SEMINAL FRUCTOSE IN VARIOUS CLASSES OF INFERTILE PATIENTS

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Background: A great number of substances have been found in sperm plasma but so far it has not been possible to provide evidence of clinical significance for all of them. Fructose occupies the most important place in biochemical investigations. Fructose acts as a donor of energy to the spermatozoa. Fructose is secreted from the seminal vesicles and the accessory sex glands. It is the major carbohydrate found in seminal plasma, and appears essential for normal sperm motility. We present results of a prospective study of seminal fructose in patients referred for routine semen analysis prior to infertility treatment. **Methods:** Qualitative measurement of fructose in seminal fluid was carried out by Resorcinol method. **Results:** Fructose level in various groups of male infertility, and sperm concentration in various groups was estimated. They were classified as azoospermic, oligozoospermic, polyzoospermic, normozoospermic, asthenozoospermic, and teratozoospermic on the basis of sperm concentrations, motility and morphology respectively. **Conclusion:** It is indicated that the true corrected fructose level is a simple method for assessment of the seminal vesicular function.

Keywords: Infertility, fructose, semen

INTRODUCTION

A great number of substances have been found in sperm plasma but so far it has not been possible to provide evidence of clinical significance for all of them. In the light of most recent knowledge, fructose occupies the most important place in biochemical investigation. In 1945, Mann identified fructose in the form of methyl-phenyl-fructosazone. Fructose acts as a donor of energy to the spermatozoa, which break it down selectively and convert it into energy. The motility of spermatozoa is very closely connected with fructose break down.[1] The importance of fructose in sperm plasma lies in its anaerobic conversion into energy. Glucose, as well as galactose, is also present in seminal fluid, although to a much lesser extent. It has been demonstrated that there is a definite ratio between the fructose level and the number of spermatozoa in the ejaculate; therefore, an increase in the number of spermatozoa is usually accompanied by significant fall of fructose in the semen.[2] As the number of spermatozoa increases, an increase of total estrogens in the sperm plasma also occurs.[1]

Fructose and citric acid are reported to play important roles in sperm motility and concentration, particularly with regard to energy metabolism.[3] Fructose and citric acid are closely involved in certain aspects of energy metabolism, through glucose utilization. Fructose is one of the major energy yielding nutritive substrates present in human seminal fluid.[4] A study conducted in 1997, shows that low levels of seminal fructose are positively correlated with low seminal volume, low sperm motility and high sperm chromatin stability under SDS and EDTA treatment.[5]

Fructose is secreted from the seminal vesicles and the accessory sex glands. It is the major carbohydrate found in seminal plasma, provides over half the spermatozoa carbohydrate consumption and appears essential for normal sperm motility. The determination of fructose itself is of particular significant because there is a direct relationship between the fructose level in sperm plasma and the testosterone function of the interstitial cells of Leydig. Fructose values which fall below normal may be a consequence of inflammation in the prostrate or seminal vesicles, or structural abnormality of the seminal vesicles and their ducts.[1]

Seminal fructose is often routinely measured in the assessment of seminal vesicle function and male factor infertility. Clinical studies of the role of seminal fructose content on semen parameters are miscellaneous. The decrease and normal level of seminal fructose in oligozoospermic and azoospermic men, when compared with normozoospermic men has been reported.[6,7]

We present the results of a prospective study of seminal fructose in patients referred for routine semen analysis prior to infertility treatment.

MATERIAL AND METHODS

The present study was carried out in the Department of Reproductive Physiology/Health, Public Health Laboratories Division, National Institute of Health Islamabad. A total of 2,000 subjects were referred for analysis from different infertility clinics, to Reproductive Physiology/Health, National Institute of Health, Islamabad in a 5 year period from 2002 to 2005. Out of these, 1521 subjects were analysed and

included in the study, along with 97 proven fathers as control, while the rest were unable to fulfil the criteria.

Inclusion Criteria

Patients with primary and secondary infertile males without treatment and having no relatable cause of male infertility were classified in different groups, based upon their semen picture. The patients were enquired about their abstinence period and were informed that the ideal period is 2 to 7 days. Semen samples were obtained through masturbation and were ejaculated into clean wide mouthed plastic containers, which had already been confirmed to be non-toxic to spermatozoa.

Exclusion Criteria

The subjects, who had undergone pelvic surgery or hernia repair, patients with diabetes mellitus, thyroid disease and subjects who were on drug e.g. antipsychotic, antihypertensive, neuroleptic and alcohol, nicotine were not included in this study.

Semen examination of the patients visiting the Reproductive Physiology/Health Laboratories of the National Institute of Health, Islamabad, was carried out according to the standardised method of the World Health Organisation.[8,9] A complete medical history of the patients was recorded.

The collection and analysis of semen were done by properly standardised procedures as mentioned in WHO Laboratory Manual (1980). After taking history of the patients, following instructions regarding the collection of semen were followed:[10]

a. The samples were collected after a minimum period of 48 hours but no longer than seven days of sexual abstinence. The name of the patient, the period of abstinence, the date and time of collection and interval between collection and analysis were recorded in the Performa.
b. The semen was obtained by masturbation into a clean, sterile wide mouthed plastic semen container.
c. The semen was passed in privacy of a room adjacent to the laboratory.
d. The semen containers were labelled with the patient's name, registration number, date and time of collection.
e. Incomplete or spilled semen samples were not analysed, and were repeated.
f. Semen mixed with water, urine, or any other materials were also rejected and repeated.
g. The semen samples were protected from extremes of temperature during transport to the laboratory.

Qualitative measurement of fructose in seminal fluid was carried out by Resorcinol method.[11]

Statistical analysis of the results was performed by using SPSS version 10.

RESULTS

Fructose present in various groups of male infertility and sperm concentrations in various groups are represented in Table-1 and 2, after classifying the subjects as azoospermic, oligozoospermic, polyzoospermic and normozoospermic on the basis of their sperm concentration, and asthenozoospermic and teratozoospermic on the basis of sperm motility and morphology.[8,12] Men who had successfully impregnated their wives without any assisted method during the last six months, and thus exhibited their fertility potential, were placed in the proven fathers' group.

Table-1: Presence of seminal fructose in various infertile and control groups

Groups	Total Subjects, n (%)		
	Total	Fructose Present	Fructose Absent
Azoospermic	203 (13.3%)	190 (93.6%)	13 (6.4%)
Oligozoospermic	353 (23.2%)	345 (97.8%)	8 (2.2%)
Asthenozoospermic	535 35.2%	515 (96.3%)	20 (3.7%)
Oligoasthenozoospermic	159 (10.5%)	142 (88.9%)	17 (11.1%)
Teratozoospermic	37 (2.4%)	37 (100.0%)	00 (0.00%)
Normozoospermic	221 (14.5%)	217 (98.3%)	4 (1.7%)
Polyzoospermic	13 (00.9%)	13 (11.0%)	00 (0.00%)
Proven fathers	97	97 (100%)	00 (0.00%)
Total	**1521**	**1459**	**62**

Table-2: Sperm concentrations in various groups of infertile cases and control group

Groups	Subjects	Sperm Concentration (million/ml)	
Azoospermic	203 (13.3%)	0.00±0.00	a
Oligozoospermic	353 (23.2%)	6.99±0.35	b
Asthenozoospermic	535 (35.2%	50.11±2.12	c
Oligoasthenozoospermic	159 (10.5%)	4.45±0.42	d
Teratozoospermic	37 (2.4%)	5.64±1.15	bde
Normozoospermic	221 (14.5%)	67.49±3.51	f
Polyzoospermic	13 (00.9%)	402.23±39.70	g
Proven fathers	97	102.12±1.34	h

Means sharing a common letter do not differ significantly, others differ significantly ($p<0.05$)

DISCUSSION

Due to the nature of the study population, the patients included possessed a varying degree of fertility potentials and to our knowledge; it is one of the largest and first ever prospective study of its nature, conducted in Pakistani population.

The clinical value of biochemical analysis of sperm is still unclear. A study was evaluated to see the potential of several biochemical markers in the seminal plasma (zinc, citrate, acid phosphatase, fructose and neutral alpha-glucosidase) as a screening method in male infertility investigation, and to examine the relationship between semen quality and the seminal plasma components carnitine, alpha-glucosidase, fructose, citrate and granulocyte elastase in infertile men when compared with a normal population. It had been concluded that for the differential diagnosis of

azoospermia, only the determination of the neutral alpha-glucosidase activity had proved to be useful.[13,14]

In another study, the relationship between seminal fructose concentration and sperm characteristics was investigated in semen of 187 suspected infertile men without evidence of disturbances in the seminal vesicular function. Sperm density, viability, motility, morphologically oval sperm, and 10 categories of defective spermatozoa (small, large, amorphous, round-head, double-head, pin-head, tapering, mid-piece defects, tail defects, and combined defects) were assessed in 6 levels (0–>5.0 mg/dl) of seminal fructose concentration. None of the sperm characteristics analyzed had shown statistically significant differences among the study groups.[15]

Clinical studies of the role of seminal fructose content on semen parameters are miscellaneous. Little correlation between seminal fructose concentrations and seminal activity was reported by some investigators. However decreased fructose concentrations with increasing sperm density and motility have been observed.[16] It has also been reported that seminal fructose showed decrease level in oligozoospermic and azoospermic men, when compared with normozoospermic men[7], but these findings are in contrast to the other studies, which showed normal level of seminal fructose in severely oligozoospermic males.[6] In our study, we find that percentage of seminal fructose absentia is more profound in oligoasthenozoospermia (11.1%), and azoospermia (6.4%), while it is less examined in asthenozoopsremia (3.7%). These findings are in agreement with a previous study.[7]

CONCLUSION

The true corrected fructose level is a simple method for the assessment of the seminal vesicular function. The true corrected fructose defined as [log motile sperm concentration] × [seminal fructose concentration] has been shown to be a better marker of the seminal vesicle function.

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