

MALE INFERTILITY: LIFESTYLE AND ORIENTAL REMEDIES

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Introduction

Male reproductive health refers to a man's ability to procreate, and to bring a living being into existence. Male reproductive health has social and psychological impact on normal life (Smith *et al.*, 2009). A normal male reproductive health is a compound result of normal functioning of male reproductive system. In the last 50 years, a significant decrease in human fertility has been observed. It has also been stated that 15% of couples have fertility problems. Among infertile couples, it is man who is responsible for 50% cases of infertility. The studies indicate that 6% of men aged 15-44 years are infertile or their fertility is significantly compromised (Smith *et al.*, 2009). Reports in recent years have shown that incidence of male infertility has increased as a result of various factors such as environmental pollution, stress and lifestyle (Mendiola *et al.*, 2009). Although there are several lifestyle factors which contribute to male factor infertility, we will focus in this review on only certain factors such as psychological stress, genital heat stress, smoking, and alcohol, and these are responsible for decline in male reproductive health directly or indirectly.

Psychological Stress

Many forms of stress including psychological can affect male fertility and reproduction. The autonomic nervous system and the adrenal hormones participate in the classic stress response while also affecting the reproductive system. In animals, social stress, high altitude, surgery, and immobilization stress affect body weight, testosterone level, and copulatory behavior with variable effects on testicular morphology. Stress applied to the pregnant rat also affects the development and sexual behavior of the male offspring (Gulati and Ray, 2011). Evidence exists that mild-to-severe emotional stress decreases testosterone and interferes with spermatogenesis in the human male (Hall and Burt, 2012). It has been observed that some seminal antioxidant contents, as well as



motility and morphologically normal spermatozoa decrease in students undergoing examination stress (Lampiao, 2009). Further, reports indicate that work stress disturbs the LH pulse, which is responsible for erectile dysfunction and poor semen quality (Negro-Vilar, 1997). In males involved in IVF procedures, the quality of the semen sample obtained on the day of egg retrieval was significantly worse than the quality of the first sample analyzed in the same patients. The decline in semen quality in the second sample was attributed to the psychological stress involved in that clinical process (Clark *et al.*, 1999).

Genital Heat Stress

Normal sperm production depends on an optimal testicular temperature maintained below body temperature (typically between 34-35°C) (Mendiola *et al.*, 2009). The temperature range for spermatogenesis is critical such that lower temperature reduces metabolic rate and sperm can be stored for longer (Ivell, 2009). It is well known that the increased temperature of the scrotum affects spermatogenesis, so the formation of sperm. A relationship between fever and deteriorated semen quality has been reported. Duration of sitting during work positively correlates with daytime scrotal temperatures and this negatively correlates with semen quality. Fertility parameters of professional drivers with long periods of sitting in vehicles are also reported to be impaired (Jung and Schuppe, 2007). Wearing tight fitting compared with loose-fitting underwear is associated with significantly higher scrotal temperatures. Oligozoospermic men with varicocele have significantly higher scrotal temperatures than normozoospermic men, and varicocelectomy has been shown to normalise scrotal temperatures (Paul *et al.*, 2009).

Smoking

Cigarettes contain more than 4000 chemical compounds and at least 400 toxic substances. Smoking is associated with numerous pathologies such as lung cancer and heart disease, and these have been extensively studied and reported. On the other hand, however, the effect of smoking on infertility and sexual dysfunction is rarely described. As a result, awareness about these additional ill effects of smoking is limited. The harmful effects of cigarette smoking on human male fertility are now clear. The association of smoking and male sexual dysfunction has been found in both epidemiologic and clinical studies. The endothelial dysfunction that results from smoking and causes coronary artery disease also affects the penile vasculature, which is critical for initiating an erection. Available evidence suggests an association between smoking and erectile dysfunction (Kumar, 2010).

Smoking is associated with high levels of lead and cadmium in the blood, and these elevated levels have also been found in the semen of infertile smokers who had poorer semen parameters than nonsmokers. Smoking affects sperm concentration, motility and morphology. Smoking is associated with a 48% increase in seminal leukocyte concentrations, 107% increase in ROS levels, and a 10-point decrease in ROS-TAC scores (Saleh *et al.*, 2002). Further in smokers, an increased risk of sperm aneuploidy,



alterations in sperm plasma membrane phospholipids asymmetry and sperm DNA fragmentation have been documented (Mendiola *et al.*, 2009).

Alcoholism

Alcohol intake has long been associated with reproductive health disorders such as impotence or testicular atrophy. In men, alcohol reduces testosterone levels. A report showed that testosterone levels fell just after five days among normal healthy men who were given alcohol, and continued to fall throughout the four-week study period (Emanule and Emanule, 2001). A lack of testosterone leads to loss of libido and reductions in sperm quantity and quality. In some reports, alcohol is directly toxic to the testes (Gaur *et al.*, 2010). Alcohol also depresses the central nervous system, affecting sexual performance. Men may find it difficult to get and maintain an erection – otherwise known as brewer's droop – and control their ejaculation (Wright *et al.*, 1991). Alcohol may also affect the structure and movement of sperm by stopping liver from properly metabolising vitamin A, which is necessary for sperm development (Leo and Lieber, 1982). Zinc is an important mineral in the formation of the sperm cells outer layer and tail. Zinc deficiency has been detected in men who have low sperm counts. Sperm cells need strong tails for good motility (the ability to move and swim and penetrate an egg). Alcohol also drastically inhibits the absorption of zinc. Alcohol consumption has therefore been linked to the production of abnormal sperm cells with deformed heads and tails (Emanule and Emanule, 2001).

Oriental Remedies

Male infertility by itself does not threaten the life, but it has devastating psychosocial consequences on infertile male, because an infertile man is generally treated as an incomplete man in Indian subcontinent (Mishra and Singh, 2008a). There is no specific medication for the management of male infertility in modern medicine. The available options of male infertility management (medical treatment: administration of certain drugs to improve seminal quality; surgical treatment; and the different assisted reproduction techniques), are often related to issues of efficacy, cost, ease of use or administration, and its side effects. Also legal, cultural and religious inquiries have limited the available choices in developing countries. According to World Health Organisation survey, 70% to 80% of the world populations rely on non-conventional medicine in their primary healthcare (Chan, 2003). Therefore, there is a renewed interest towards oriental medicines, such as Shilajit, Black musli, and Ashwagandha which are being constantly claimed as aphrodisiac and used in the treatment of male infertility by traditional healers of Asian countries.

Shilajit

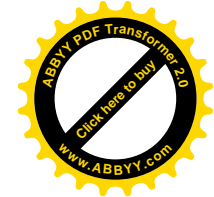
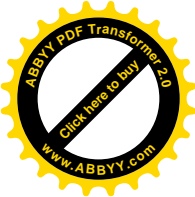
Shilajit is a pale-brown to blackish-brown exudation, from layers of rocks in Himalayan ranges of the Indian subcontinent at altitudes between 1000 and 5000 m. Shilajit is a compact mass of humus (60–80%) along with other components such as



benzoic acid, hippuric acid, fatty acid, ichthyol, ellagic acid, resin, triterpenes, sterol, aromatic carboxylic acid, 3, 4-benzocoumarins, amino acids and phenolic lipids (Agrawal *et al.*, 2007). The major physiological action of shilajit was found to be due to the presence of the bioactive dibenzoalpha- pyrones along with humic and fulvic acids which acted as carrier molecules for the active ingredients (Ghosal, 1990). In oriental medicines, Shilajit is well known rejuvenator and prescribed to treat genitourinary disorder, digestive disorders, nervous disorder, chronic bronchitis, anemia, diabetes, and kidney stones (Agrawal *et al.*, 2007). Modern scientific research has systematically validated a number of properties and has proven that Shilajit is truly a panacea in oriental medicine (Agrawal *et al.*, 2007). According to recent reports, Shilajit was found to have significant anti-inflammatory activity (Goel *et al.*, 1990), free radical elimination functions (Bhattacharya and Sen, 1995), and anxiolytic effects (Jaiswal and Bhattacharya, 1992). In oriental medicines of Asian countries, Shilajit has also been ascribed as a potent aphrodisiac and used to treat male sexual dysfunction (Agrawal *et al.*, 2007; Park *et al.*, 2006). It has been reported that Shilajit increases serum testosterone level and sperm number in rat and man (Park *et al.*, 2006; Biswas *et al.*, 2009). Further, in a study we found that shilajit improves the reproductive indices in cadmium-induced infertile Parkes (P) strain mice. Shilajit reverted back the adverse effects of cadmium on motility and density of cauda epididymidal spermatozoa, testicular daily sperm production, and on serum testosterone level and seminiferous tubules (Table 1).

Table 1
Protective effect of Shilajit on Cd-induced reproductive indices in P mice
Values are mean \pm SD (N = 3).

Treatment	Sperm motility (%)	Sperm concentration ($\times 10^6$)	% of Affected seminiferous tubules	Testicular daily sperm production ($\times 10^6$)	Testosterone (ng/ml)
Distilled water	78.00 \pm 4.74	7.44 \pm 4.58	14.75 \pm 2.98	2.12 \pm 0.13	2.37 \pm 0.28
Cd (2mg/kg bw) 35 days	10.50 \pm 2.56	2.51 \pm 1.13	75.66 \pm 4.50	0.86 \pm 0.22	0.66 \pm 0.23
Shilajit (100mg/kg bw) 35 days	45.50 \pm 5.22	5.69 \pm 2.39	35.50 \pm 4.55	1.48 \pm 0.35	1.81 \pm 0.33
Shilajit (200mg/kg bw) 35 days	69.94 \pm 3.73	6.93 \pm 2.36	24.81 \pm 3.71	2.03 \pm 0.14	2.13 \pm 0.27



Black Musli

Black musli (*Curculigo orchoides* Gaertn) is found in the sub-tropical Himalayan ranges of India from Kumaon eastwards and in the Western Ghats from Konkan southwards. It's tuberous root contains carbohydrates, alkaloids, glycoside, saponins and sterols, curculigoside B and curculignin B and C (Chauhan and Dixit, 2007; Lakshmi *et al.*, 2003). Indigenous medical practitioners of India, use tuberous roots of black musli as tonic, restorative, and as a medical cure for piles, asthma, jaundice, gonorrhoea, vigor, and male sterility (Chauhan and Dixit, 2007; Sharma, 2001). It has also been shown as hepatoprotective, immunostimulant, and antioxidant (Chauhan and Dixit, 2007; Bafna and Mishra, 2006). It has been reported that ethanolic extract of black musli enhances sexual activity in male rats (Chauhan and Dixit, 2007). We found that 50% ethanolic extract of black musli root protects the functional environment of male reproductive organs from cadmium-induced toxicity in P mice. Black musli improves the adverse effects caused by cadmium on motility and density of cauda epididymidal spermatozoa, testicular daily sperm production, and on serum testosterone level and seminiferous tubules (Table 2).

Table 2
Effect of black musli on Cd-induced male reproductive indices in P mice.
Values are mean \pm SD (N = 3).

Treatment	Sperm motility (%)	Sperm concentration ($\times 10^6$)	% of Affected seminiferous tubules	Testicular daily sperm production ($\times 10^6$)	Testosterone (ng/ml)
Distilled water	81.00 \pm 4.54	8.49 \pm 4.78	17.47 \pm 3.67	2.45 \pm 0.23	3.13 \pm 0.32
Cd (2mg/kg bw)	12.35 \pm 2.34	2.31 \pm 1.34	77.39 \pm 5.35	0.79 \pm 0.27	0.73 \pm 0.26
Black Musli (100mg/kg bw)	50.45 \pm 4.26	6.09 \pm 2.72	31.50 \pm 5.57	1.59 \pm 0.36	1.94 \pm 0.41
Black Musli (200mg/kg bw)	71.94 \pm 4.76	7.13 \pm 3.55	19.57 \pm 4.52	2.23 \pm 0.15	2.74 \pm 0.23

Ashwagandha

Withania somnifera L. (Ashwagandha), also known as Indian ginseng (family, Solanaceae), has been described in folk medicine as an aphrodisiac and geriatric tonic. Different investigators have reported that *Withania somnifera* possesses antiserotogenic,



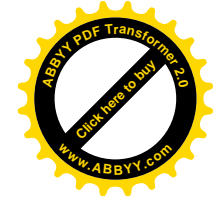
anticancer, and anabolic activity and is beneficial in the treatment of arthritis, geriatric problems, stress, and male sexual dysfunction. It also possesses adaptogenic, cardiotropic, cardioprotective, and anticoagulant properties. *Withania somnifera* has been shown to inhibit lipid peroxidation in stress-induced animals. Earlier studies have shown that aqueous extract of this plant elicits changes in pituitary gonadotropins coupled with an enhancement in epididymal sperm pattern in adult male rats and folliculogenesis in immature female rats. *Withania somnifera* treatment induced testicular development and spermatogenesis in immature Wistar rats by directly affecting the seminiferous tubules (Abdel-Magied *et al.*, 2001; Ahmed *et al.*, 2010). In our study, we found that *Withania somnifera* improves prosexual behavior (chasing, nosing, and genital sniffing) of sexually sluggish mice. Treatment with *Withania somnifera* increases testicular daily sperm production and serum testosterone level. Further, *Withania somnifera* treatment reverted back the adverse effects of cadmium on seminiferous tubules, and motility & density of cauda epididymal spermatozoa in P mice (Table 3).

Table 3
Effect of *Withania somnifera* on Cd-induced male reproductive indices in P mice
Values are mean \pm SD (N=3).

Treatment	Sperm motility (%)	Sperm concentration ($\times 10^6$)	% of Affected seminiferous tubules	Testicular daily sperm production ($\times 10^6$)	Testosterone (ng/ml)
Distilled water	77.50 \pm 5.51	8.59 \pm 5.38	16.37 \pm 3.59	2.78 \pm 0.19	1.98 \pm 0.12
Cd (2mg/kg bw)	13.05 \pm 3.61	1.99 \pm 1.51	69.26 \pm 5.45	0.73 \pm 0.19	0.53 \pm 0.14
<i>W. somnifera</i> (100mg/kg bw)	53.33 \pm 4.56	7.26 \pm 2.13	42.35 \pm 4.61	1.78 \pm 0.66	1.50 \pm 0.21
<i>W. somnifera</i> (200mg/kg bw)	73.59 \pm 6.25	8.09 \pm 2.17	19.58 \pm 4.37	2.59 \pm 0.14	2.01 \pm 0.23

Conclusion

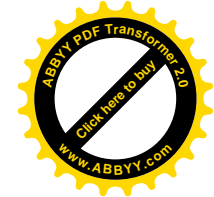
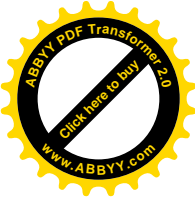
Male infertility is a reproductive health problem having profound psychological and social effects. Living a healthy lifestyle is important to male fertility. On the other hand, recent documentations suggest that by adopting certain negative life style, one is compromising with his reproductive health, though man can control lifestyle factors to a great extent. Specific and directed treatment for male infertility is not available owing to the unexplained and heterogeneous nature of the disorders. Under such circumstances,



only assisted reproductive technologies are of some help. However, these treatments are expensive and inaccessible to all. The lack of specific therapies for men with infertility demands the exploration of oriental medicines. The rationale for the use of these medicines is based on the speculation that some forms of male infertility are caused by oxidative insult and hormonal imbalance, and the use of oriental medicines may improve male fertility potential and semen quality.

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