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Effect of *Rajat bhasma* and *Sweta musali* in the management of *Ksheenasukra* with special reference to oligospermia – A randomized comparative open clinical trial

Research Article

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Abstract

Background: Male infertility can be defined as an inability to induce conception due to defect in spermatic functions. It is multifactorial condition. Except some physical sperm defects low sperm count and poor sperm quality are responsible for the male infertility in more than 90% of cases. Sperm count less than 20 million/ml is considered as oligospermia. It is correlated to Kshinasukra condition. It is pathological condition of Sukra in which there is reduced sperm count and quality of sperm. In classics, many Sukra-janaka (aphrodisiac) drugs have been explained for the management of Kshinasukra. Sweta musali and Rajata bhasma are explained as vrisya drugs and widely used by practitioners in the management of male infertility. So, present study was aimed to know the effect of these drugs in the management of oligospermia. Methodology: Diagnosed cases of oligozoospermia were included in the study and divided into two groups by following a block randomization method. Group A received Sweta musali 10gms daily and Group B received Rajata bhasma 60mg daily for the duration of two months. Semen analysis was done before treatment and at the interval of 30 days till the completion of study. Results and conclusion: Sweta musali and Rajata bhasma were shown significant improvement in the sperm count, total motility and total abnormality as $p<0.05$. Comparative effect of drugs was shown almost similar effect on seminal parameters with mild variation.

Key Words: *Oligospermia, Kshina Sukra, Sweta Musali.*

Introduction

Male infertility refers to the inability of a male to achieve a pregnancy in a fertile female. In humans, it accounts for 40-50% of infertility(1). Male infertility is commonly due to deficiencies in the semen and semen quality which is used as a surrogate measure of male fecundity (2). Some of the known responsible factors for male infertility are poor semen quality, endocrine inter-relationship, testicular function, and genetic factors etc(3). Except some physical defects, low sperm count and poor sperm quality are responsible for the male infertility in more than 90% of cases (4). Low sperm count (according to WHO criteria<20million sperm/ml[5].) is called as oligospermia and which is one of the factors for male infertility.

Oligospermia or oligozoospermia, refers to semen with a low concentration of sperm and is one of the finding in male infertility. Recent study has indicated that the prevalence of oligozoospermia extremely high in metropolis as well as smaller towns of India (6). *Kshinaretas* is a condition explained in classics in which *Sukra* is reduced in middle age because of some etiological factors (7).

Vajeekarana is a specialized branch in *Ayurveda* dealing with remedies for specific problems concerned to reproductive health. Numerous *Vajeekarana* drugs have been explained in the *Ayurvedic* classics. *Sweta musali* and *Rajata bhasma* is two among those.

The objective of present clinical study was evaluating the effects *Sweta musali* and *Rajata bhasma* in the management *kshina sukra* with special reference to oligozoospermia.

Objectives

The objectives of the study are

- To know the effect of *Sweta Musali* and *Rajata bhasma* in the management of *ksheenasukra* i.e., oligospermia and other seminal parameters.
- To compare the effect of Sweta *Musali* and *Rajata bhasma* in the management of *ksheenasukra* i.e., oligospermia and other seminal parameters

Materials and Methods

Open randomized comparative clinical study was done among 42patients visiting the outpatient department of *Srusti Fetility Centre*, KLE's Ayurveda Hospital and Research Centre Belgaum for infertility

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treatment from 2013 to 2014. The known case of oligospermia patients were selected and subjected for semen analysis for confirmation of oligospermia. Informed written consent was taken before enrolling the patients for the study. Ethical clearance was obtained for this study from the institutional ethics committee and this study was also registered in the clinical trial registry of India (CTRI) vide REF/2013/07/005305

The patients were divided into two groups (Group A – *Sweta Musali* & Group B- *Rajat Bhasma*) by following computer generated block randomization plan. Out of 42 patients, 40 patients completed clinical trial and two were the drop outs one in each group.

Inclusive criteria

- Age – 20 to 45yrs.
- K/C/O of oligozoospermia i.e., sperm count less than 20million/ml (WHO criteria).

Exclusion criteria

- Individuals with any type of congenital abnormality like Cryptorchidism, Downs syndrome, hypogonadism etc.
- Individual having other systemic disorder affecting the semen quality like acute viral fever, cirrhosis of liver, chronic renal failure etc.

Drug procurement for clinical trial

Raw *Sweta Musali (Asparagus adecendens)* was purchased from Kolhapur (Maharashtra) farmhouse and authentication was done with the help *Dravyaguna* department. *Sweta Musali Churna* was prepared and packed in the 5gms sachets in the GMP certified KLE Ayurvedic pharmacy.

Rajata bhasma was purchased from GMP certified company Kashmir pharmacy (batch no 2877) and 250 mg capsule was prepared by mixing 30mg *Rajata bhasma* and 220mgs of starch and packed in GMP certified KLE Ayurvedic pharmacy.

Duration of study and intervention

The treatment period was for 63 days. Initially for 3 days, all patients were administered 10gms Haritakyadi *churna* [8](*Haritaki, Amalaka, Saindav Lavan, Vacha, Vidanga, Haridra, Shunti, Pippali* and *Guda*) at bed time with warm water for *Kostashodan* purpose and normal diet was advised. The drugs under trail were administered for 60 days. All the patients included in the study irrespective of group were instructed to maintain the regular dietetic habits and to have normal routine diet during clinical trial.

Intervention

- Group A (*Sweta Musali* group) -The patients were advised to take one sachet containing 5gms of *Sweta Musali churna* with warm milk two times a day before food for 60 days.
- Group B (*Rajata bhasma* group) -One capsule containing (30mg Rajatabhasma and 220mgs starch) was given two times a day before food along with warm milk for 60 days.

Follow up

The patients were advised to undergo semen analysis and known the *reto dusti* type before starting treatment (for confirmation of oligospermia) and advised to visit hospital on 30th day and 60th day of clinical trial for semen analysis with abstinence from sexual intercourse or masturbation of 3 to 5 days and medicine.

Criteria for assessment

The improvement in the patients was assessed mainly on the basis semenogram, especially in the sperm count and motility of sperm and *reto dusti* type as per Ayurveda.

Collection method of Semen sample

- Sample collection- All the patients were given clear oral instruction for proper collection of semen.
- Container – Wide mouth glass container i.e., 50ml glass container beakers (sterile, labelled) were used for semen collection
- Abstinence – Masturbation or sexual abstinence of 3 to 5 days.
- Method of collection – Masturbation (is believed to be the best method of collection).

Statistical analysis

The data generated in the clinical trial was analyzed by applying the student's 't 'test for objective criteria of a single group and to compare the effect of the treatment between the two groups. The obtained results were interpreted as follows

- No significant (NS): P>0.05
- Significant (S): P<0.05 or P<0.01
- Highly significant (HS): P<= 0.001

Observations

Observations were related to principal variables namely age, education, occupation, socioeconomical status, family history, marital status, type of infertility, past history, contraceptive, working pattern and also includes dietary habits etc.

Character	Categories					Number of patients	
		Group A	Group A %	Group B	Group B%	Total	Percentage
Age (years)	20-30	11	55	14	70	25	62.5%
	31-40	09	45	06	30	15	37.5%
	41-50	00	00	00	00	00	00%

Religion	Hindu	17	85	20	100	37	92.5%
	Muslim	03	15	00	00	03	7.5%
	Others	00	00	00	00	00	00%
Socioeconomical status	Poor class	03	15	02	10	05	12.5%
	Middle class	16	80	18	90	34	85%
	Rich class	01	05	00	00	01	2.5%
Infertility	Primary	17	85	18	90	35	87.5%
	Secondary	03	15	02	10	05	12.5%
Illness- past history	Yes	04	20	03	15	07	17.5%
	No	16	80	17	85	33	82.5%
Contraceptive history	Noting	18	90	20	100	38	95%
	Condom	01	05	00	00	01	2.5%
	Oral Contraceptive pills	01	05	00	00	01	2.5%
Conception history (family)	Noting significantly	20	100	18	90	38	95%
	Delayed conception	00	00	02	10	02	05%
	Infertility in siblings	00	00	00	00	00	00%
Diet	Vegeterian	04	20	03	15	07	17.5%
	Mixed diet	16	80	17	85	33	82.5%
Vihara	Shramajanya	08	40	11	55	19	47.5%
	Madyam shrama	11	55	08	40	19	47.5%
	Alpa shrama	01	05	01	05	02	02%
	No shrama	00	00	00	00	00	00%
Working condition	Normal	13	65	09	45	22	55%
	Air Conditioner	01	05	00	00	01	2.5%
	Sunlight	04	20	11	55	15	37.5%
	Near furnace	02	10	00	00	02	05%
Type of work	Mental	07	35	05	25	12	30%
	Physical	09	45	11	55	20	50%
	Frequent tours	00	00	00	00	00	00%
	Mental physical	04	20	04	20	08	20%
Psychological status	Normal	11	55	08	40	19	47.5%
	Elevated	02	10	03	15	05	12.5%
	Depressed	07	35	09	45	16	40%
Undergarment use	Cotton	05	25	07	35	12	30%
	Synthetic	15	75	13	65	28	70%
Bathing habit	Warm water	20	100	20	100	40	100%
	Hot water	00	00	00	00	00	00%
	Cold water	00	00	00	00	00	00%
Sleep pattern	Disturbed	01	05	00	00	01	2.5%
	Normal	19	95	20	100	39	97.5%
Day sleep	Yes	00	00	02	10	02	5%
	No	20	100	18	90	38	95%
Mala pravruti	Regular	19	95	19	95	38	95%
	Constipated	01	05	01	05	02	05%
Addiction	Alcohol	05	25	05	25	10	25%
	Smoking	01	05	01	05	02	05%
	Tobacco	02	10	02	10	04	10%
	Alcohol+ Smoking	02	10	02	10	04	10%
	Alcohol+Tobacco+ Smoking	03	15	03	15	06	15%
	Tobacco	00	00	01	05	01	2.5%
	No habits	07	35	06	30	13	32.5%
Fertile period knowledge	Adequate	14	70	17	85	31	77.5%
	Nil	06	30	03	15	09	22.5%
Sexual life	Satisfactory	18	90	20	100	38	95%
	Unsatisfactory	02	10	00	00	02	05%
Use of Lubricants during sex	Yes	00	00	02	10	02	05%
	No	20	100	18	90	38	95%
Kosta	*Krura*	06	30	02	10	08	20%
	Vishama	05	25	03	15	08	20%
	Tikshna	05	25	13	65	18	45%
	Sama	04	20	02	10	06	15%

Prakriti	*Vatapitta*	07	25	06	30	13	32.5%
	Vatakapha	08	40	10	50	18	45%
	Kaphapitta	05	25	04	20	09	22.5%
Ahara shakti	*Avara*	01	05	00	00	01	2.5%
	Madyam	14	70	11	55	25	62.5%
	Pravara	05	25	09	45	09	35%
Vyayam shakti	*Avara*	00	00	00	00	00	00%
	Madyam	17	85	13	65	30	30%
	Pravara	03	15	07	35	10	10%
Desha	*Anoopa*	08	40	06	30	14	35%
	Jangala	01	05	01	05	02	05%
	Sadharana	11	55	13	65	24	60%
Secondary sexual character	Well developed	16	80	17	85	33	82.5%
	Under developed	04	20	03	15	07	17.5%
Testicular examination							
Testis size	<15	01	05	00	00	01	2.5%
	15-20	08	40	04	20	12	30%
	21-25	09	45	15	75	24	60%
	>25	02	10	01	05	03	7.5%
Consistency	Firm	14	70	20	100	34	85%
	Soft	06	30	00	00	06	15%
Surface	Smooth	20	100	20	100	40	100%
	Nodular	00	00	00	00	00	00%
Epididymis	Normal	19	95	20	100	39	97.5%
	Tender	00	00	00	00	00	00%
	Enlarged	01	05	00	00	01	2.5%
Spermatic cord findings	Normal	19	95	18	90	37	92.5%
Varicocele	Bilateral	01	05	02	10	03	7.5%
	Unilateral	00	00	00	00	00	00%
Retodusti	*Tanu retas*	11	55	08	40	19	47.5%
	Picchila retas	04	20	05	25	09	22.5%
	Ruksha retas	01	05	01	05	02	05%
	Granthibhuta retas	02	10	03	15	05	12.5%
	Anyadhatusamsrita	01	05	02	10	03	7.5%
	Putipuya retas	01	05	01	05	02	05%
Sukra varna	*Sweta*	13	65	12	60	25	62.5%
	Peeta	07	35	08	40	15	37.5%
Sukra gandha	*Visraganda*	14	70	15	75	29	72.5
	Nirganda	06	30	04	20	10	25
	Putiganda	00	00	01	05	01	2.5
Sukra pramana	*Alpa (< 2ml)*	02	10	01	05	03	7.5%
	Madyama (3-5ml)	18	90	19	95	37	92.5%
	Bahula (>5ml)	00	00	00	00	00	00%
Type of oligospermia	Sever (< 5 million)	06	30	06	30	12	30%
	Moderate (5- 10miln)	04	20	03	15	07	17.5%
	Mild (11-20milllion)	10	50	11	55	21	52.5%

Results

Effect of the treatment was appreciated when the results were statistically analyzed using the parameters taken for the study. Data collected before treatment and on 60th day. There were analyzed by using paired and unpaired t-test. The results were analyzed individually of each group and were also compared.

Effect of *Sweta Musali* and *Rajata bhasma* on sperm count and other seminal parameters

In group A, there was marked improvement seen in sperm count. Before the treatment the mean score was 10.7 and increased to 20.4 after the treatment. There was change that occurred with the treatment was statistically significant as P<0.05(P value 0.0003). Indicates, the *Sweta musali* group was having significant effect in increasing the sperm count.

In group B, the mean score before the treatment was 9.9 and increased to 19.8. There was change that occurred with the treatment was statistically insignificant as P< 0.05 (P value 0.0001). It indicates *Rajata bhasma* was having significant effect in increasing the sperm count.

The results of both the groups were compared by applying unpaired t test. The p value was 0.9473 which was >0.05, indicating the difference in the effects of both the groups in increasing the sperm count was statistically insignificant. When the effect of *Sweta musali* and *Rajata bhasma* was compared on sperm count both groups have similar effect by statistical analysis.

Table no 1: Results of *Sweta musali* on seminal parameters

Parameters	Mean of differences	SD of differences	SEM of differences	P value	P value summary	Significantly different? (P< 0.05)
Semen quantity	0.2250	0.9525	0.2130	0.3040	Not significant	No
Sperm count	9.900	9.222	2.062	0.0001	***	Yes
Ph	0.0500	0.2236	0.0500	0.3299	Not significant	No
Viscosity	Sum of signed ranks (W)-7.000	-	-	0.6875	Not significant	No
Total motility	13.75	12.45	2.783	< 0.0001	****	Yes
Rapid Linear Progress	4.250	10.92	2.441	0.0978	Not significant	No
Slow Linear progress	4.500	9.854	2.203	0.0553	Not significant	No
NON progressive	3.750	9.014	2.016	0.0784	Not significant	No
Immobile	13.25	12.80	2.863	0.0002	***	Yes
Total abnormality	13.00	15.59	3.487	0.0014	**	Yes
Head abnormality	11.75	12.70	2.839	0.0006	***	Yes
Midpiece abnormality	0.8000	12.32	2.755	0.7746	Not significant	No
Tail abnormality	1.500	8.127	1.817	0.4194	Not significant	No
Headless abnormality	2.250	5.250	1.174	0.0705	Not significant	No

Table no 2: Results of *Rajata bhasma* on seminal parameters

Parameters	Mean Of differences	SD of differences	SEM of differences	P value	P value summary	Significantly different (P< 0.05)
Semen quantity	0.7000	1.174	0.2626	0.0153	*	Yes
Sperm count	9.700	9.788	2.189	0.0003	***	Yes
Ph	0.1000	0.4472	0.1000	0.3299	Not significant	No
Viscosity	Sum of Signed ranks (W) 7.000	-	-	0.6875	Not significant	No
Total motility	14.75	16.66	3.725	0.0008	***	Yes
Rapid Linear Progress	6.400	13.45	3.006	0.0466	*	Yes
Slow Linear progress	4.500	11.80	2.638	0.1044	Not significant	No
NON progressive	2.000	9.375	2.096	0.3520	Not significant	No
Immobile	9.600	30.14	6.740	0.1705	Not significant	No
Total abnormality	19.75	14.82	3.314	< 0.0001	****	Yes
Head abnormality	13.50	18.50	4.137	0.0041	**	Yes
Mid piece abnormality	2.000	10.93	2.444	0.4233	Not significant	No
Tail abnormality	1.500	8.900	1.990	0.4603	Not significant	No
Headless abnormality	0.2500	5.250	1.174	0.8336	Not significant	No

Table no 3: Comparative Results of *Sweta Musali v/s Rajata Bhasma* on Seminal Parameters

Parameters	Mean ± SEM of column A	Mean ± SEM of column B	Difference between means	P value	P value summary	Significantly different? (P < 0.05)
Semen quantity	0.7000 ± 0.2626 N=20	0.2250 ± 0.2130 N=20	0.4750 ± 0.338	0.1682	Not significant	No
Sperm count	9.700 ± 2.189 N=20	9.900 ± 2.062 N=20	0.2000 ± 3.007	0.9473	Not significant	No
pH	-0.1500 ± 0.08192 N=20	0.0500 ± 0.0500 N=20	0.2000 ± 0.09597	0.0439	*	Yes
Viscosity	Sum of ranks in column A 411.0,	Sum of ranks in column B, 409.0	-	>0.9999	Not significant	No
Total motility	14.75 ± 3.725 N=20	13.75 ± 2.783 N=20	1.000 ± 4.650	0.8309	Not significant	No
Rapid Linear Progress	6.900 ± 2.992 N=20	4.250 ± 2.441 N=20	2.650 ± 3.861	0.4967	Not significant	No
Slow Linear progress	4.500 ± 2.638 N=20	4.500 ± 2.203 N=20	0.0 ± 3.437	>0.9999	Not significant	No
NON progressive	2.000 ± 2.096 N=20	3.750 ± 2.016 N=20	1.750 ± 2.908	0.5509	Not significant	No
Immobile	14.50 ± 3.733 N=20	13.25 ± 2.863 N=20	1.250 ± 4.704	0.7919	Not significant	No
Total abnormality	19.75 ± 3.314 N=20	13.00 ± 3.487 N=20	6.750 ± 4.811	0.1687	Not significant	No

Table No 4: Type of Oligospermia Wise Distribution of Patients of Group A and Group B

	GROUP A				GROUP B			
	BT	%	AT	%	BT	%	AT	%
Severe (<5ml)	6	30	2	10	6	30	1	5
Moderate (05-10ml)	4	20	4	20	3	15	1	5
Mild (11-20ml)	10	50	4	20	11	55	9	45
>20ml	0	0	10	50	0	0	9	45

Discussion

Discussion on effect of therapies

In classics, mainly three types of *Retodusti* have been explained. Those are *Alparetas, Kshinaretas* and *Vishuskaretas*. Among these conditions *Kshinasukra* is a condition caused by the vitiation of the *vata* and *pitta dosha*. The effect of *Sweta Musali* and *Rajata bhasma* was studied on following sperm count and other seminal parameters.

Effect on Sperm Count

Sperm density is one of the main parameters determining the success of fertilization and can be a key factor for assessing the fertilization rates.

By comparing the mean differences of both the groups at different levels of the study, it was observed that the *Rajata bhasma* shown good improvement at the end of the first month as compared to *Sweta Musali* on sperm count. At the end of the second month the *Sweta Musali* had shown better results than the *Rajatabhasma*. Statistical analysis of both groups efficacy on sperm count was statistically insignificant as P>0.05(P=0.95).

It indicates that the *Rajatabhasma* and *Sweta Musali* were having almost similar effects in increasing the sperm count. Before starting therapy there were 30% of patient (6 patients) belongs to the severe oligospermia category in the both groups. At the end of the therapy 20% patients (4 patients) of severe oligospermia were improved in group A and 25% (5 patients) improved in group B. In group A, 20% of moderate oligospermia patients were there before the treatment and in group B 15% of patients of same category. At the end of two-month treatment there was no improvement observed in the moderate oligospermia patients in group A, but there was 10% improvement was seen in group B under the same category. Before the treatment, 50% were having mild oligospermia and 30% improvement was observed at the end of two-month treatment in group A. In group B, there was 55% patients were having mild oligospermia before treatment and at the end of two-month treatment 10% improvement was seen.

In both groups there was significant improvement in sperm count was observed. The improvement in the sperm may be seen because of increase in spermatogenesis.

Mode of action of drugs on seminal parameters as follows:

As *Sweta Musali* shown improvement in the sperm count it may be because of *Sukra-janaka* property of the drug. For the *Sukra poshana, madhura* and *tikta* rasa are responsible. Madura rasa of the drug may be helpful in the proper nourishment of germinal layer of the testis and to regulate the *vata dosha* activity at the spermatogenesis level. *Tikta* rasa has the karma like *pitta shaman* and *drava shoshan*. Regulation of *pitta* at testicular level also important to maintain or enhance spermatogenesis because spermatogenic activity is highly sensitive to the increase in temperature at testicular level and as pitta is *agni mahabhuta pradhana.* If there is vitiation of pitta dosha at testicular level or at *sarva dhahika pitta*, it may increase the temperature in the body or testicular level and may interfere in the spermatogenesis. Excessive thick secretions at testicular level may also inhibit the functioning of the germinal layer. To maintain normal favorable environment or media at testicular level these rasas of the drug might be more helpful, so only madhura and tikta rasa might be explained as *Sukra poshaka.* The properties of the *Sukra* and *Sweta Musali* are almost similar. So, we can infer based on the fact *sarvada sarvabhavanam samanyam vridhikaranam* that *Sweta Musali* helps in the improvement of sperm count. *Sweta Musali* is known for its Sukra-janaka property. For the optimum functioning of the all dhatus and tridosha in the body, proper nourishment of dhatus and hemostasis of *sharirika dosha* is very important. Thus, we can say that *Sweta Musali* is more helpful in the oligopsermia which is caused because of the *apatarpana janyanidanas. Sweta Musali* might be helpful in maintaining the normal healthy integrity of the germinal layer of the testes by proper nourishment. By this spermatogenic activity will be enhanced and there will be increase in the sperm count. If person is of *vata prakriti* and emaciated because of improper nourishment of the bodily constituents, for such persons *Sweta Musali* will be more helpful in increasing the sperm count by doing the *Rasadi Dhatu Poshana* of the body. Thus, we can say that *Sweta Musali* will be helpful in oligospermia conditions caused by *Apatarpanakar Nidanas*.

Rajata bhasma is having *Amla* and *Madura rasa*, *laghu –snigdhagunas*, *sheetaveerya* and *madhuravipaka*. *Amla rasa* is *pitta shamaka*, *srotoshodaka* and increases the secretions in the body by stimulatory action. When there is increase in the *kharatva* of the *srotasa* because of vitiated *pitta dosha*, at that time *amla rasa* drugs will be more helpful in the treatment i.e., to subside or to correct vitiated *pitta* and maintain the normal secretory function of the *srotasa*. As there is *madhura* is *anurasa* in the *Rajata* it helps to bring normal functioning capacity of the *srotasa* by doing the *tarpana karma* of the *srotasa*. So, we can say that the oligospermia may occur because of vitiated *pitta dosha* (cause may be *Aharja*, *Viharaja* and *Aghantuja*), secondary to infections of genital organs, hypo-spermatogenesis because *dosha avarana* or may be maturation arrest. Here *Rajata bhasma* helps in restoring the integrity of the *Shukravaha srotas* by correcting the doshic vitiation at the *dhatu* and *srotasa* level. Once the integrity of the *mulastana* of *Shukravahasrotas* is maintained normal spermatogenesis will be going to restore. In this way *Rajata bhasma* may be helpful in the management of the oligospermia caused by above mentioned causes.

On Sperm Motility

Normal spermatozoa exhibit motility ranging from fast progressive to slow progressive. The spermatozoa move at the speed of 25µ/sec or 3 mm/hr. A normal ejaculate has at least 25 percent fast progressive or 50 percent slow progressive spermatozoa.

The single most important factor responsible for changes in ATP content and sperm motility was the temperature and the medium respectively (9). Considering this point, we can say that *pitta dosha* is responsible for the maintenance of the temperature in the body as well as at testicular level and it also maintains the viscosity of the bodily fluids. Sperm motility depends on the proper nourishment and medium through which sperm moves. Thus, we can say that *madhura rasa* of the drug may help full in the nourishment by providing carbohydrates to the cell. The energy which is liberated by the breakdown of carbohydrate in the mitochondria of the sperm is responsible for the motility of sperm. *Sweta Musali* is rich carbohydrate content and it is having *madhura rasa*, *madhura vipaka* and it is source of carbohydrate. Because of these properties the *Sweta Musali* group has shown significant improvement in the rapid linear progression of the sperm in this clinical trial. Active sperms might utilize the energy source of *Sweta Musali* of ATPase which is derived by breakdown of carbohydrates at the mitochondria and which might have helped in increasing the sperm motility i.e., RLP. The effect of *Sweta Musali* on slow progressive, non-progressive and immotile sperms showed statistically insignificant effect. But by observing the mean differences, there was minimal increase in motility on SLP and NP also. This clinical trial includes only 20 patients in a single group, so it is difficult to conclude the effect of *Sweta Musali* on these parameters. Hence study can be extended with larger sample size.

Effect of *Rajata bhasma* was studied on the sperm motility. It has shown statistically significant improvement in immotile sperms. The numbers of immotile sperm were significantly reduced in *Rajata bhasma* group. Following factors might be responsible for immobility of the sperm,

- Hampered glucose metabolisms and ATPase derivation at mitochondrial level
- Increased viscosity of the medium.
- Improper utilization of glucose by sperm because of deprived metabolism.

Metabolism of the glucose in the whole body is maintained by the *pitta dosha* dominantly. *Karmataha kshaya* of the *pitta* at testicular level might be responsible for the immobility of sperm. *Pitta* is the *dosha* which is responsible for the maintenance of *Urjha* (energy) in the body. Because of hypo functioning of the *pitta dosha* at testicular level and

sperm level, the utilization of glucose and the energy liberation at mitochondria is also going to hamper. Body functions and cellular normal activity are maintained by the equilibrium of *tridoshas*. Thus, for the mobility of sperm *vata* and *pitta dosha* are responsible. The *laghu* and *chala guna vata* and production of energy by piita dosha from the mitochondria required to maintain the sperm mobility. *Amla rasa* and *laghu guna* of the *Rajata bhasma* might have helped to mobilizing the immotile sperm. *Amla rasa* might be helpful to correct the hypo functioning of the pitta and which might ultimately help in improving metabolism at mitochondria level. Once metabolism improved at mitochondria level, energy (ATPase) production is going to increase, which ultimately helps in increasing the motility of the sperm. *Amla rasa* also helps maintaining the normal consistency of medium by regulating the secretions at testicular level. *Laghu guna* of *Rajata bhasma* might be helpful in bringing the lightness in the sperm by removing the *avarana* to the sperm. Thus, *Amla rasa* and *Laghu guna* of *Rajata bhasma* might be mainly helped in reducing the number of immobile sperm. *Rajata bhasma* has not shown any significant improvement on RLP and NP. But clinically improvement is seen in these parameters also. Both groups have shown significant improvement in the total motility statistically.

On Semen pH

Seminal plasma has a unique biochemical composition to support normal spermatozoa functions(10).. Semen is strongly alkaline. The pH ranges from 7.3 to 8.0. The secretions of the seminal vesicles contribute to the alkalinity of the semen. Semen is the strongest buffer in the body. The alkaline semen buffers the acidic environment of the vagina. pH will be known as an important factor in sperm development (11) and with other external factors appears a key role in the sperm physiology. pH may be considered as an important factor leading to sperm activation. The effect of higher pH on increasing of sperm motility has been reported on rainbow trout (12). Reduce of pH from 8 to 7.5 in the sperm of Atlantic cod (*Gadusmorhua*), made severe reduction in percentage of spermatozoa motility and velocity (13). Ingermann*et al* (2002) reported that the initiation of sperm motility has been inhibited at Ph 7.5 and the maximum motility rate shown at Ph 8.2 in white sturgeon. A significant decrease of hatching rate by decreasing semen Ph was observed [122]

In this clinical trial, in group A, the average of pH before treatment was 8.6 and after the treatment were 8.5. The mean difference between the pH is 0.1. This difference in the pH value is non-significant statistically. In group A, the pH of the semen was slightly reduced. But the seminal pH remains towards alkaline only. Hence it might have not affected the motility and density of the sperm in this study. Up to what extent the *Sweta Musali* is going to reduce pH is to be studied on larger samples so that it may affect the motility and density by reducing pH significantly.

In group B, the average pH before treatment was 8.25 and at end of two-month treatment average pH were 8.3. The mean difference of 0.05 indicates the *Rajata bhasma* has slightly increased the alkalinity of the semen even though shown statistically insignificant. This increased alkalinity of the semen might be also helped in the increasing motility in the *Rajata bhasma* group. As the semen alkalinity is maintained and increased, it might have also helped to maintain sperm density.

On Semen Volume

The normal ejaculate has a volume of about 2 to 6ml. The major contribution to the seminal volume is from the seminal vesicles (70%). Prostate contributes to 20 percent of the seminal volume. Testes and bulbourethral glands contribute 5 percent each(14).

By comparing the mean differences of both the groups at different levels of the study, it was observed that the *Sweta Musali* had shown good improvement at the end of the second month as compared to *Rajata bhasma*. While comparing the efficacy of both drugs in increasing semen volume shown statistically insignificant as P>0.05(P=0.1682). It indicates that the *Rajata bhasma* and *Sweta Musali* were having almost similar effects in increasing the semen volume.

Semen is a secretion of accessory glands and testis. Thus, to increase the semen volume secretion of these glands must be increased. Proper secretion of the glands is only possible when these glands are well nourished and it possible with proper nourishment of *rasadi sapta dhatu*. *Sweta musali* is drug which is useful for nourishment of *rasadi sapta dhatu* by its *madhura rasa, madhura vipaka* and *ushana veeya*. *Apatarpana* is one of the causes for *sukra kshaya* i.e., semen volume. and it is corrected with *santarapan chikitsa* of *sukra*. It might be fulfilled with the *santarpana karma* of *Sweta Musali* and might be helped in the increasing the secretions of secretory glands of male reproductive system. As in this clinical trial semen volume increased, which is suggestive of *santarpana* function of *sweta Musali.*

On Total abnormality

It was observed that the *sweta musali* had shown good improvement at the end of the second month as compared to *Rajata bhasma*. While comparing the efficacy of both drugs on total abnormality shown statistically insignificant as P>0.05(P=0.1687). It indicates that the *Rajata bhasma* and *sweta Musali* were having almost similar effects on sperm abnormality. There was statistically non-significant improvement in both groups on other abnormalities like mid piece, tail and headless but clinically mild improvement was seen in these parameters also.

The improvement in the abnormality of sperm might be reduced because of increased production of new healthy sperms or might be improvement because of drugs action on abnormality. As previously explained both groups helped in increasing sperm, so there might be count of abnormal sperm might be reduced or *tikta rasa* of the drug might be helped in this condition to correct the abnormality.

On Viscosity

The *Sweta Musali* group average of viscosity before the treatment was 1.4 and after the treatment it was 1.3. There were 0.1 differences in the viscosity of semen at the end of second month of treatment. In group B also, there is 0.1 mean differences. Both the groups have shown non-significant improvement statistically. *Sweta Musali* is of *ushna veerya* drug. This property of the drug might be helped to maintain the viscosity of semen. *Amla rasa* and *laghu guna* of the *Rajata bhasma* might be helped in reducing the viscosity of the semen.

Conclusion

Present study was carried out on total 40 diagnosed cases as *Kshinasukra,* which can be compared with Oligospermia in contemporary science. Patients were divided into two groups by following block randomization method. Group A consists of 20 patients and given *Sweta musali*, Group B consists of 20 patients and given *Rajata bhasma*. The statistical analysis revealed both the drugs shown highly significant results in increasing the sperm count, motility and total morphological abnormality especially on head abnormality. *Sweta musali* had shown better results than *Rajata bhasma* in increasing semen quantity and RLP. *Rajata bhasma* had shown significant results in increasing the motility of immotile sperms as compared to *Sweta musali. Rajata bhasma* had shown tendency towards increasing the alkalinity of semen by increasing the pH, *whereas Sweta musali* slightly decreased the Ph. But changes in pH are statistically insignificant in both groups. No significant changes observed on Viscosity, SLP and NP in both the groups. By comparing the efficacy of both the drugs on different seminal parameters revealed no significant difference statistically. It indicates both the drugs are equally effective in the treatment of *Kshinasukra* (Oligozoospermia). As seminal parameters are highly variable from one analysis to another, studies with larger samples may confirm the present finding.

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