

Abstract

The term nutraceutical is composed of nutrition and pharmaceuticals. Nutraceutical is a vital part of food which play a prime role in maintaining the steady state of the health by providing medical as well as physical benefits. Nutraceuticals are mainly isolated from dietary supplement, processed food, and herbal products. Modern world is favouring the use of nutraceutical than the synthetic drug though the use of nutraceutical was being conceptualise by Hippocrates about 2500 years age by saying “Let food be thy medicine”. About 80% population belonging from developing countries are using nutraceuticals as a primary tool for safe, effective, pocket friendly measure to treat disease. Some well known and important nutraceuticals are omega-3, genistein, vitamin C, curcumin, catechin and lycopene etc. Besides minimising the risk of several diseases like CVD, cancer, diabetes, atherosclerosis etc nutraceuticals play an important role to maintaining the redox balance of our body. Oxidative stress is a condition due to the imbalance between the generation of free radical and antioxidant defense system in the body. Free radical formation takes place when the cell uses oxygen to generate energy. Reactive Oxygen Species (ROS) which is a cellular by-product is generated during cellular redox process. Oxidative stress plays a crucial role for the onset of inflammatory diseases, process of aging, cancer, atherosclerosis, infertility etc. Specific amount of free radical is important for maintaining the sperm function like sperm motility, capacitation etc. Excessive production of free radical causes adverse effect on semen quality and fertility ability as well. The sperm membrane is rich in docosahexanoic acid (DHA) which is very much prone to ROS. Excessive ROS production affect morphological structure of the sperm and ultimately lead towards the azoospermia condition which is directly associated with male infertility. Moreover, it has been observed that infertile male are deficient in protamine by which sperm DNA is packed in tight manner to protect it from free

radical attack. Free radical directly damage the sperm DNA by destroying the purine and pyrimidine base. On the other side the free radical has the capability to initiate the apoptosis in sperm by triggering the caspase mediated apoptosis. About 60 million couple around the world are suffering from infertility and among them half of the cases are responsible for male factor.

Lycopene is a well known nutraceutical. Its free radical quenching ability is ten times more than α -tocopherol. It is a bright red carotenoid isolated from 8 isoprene units. Lycopene is mainly available in tomato, water melon, gac, papaya etc. Considering its remarkable role in free radical destruction ability, the thesis is mainly focused to know about the remedial effect of lycopene on CPA-induced male hypotesticular dysfunction. To investigate the therapeutic efficacy of lycopene following experiments were conducted:

- Cyproterone acetate (CPA) induced testicular dysfunction in Wistar strain male albino rat: A study for infertile model animal
- Protective efficacy of a potent nutraceutical, lycopene on CPA induced hypotesticular activities in Wistar strain male albino rat: A dose dependent study for infertility management.
- Duration dependent efficacy of lycopene on cyproterone acetate induced male andrological hypo-function in male Wistar strain albino rat in connection with male infertility management
- Reversible or irreversible nature of revival efficacy of lycopene at the potent dose for the management of CPA-induced male reproductive abnormalities: A duration dependent withdrawal study
- Defensive mechanism of lycopene on testicular impairment in CPA-induced infertility in male Wistar Strain albino rat: A molecular transection study

- Role of lycopene on testicular androgenic key enzymes and antioxidant enzymes in cyproterone acetate induced male infertile rats: An *in vitro* study.
- Assessment of toxicity profile of the potent dose of lycopene in cyproterone acetate-induced testicular impairment in male infertile Wistar strain albino rat.
- Assessment of fertility ability after treatment with lycopene to the cyproterone acetate-induced infertile Wistar strain albino rat: An approach through mating study.

Evaluation of the remedial effect of lycopene on cyproterone acetate induced male hypotesticular dysfunction was performed by the following parameters:

- ❖ Initial and final body weight and weight of male reproductive organs
- ❖ Sperm count, motility and viability
- ❖ Acrosomal status, nuclear chromatin decondensation, hypo-osmotic swelling test.
- ❖ Activities of Δ^5 , 3β -HSD, 17β -HSD in testicular tissue, levels of testicular cholesterol, serum testosterone and seminal vascular fructose.
- ❖ Oxidative stress assessment by measuring the activity of catalase, peroxidase, superoxide dismutase, glutathione-S-transferase, levels of conjugated diene and malondialdehyde.
- ❖ Histometric study of testicular tissue and quantification of germ cell at stage VII spermatogenic cycle.
- ❖ Gene expression study of Δ^5 , 3β -HSD, 17β -HSD, SOD, catalase, peroxidase, Bax, Bcl-2, caspase 3, 8, 9 and cytochrome *c* by qRT-PCR analysis.
- ❖ Western blot study of the Δ^5 , 3β -HSD, 17β -HSD, SOD, catalase, Bax, Bcl-2 and caspase 3.
- ❖ Comet assay, immunohistochemistry study by ISEL
- ❖ Flow cytometric analysis of sperm viability and sperm mitochondrial integrity.

- ❖ Toxicity assessment by GOT, GPT, albumin, globulin, urea, BUN, uric acid, creatinine, total protein, tryglyeride, LDL, VLDL, HDL in serum level and ACP, ALP in hepatic and renal tissue.

The whole thesis has been divided in following parts for convenience in reading and for better understanding:

- Introduction and literature review
- Aims and objective
- Material and methods
- Experiments, results and discussion.
- Summary and conclusion
- Applied value of the study
- References