:46-47.
- Ambikadatta, S. (1997b)**, Sushruta Samhita, Nibandha sangraha commentary of Dalhanacharya published by Chaukhamba Sanskrit Sansthan Varanasi, Eleventh edition, Sutrasthana, Shonitavarniya Adhyaya, Verse 34, pp:109.
- Ambikadatta S. (1997c)**, Sushruta Samhita, Nibandha sangraha commentary of Dalhanacharya published by Chaukhamba Sanskrit Sansthan Varanasi, Eleventh edition, Sharirsthana, Siravyadha Vyadhi Sharira Adhyaya, Verse 6, pp:67.
- Ambikadatta S. (1997d)**, Sushruta Samhita, Nibandha sangraha commentary of Dalhanacharya published by Chaukhamba Sanskrit

Sansthan Varanasi, Eleventh edition, Sharirsthana, Siravyadha Vyadhi Sharira Adhyaya, Verse 6, pp :69.

- Ambikadatta S. (1997e)**, Sushruta Samhita, Nibandha sangraha commentary of Dalhanacharya published by Chaukhamba Sanskrit Sansthan Varanasi, Eleventh edition, Sharirsthana, Siravyadha Vyadhi Sharira Adhyaya, Verse 08-9, pp:64.
- Ambikadatta S. (1997f)**, Sushruta Samhita, Nibandha sangraha commentary of Dalhanacharya published by Chaukhamba Sanskrit Sansthan Varanasi, Eleventh edition, Sutrasthana, Shastravacharaniya Adhyaya, Verse 6, pp:67.
- Ambikadatta S. (1997)**, Sushruta Samhita, Nibandha sangraha commentary of Dalhanacharya published by Chaukhamba Sanskrit Sansthan Varanasi, Eleventh edition, Sutrasthana, Shonitavarniya Adhyaya, Verse 38, pp:55.
- Parikha, R. J. (2003)**, Madhava Nidana with Madhukosha tika by Vidyodini, published by Sastusahitya Vardhaka Karyalaya Ahmadabad, Kushthanidan Adhyaya, Verse 49, pp:23.
- Singh, R. H. (2000)**. Panchakarma therapy Published by chaukhamba Sanskrit series office Varanasi second edition. pp:176.
- Tekade, A. (2018)**. Importance of *Raktamokshana* in the management of *Tvachavikar*, Int. J. of Ayu. and pharma. Res., **6(8)**:81-86.
- Tripathi, R. (2009)**. Ashtang Haridyam, published by Chaukhamba Sanskrit Pratissthan Delhi, Tenth edition, Sutra Stana, 26th Chapter Verse, pp:182.
- Raut, S.Y.; Rasale, P.L. and Tamde, A. (2013)**. A Study of changes in RBC indices after *Raktamokshana* with special reference to *Siravedha*, Int. J. of Ayu. Med., **4(3)**:165-170.
- Kashya, V. (2019)**. Raktamokshana: An ancient ayurvedic parasurgical practice and Its Applicability in Contemporary Clinical Practice, Euro. J. of Pharma. and Med. Res., **5(9)**:26-30

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