

The effect of Ginger on semen parameters and serum FSH, LH & testosterone of infertile men

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Abstract

Background:- The chemical constituents of ginger classified to volatile oils (including borneol, camphene, citral, eucalyptol, linalool, phenllandrene, zingiberine and zingiberol penols (gingerol, zingerone and shogaol) and resin) which constitutes (1-3%) mainly of zingiberene nonvolatile pungent compounds oleo-resin constitutes (4-7.5%) mainly gigerols and other constituents with more than 50% of starch.

Aim: The aim of this study is to examine the effect of ginger supplements on semen parameters & serum FSH, LH, & testosterone & of infertile men.

Patients & methods: A longitudinal study comprised 75 infertile men, their ages from 19-40 years. All infertile patients were married for at least two years and had no children. The Study samples were obtained from infertile clinic in Tikrit teaching hospital, private clinics in Kirkuk city, from 1-10- 2011 to 1-5-2012. This study involves clinical trial by treating the whole infertile patients with ginger. At least 2-3 semen analyses were done during 3 months of treatment for each patient before making a final conclusion regarding the base line sperm parameters. Serum concentrations of FSH, LH & testosterone were measured using ELISA.

Results: There was significant ($p<0.01$) increase in sperm count of infertile men after treatment with ginger as compared with that before treatment. With a % of increase in sperm count up to 16.2%. Also, the study record a significant ($p<0.01$) increase in sperm motility of infertile men after treatment with ginger, as compared with before treatment with a % of increase in sperm motility was recorded was up to 47.3%. Moreover, there was significant ($p<0.01$) increase in sperm viability & normal sperm morphology of infertile men after treatment with ginger as compared with before treatment, with increase in percentage of sperm viability up to 40.7 %. The study observed a significant increase in ejaculate volume of infertile men after treatment with ginger, as compared with before treatment with a increase in percentage of ejaculate volume was recorded up to 36.1%. There is significantly ($p<0.01$) reduction in serum MDA & significant increase in serum glutathione ($p<0.01$) in infertile men after treatment with ginger as compared with before treatment. There were significant increases in serum FSH, LH & testosterone levels in infertile men after treatment by ginger as compared with before treatment.

Conclusion: The present study conclude that after treatment with ginger, cause a significant reduction in serum MDA & significant increase in serum LH, FSH & testosterone. Treatment with ginger increase serum glutathione & reduce serum & seminal fluid MDA.

The present study recommends the use of ginger by Iraqi community as a food additive.

Key words: Infertile men, MDA, GSH, LH, FSH, testosterone, ginger, & semen analysis

Introduction

Zingiber officinale commonly called ginger belongs to family Zingiberaceae, which contains about 1300 species in 50 genera, along with four other families is placed in the order *Zingiberales* (1). The plant is completely sterile (produce no seed) and only propagated by rhizomes (2). Ginger is a plant that come from south-east Asia, and also in cultivated in Africa, China, India and Jamaica, the India more areas production to ginger (3-5).

Ginger, which is used in a vast array of sweet and savory around the world, is a tender, creeping perennial. The chemistry of ginger is well documented with the respect to the oleoresin and volatile oil. More than 400 chemicals have been identified in ginger rhizome (6).

Chemical constituents of ginger classified to volatile oils (including borneol, camphene, citral, eucalyptol, linalool, phenllandrene, zingiberine and zingiberol penols (gingerol, zingerone and shogaol) and resin) which constitutes (1-3%) mainly of zingiberene nonvolatile pungent compounds oleo-resin constitutes (4-7.5%) mainly gigerols and other constituents with more than 50% of starch (2-3). The nutritional contents of ginger includes protein, lipids, carbohydrates, and its good source from sources Fe, Mg, Ca and vitamins especially vitamin C (6).

Ginger is used as support in inflammatory conditions such as arthritis, & may even be used in heart disease (7). The important active compounds of the ginger root are thought to be volatile oils and pungent phenol compounds such as gingerols, shogaols, zingerone, and gingerols (6).

The aim of this study is to examine the effect of ginger supplements on serum FSH, LH & testosterone of infertile men.

Patients & methods

A longitudinal study comprised 75 infertile men and 25 normal healthy fertile married subjects as control. Their ages from 19-40 years. All infertile patients were married for at least two years and had no children. The Study samples were obtained from infertile clinic in Tikrit teaching hospital, private clinics in Kirkuk city, from 1-10- 2011 to 1-5-2012. This study involves clinical trial by treating the whole infertile patients with ginger.

At least 2-3 semen analyses were done during 3 months of treatment for each patient before making a final conclusion regarding the base line sperm parameters. Semen specimens were collected from all patient and control subjects after at least 3 days of sexual abstinence in sterile containers. Samples

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were obtained by masturbation in room beside the laboratory. Containers were closed and labeled (name, age, time of ejaculates and duration of abstinence). The ejaculates were allowed to liquefy in an incubator at 37°C for 30 minutes. Within ½ -1hr., semen parameters were analyzed according to World Health Organization (WHO) guidelines (8).

Blood samples were obtained from the patients and control. Then blood in the plain tubes was allowed to clot at room temperature (25°C) for 1 hour. After that centrifugation was done at (3000) rpm for 3 minutes to separate the serum. The serum was transferred by micropipette and divided into 5 equal fractions in 5 test tubes, one fraction for each hormonal assay. The sera were stored at -20 °C until the assay was done.

All subjects were questioned about IVF trials, testicular biopsy, mumps, venereal disease, varicocele, drugs which may interfere with fertility and all underwent complete clinical and physical examination. The subjects considered infertile according to WHO criteria, (8).

Serum concentrations of FSH & LH were measured using ELISA. The ELIZA kit that was used was produced by Monobind, Inc. company (U.S.A.). We used test procedure and protocol recommended by the kit manufacturer

which was given in details in the kit's insert for FSH & LH.

The level of serum testosterone for male patients with infertility and control was measured using enzyme-linked immunosorbent assay (ELIZA) method. The ELIZA kit that was used was manufactured by Bio-Check, Inc. company (USA). The test procedure and protocol recommended by the kit manufacturer was adopted which was given in details in the kit's insert.

MDA determination is based on the colorimetric reaction with thiobarbituric acid (TBA) at 90-100°C and pH 2-3 for 15 minutes to form pink color product, which can be measured by spectrophotometer, (9). Semen or serum (GSH) was determined by the modified method and depended procedure on used Elleman's solution. Serum GSH were performed by standard procedure, (10).

Statistical analysis done by using unpaired student T test. All data are present as a mean & standard deviation (SD). Pearson correlation and unpaired T-test was used. P- Value ≤ 0.05 was considered significant throughout the study.

Results

There was significant ($p < 0.01$) increase in sperm count of infertile men after treatment with ginger (73.86 ± 4.6) as compared with that before treatment

(61.85 ± 9.5). With a % of increase in sperm count up to 16.2%.

The study record a significant ($p < 0.01$) increase in sperm motility of infertile men after treatment with ginger ($57.0 \pm 13.4\%$), as compared with before treatment ($30 \pm 9.4\%$) with a % of increase in sperm motility was recorded was up to 47.3%, (Table 1).

There was significant ($p < 0.01$) increase in sperm viability of infertile men after treatment with ginger ($67.5 \pm 15.7\%$), as compared with before treatment ($40 \pm 9.4\%$). With an increase in percentage of sperm viability up to 40.7% , (table 1).

There was significant ($p < 0.01$) increase in normal sperm morphology of infertile men after treatment with ginger ($84.5 \pm 4.38\%$), as compared with before treatment ($68.88 \pm 6.5\%$). There was an increase in normal percentage of sperm morphology up to 18.4%, (Table 1).

The study observe a significant increase in ejaculate volume of infertile men after treatment with ginger (3.52 ± 0.38 ml), as compared with before treatment (2.25 ± 0.42 ml) with a increase in percentage of ejaculate volume was recorded up to 36.1%, (Table 1).

There is significantly ($p < 0.01$) reduction in serum MDA in infertile men after treatment with ginger (2.734 ± 0.44 $\mu\text{mol/l}$) as compared with that value of MDA before treatment (5.913 ± 0.43 $\mu\text{mol/l}$). MDA in serum decreased after treatment by 53.7%, (Table 2).

However, there is significant increase in serum glutathione ($p < 0.01$) increased in infertile patients treated by ginger (11.057 ± 1.01 $\mu\text{mol/l}$) as compared with that value of glutathione before treatment (8.1 ± 1.3). The study observe an increase in semen glutathione up to 26.7% (Table 2).

Serum FSH level was increased significantly in infertile men after treatment by ginger (7.83 ± 2.1 mlU/ml)

as compared with before treatment (6.45 ± 3.4 mlU/ml). Serum FSH level was increased after treatment by 17.6%, (Table 3).

Moreover, serum LH concentration is significantly increase in infertile men after treatment with ginger (6.475 ± 0.92 mlU/ml) as compared with before treatment (3.676 ± 0.789 mlU/ml). Serum LH level was increased after treatment by 43.2% (Table 3).

Furthermore, serum testosterone concentration is increased significantly when infertile men were treated by ginger (11.026 ± 0.489 ng/ml) as compared with before treatment (9.07 ± 0.72 ng/ml). The level was increased after treatment by 17.7% (Table 3).

Discussion

Previous results were supported by the finding of Arsh *et al* (2009), who reported that administration of 50 mg/kg or 100 mg/kg/rat ginger for twenty days significantly increased sperm functions (sperm count, motility, viability), concentrations in rat, who treated with ginger have protective effects against oxidative stress in rat (11). This finding is in accordance with present results.

Amr *et al*, (2006) reported in animal models that administration of *Zingiber officinale*, increased sperm count and normal morphology. It have protective effects against oxidative stress in rats (12). The major active phenolic ingredients isolated from *Z. officinale* (Zingerone, Gingerdiol, Zingibrene, gingerols and shogaols) have antioxidant activity. Phenolic compound as antioxidant specified by its ability in capturing free radical and ROS (6-13). These results were supported by previous findings who found that ginger increased in sperm motility of treated groups in animal model (11).

A decrease in the semen & serum MDA & increase in glutathione concentration in patients taken ginger have the protective effect of *Z. officinale* was reflected by the increase of antioxidant activities represented by glutathione & concurrent decrease oxidative stress of MDA. The major active phenolic ingredients isolated from *Z. officinale* have antioxidant activity (13-14).

Previous study on animals, it was found a significant decrease in semen & serum MDA during the protective effect of ginger rhizome a administration (6). Also these results were supported by findings of Arsh *et al* (2009), who reported that administration of 50 mg/kg or 100mg/kg/rat ginger for twenty days, lead to significantly increase in glutathione and decreased of MDA concentrations in rat (11).

In according with these results, Hamza *et al* (2006) have demonstrated that *Z. officinale* treatment increased the activities of testicular antioxidants enzyme in rats (12). Ginger extracts have been extensively studied for a broad range of biological activities, especially its antioxidant activities found that ginger significantly lowered lipid peroxidation by maintaining the activities of the antioxidant enzymes such as superoxide dismutase, catalase and glutathione peroxides in rats (6-7).

The present study shows that there was high statistically significant increase of serum hormones ($p < 0.01$) in all infertile groups post-treated when compared with before treatment. FSH was the significantly increased after treatment ($p < 0.05$). These results were supported by studying the rats, it was found a significant increase in serum testosterone after treatment with *Z. Officinale* (13-14).

A previous study was conducted on rats, it was found a significant increase in serum testosterone after 8 days treatment with *Z. Officinale*, (7). Also, these results were supported by finding of Arsh *et al* (2009), who reported

that administration of ginger for twenty days significantly increased testosterone (11).

FSH and LH concentrations in infertile men treated ginger were increased significantly by *Zingiber Officinale* treatment. There was an agreement with previous the finding done by Arsh *et al.*, (2009), who found an increase in both FSH & LH in rat but non significant (11). *Z. officinale* aqueous extracts have a potent androgenic activity in male rats. This activity was reflected by the increasing of both testis weight and serum testosterone concentrations (12-14).

Recently, a study was done in Tikrit University on the effect of *Zingiber Officinale* (ginger) aqueous extract on semen characteristic & some hormonal parameters. The study was done on broilers breeder male by giving 10% aqueous extract in drinking water for 30 weeks. It was found that there is significant increase in the weight of testis & there are significant increase in ejaculate volume, sperm count, motility & significant decrease in abnormal sperm motility. Also, there is significant reduction in semen & serum MDA, (15).

The result indicated that the extract ginger possess pro-fertility properties in male broiler which might be a product of both its potent antioxidant properties & androgenic activities, (15).

Ginger rhizome contains a wide variety of both antioxidative (6) and androgenic activity (7). Others reported that *Z. officinale* extracts have a potent androgenic activity in male rats (12). The present increasing in testosterone concentration in ginger group result from the increase androgen activity of *Z. Officinale* that increase the α -glycosidase enzyme in epididymis, and fructose sugar in seminal vesicle, and both increased due to increase formed androgen which result by increased in cholesterol was primary substance to production the androgen activity, (11).

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The present study showed a significant negative correlation between serum testosterone & sperm count concentration ($r = -0.392$, $p \leq 0.05$).

The present study conclude that after treatment with ginger, cause a significant reduction in serum MDA & significant increase in serum LH, FSH & testosterone. Treatment with ginger increase serum glutathione & reduce serum & seminal fluid MDA.

The present study recommends the use of ginger by Iraqi community as a food additive.

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Table (1) The mean & standard deviation of semen parameters before and after treatment in infertile men.

Parameters	Before treatment ^{\$}	After treatment ^{\$}	% increase
Sperm count Million/ml	61.85 ± 9.5	**73.86 ± 4.6	16.2%
Sperm motility %	30 ± 9.4	**57.0 ± 13.4	47.3%
Sperm viability %	40 ± 9.4	**67.5 ± 15.7	40.7%
Normal Sperm morphology %	68.88 ± 6.5	**84.5 ± 4.38	18.4%
Ejaculate volume ml	2.25 ± 0.42	**3.52 ± 0.38	36.1%

** : $p < 0.01$

* : $p < 0.05$

$\$ = \text{mean} \pm \text{SD}$

Table (2): Show the mean & SD serum MDA & glutathione concentration before & after treatment in infertile men.

Serum Parameters	Before treatment ^{\$}	After treatment ^{\$}	% of change
MDA ($\mu\text{mol/l}$)	5.913 ± 0.43	**2.734 ± 0.44	53.7% ↓
Glutathione ($\mu\text{mol/l}$)	6.61 ± 0.55	**11.057 ± 1.01	26.7% ↑

** : $p < 0.01$

$\$ = \text{mean} \pm \text{SD}$

Table (3): The serum FSH, LH & testosterone concentrations before and after treatment in infertile men.

Serum Parameters	Before treatment ^{\$}	After treatment ^{\$}	% increase
FSH mlU/ml	6.45±3.4	*7.83 ± 2.1	17.6%
Serum LH mlU/ml	3.676 ± 0.789	**6.475 ± 0.92	43.2%
Testosterone ng/ml	9.24 ± 0.88	**11.026 ± 0.489	17.7%

***: p < 0.01*

**: p < 0.05*

\$ = mean ± SD