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Inductively Coupled Plasma - Optical Emission Spectrometry Analysis of Siddha Formulation *POONAGA PARPAM*

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Abstract: ***POONAGA PARPAM is one of the effective herbal and animal origin siddha formulation, which is used to treat Vindhu kuraivu (Oligospermia), Vindhu velippadu (Spermatorrhea). In Siddha system most of the medicines are effective but the lack of standardization, so there is a need to subject it into standardization. This paper revealed the therapeutic safer level of heavy metals and other elements present in Poonaga parpam with scientific documentation, as per WHO guidelines with the help of simultaneous ICP-OES analysis equipment (PERKIN ELMER OPTIMA 5300 DV).***

Keywords: *Poonaga parpam*, Siddha, ICP-OES, Elements, Male infertility

1.Introduction

Siddha system is one of the oldest systems of medicine discovered in the South India. Siddha system of medicine talks more about moral principle and moral guidance which is extremely relevant to our present day health care system. The Siddha System emphasizes that the treatment of a patient should be based not just on the disease but also his physical, mental and spiritual state. The Siddha system has developed a rich treasure of medicinal knowledge that includes the use of herbs, metals, and minerals as well as marine and animal products. Now a day's people interest on Siddha medicine has taken up great dimension in changing the health care scenario across the globe. Several animal products are being utilized for medicinal purposes in Siddha System. ***"POONAGA PARPAM"*** is one of the effective herbal and animal origin siddha formulation which is used to *treat "Vindhu kuraivu, Vindhu velippadu"* in addition it provides *"Vindhu viruthi, Thathu valimai, Udal valimai, Udal valamai* [1]. In siddha system of medicine, "*Thathu kuraivu, Thathu busti kuraivu (Vindhu kuraivu)",* was compared to oligospermia (scantiness of seminal secretion) and *"Indhiriya veenum", "Sukila kuraivu"* was compared to oligospermia (decreased secretion of semen), and "*vindhu velippadu"* was compared to Spermatorrhea [2]. ICP-OES (Inductively coupled plasma-optical emission spectrometry) is a technique in which the composition of elements in samples can be determined using plasma and a spectrometer. This study is aims to detect heavy metals (lead, cadmium, mercury, arsenic) and other elements within the permissible limits as per WHO guidelines present in the siddha drug *poonaga parpam* with the help of simultaneous ICP-OES analysis equipment (PERKIN ELMER OPTIMA 5300 DV). In present scenario standardization is need to prove the safety level of any medicine. This may help the acceptance of medicine worldwide.

2.Objective

The objective of the present study is to detect heavy metals (lead, cadmium, mercury, arsenic) and other elements within the permissible limits as per WHO guidelines present in the siddha formulation *poonaga parpam*.

3.Materials and Methods

Table 1: Ingredients of trial drug *Poonaga parpam*

S. No	Tamil name	English name	Family	Zoological name / Botanical name	Parts used	Quantity
1	*Poonagam*	Earth worm	Lambricidae	*Lumbricus terrestris*	whole	2 Palam (70gm)
2	*Pulippu mathulai*	Sour Pomegranate juice	Punicaceae	*Punica granatum*	*Fruit pulp*	*S. Q*

Collection of raw drugs

Poonagam collected at Sengappadai village, Thirumangalam taluk, Madurai district and *Pulippu mathulai* collected at Tirunelveli district.

Authentication of raw drugs:

All the above drugs are Authenticated by Dr. G. Essakkypandian M. D (S)., Reader, Department of PG Gunapadam, Government Siddha Medial College and Hospital, Palayamkottai.

Purification and Preparation of *poonaga parpam*:

The purification and preparation process were done according to the procedures mentioned in the classical Siddha literature, Anuboga Vaithiya Navaneetham part - III.

Dosage: 2 - 4 *Kundrimani (*260-520 mg).

Adjuvant: Honey

Indication:

Vindhu kuraivu (Oligospermia), Vidhu velippadu (Spermatorrhea), Vindhu viruthi (Spermatogenesis), Thathu valimai (Virile power), Udal valamai (Alterative), Udal valimai (Tonic)

ICP-OES Study of POONAGA PARPAM:

ICP Optical Emission Spectrometry Principle

ICP, abbreviation for Inductively Coupled Plasma, is one method of optical emission spectrometry. When plasma energy is given to an analysis sample from outside, the component elements (atoms) are excited. When the excited atoms return to low energy position, emission rays (spectrum rays) are released and the emission rays that correspond to the photon wavelength are measured. The element type is determined based on the position of the photon rays, and the content of each element is determined based on the rays' intensity. To generate plasma, first, argon gas is supplied to torch coil, and high frequency electric current is applied to the work coil at the tip of the torch tube. Using the electromagnetic field created in the torch tube by the high frequency current, argon gas is ionized and plasma is generated. This plasma has high electron density and temperature (10000K) and this energy is used in the excitation-emission of the sample. Solution samples are introduced into the plasma in an atomized state through the narrow tube in the centre of the torch tube.

Equipment

Equipment for ICP optical emission spectrometry consists of a light source unit, a spectrophotometer, a detector and a data processing unit. There are several types of equipment based on differences in the Spectrophotometer and the detector. The most common type is shown in Figure 1.

1) Sequential type

A spectrophotometer with a Czerny-Turner monochrometor, and a detector with a photomultiplier is most common for this type. With this equipment, programmed wavelength of the spectrophotometer is consecutively varied to measure multiple elements. This causes rather long measuring time, however, with its high resolution spectrophotometers, it is favourable for measurement of high-matrix samples.

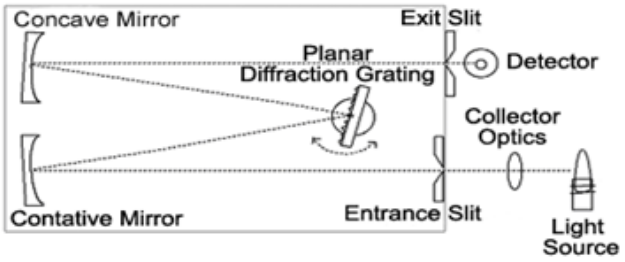

Figure 1: Sequential Type ICP-OES

2) Simultaneous Type

This type typically uses an echelle cross disperser in spectrophotometers and semi-conductor detector such as CCD for the detector. Echelle cross disperser disperses light of measurable wavelength range two-dimensionally by combining prism and echelle diffraction grating. Combination of echelle cross disperser and a CCD detector enables multi-element measurement at any wavelength. The most notable feature of this equipment is the high-speed measurement, providing information on all 72 measurable elements in measurements of 1 to 2 minutes normally.

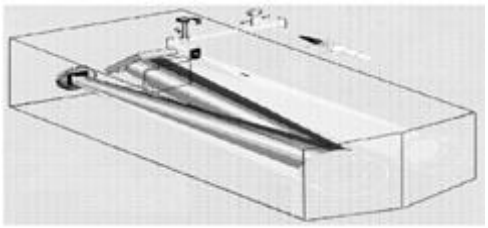

Figure 2: Simultaneous ICP-OES

Sample preparation: 0.5g of poonaga parpam drug is measured, and then dissolved in a decomposition vessel with nitric acid into 10ml solution. Partial spectral profile and analysis results shown below.

4.Result

Poonaga Parpam sample: Wt. (0.5100130g)

Table 2: Elements of the poonaga parpam

S. No	Elements	Wavelength	Concentration
1	C	193.03	185.210 mg/L
2	As	188.979	BDL
3	Ca	315.807	23.870 mg/L
4	Cd	228.802	BDL
5	Cu	327.393	320.980 mg/L
6	Fe	238.204	01.700 mg/L
7	Hg	253.652	BDL
8	K	766.491	01.223 mg/L
9	Mg	285.213	BDL
10	Na	589.592	02.009 mg/L
11	Pb	220.353	BDL
12	P	213.617	96.301 mg/L

13	**S**	**180.731**	**BDL**
14	**Zn**	**206.2**	**01.900 mg/L**

BDL - Below Detectable Limit

5.Discussion

Heavy metals

Heavy metal Viz. **lead (Pb), cadmium (Cd), mercury (Hg), arsenic (As)** of *Poonaga parpam* on table 2 was found to be within the permissible limits as per WHO guidelines.

Role of the other elements in spermatogenesis, Aphrodisiac and Antioxidant activities

Human semen contains several trace elements such as calcium (Ca), copper (Cu), manganese (Mn), magnesium (Mg), zinc (Zn) and selenium (Se) which are necessary for reproductive health, normal spermatogenesis, sperm maturation, motility and capacitation, as well as normal sperm function. Decreased level of these trace elements can negatively affect human reproductive health, semen quality, sperm normal function and as the result, fertility potency in men [4].

Calcium (Ca)

Calcium (Ca) is a significant element that acts as an intracellular second messenger. It is necessary for many physio-logical processes in spermatozoa including spermatogenesis, sperm motility, capacitation, acrosome reaction and fertilization. Although influences of Ca deficiency on sperm function and male infertility have been widely studied, mechanisms for these abnormalities are not well considered. Poor sperm motility, impairment of chemotaxis, capacitation, acrosome reaction and steroidogenesis are the major mechanisms by which Ca deficiency induces male infertility. Therefore, an optimal seminal Ca concentration is required to strengthen sperm function and all steps leading to successful fertilization [3]. Ca is essential for sperm motility and its hyperactivation, sperm capacitation and acrosome reaction, as well as sperm chemotaxis [4].

Sodium & Potassium (Na & K)
Sodium (Na) and potassium (K) are involved in sperm motility and capacitation [4].

Magnesium (Mg)
Mg is necessary for normal ejaculation, spermatogenesis and sperm motility [4].

Zinc (Zn)
Zn is one of the most significant nutrients in human semen. Seminal deficiency of Zn can be associated with delayed testicular development, impaired spermatogenesis, deficiency of sex hormones, oxidative stress and inflammation, and apoptosis [4].

Copper (Cu)
Copper is a very reactive element and in its free state, it can trigger the production of large amounts of free radicals, which will consequently lead to the damage of proteins and DNA. Because of those reasons, living organisms have developed precise mechanisms regulating the concentration of copper in cells. Copper also plays a very important role in male fertility. It is an essential element for the production of male gametes [5].

Like Se, Cu has antioxidative properties and has a positive effect on sperm parameters [4].

Iron and copper (Fe & Cu)
Iron and copper are essential trace nutrients playing important roles in general health and fertility. However, both elements are highly toxic when accumulating in large quantities. Their direct or indirect impact on the structure and function of male gonads and gametes is not completely understood yet. Excess or deficiency of either element may lead to defective spermatogenesis, reduced libido, and oxidative damage to the testicular tissue and spermatozoa, ultimately leading to fertility impairment [6].

6.Conclusion

In this result finding were; Heavy metals (lead, cadmium, mercury, arsenic) are found to be within the permissible limits as per WHO guidelines. The other elements (Ca, Cu, Fe, Zn, Na, K, Mg) of *Poonaga parpam* on table 2 are found to have spermatogenesis, Aphrodisiac, Antioxidant activities. *Poonaga parpam* was free from toxicity there by proving the safety of its utilization in siddha system. This study provides a step for scientific validation of *Poonaga parpam.*

7.Future Scope

Clinical trial can be done in *poonaga parpam* to find out spermatogenesis, Aphrodisiac and Antioxidant activities.

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