Relationship between Dietary Intake of Antioxidant (Vitamins C, E, and Selenium) with Semen Quality

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Salwa Hazim Al Mukhtar **

ABSTRACT

Background and aim: oxidative stress is detrimental to semen quality and has a significant role in the etiology of male subfertility. This study aimed at examine the relationship between dietary intake of antioxidant (vitamins c, e, and selenium) with semen quality.

Materials and method: Dietary intake of antioxidants was compared between 35 men with oligoasthenoteratozoospermic (cases) and 35 normospermic volunteers (controls) attending fertility clinic in al Batool Hospital in Mosul, Iraq. All participants were nonsmokers and matched according their age and Body Mass Index (BMI). Nutrient consumption was calculated using a semi-quantitative food frequency questionnaire. Semen samples were collected and were assessed by measuring volume, concentration, motility and morphology.

Results: infertile subjects had a significantly lower intake of Selenium compare to control ones (p<0.001). Dietary intake of vitamin C and E was lower than recommended values in 59.4% of case group that was significantly different from control ones (p<0.05). In the control group, 36.4 and 40.9% of participants had an insufficient dietary intake of vitamin C and E, respectively. Significant correlations were found between Vitamin E (r=0.5, p<0.001), Vitamin C (r=0.6, p<0.001) and percentage of motility and also between vitamin E and morphology (r=0.3, p=0.03), Selenium and concentration (r=0.4, p=0.004) in all participants.

Conclusion: In summary, a low intake of antioxidants, and vitamin E were related to poor sperm concentration and motility.

Keywords: Dietary antioxidant, Male infertility, Oligasthenoteratozoospermia

INTRODUCTION

Infertility is a condition which is defined as one-year unsuccessful attempt to conceive (Hosseini et. al., 2014). Based on the reports by the World Health Organization (WHO), at least 60–80 million couples are suffering from infertility worldwide (Eslamian et. al., 2012). A male partner factor plays a role in about 40% of infertility cases (Eslamian et. al., 2012). A reduction in male fertility has been observed over the recent decades (Anderson et. al., 2000). Sperm density has dropped by 40% during the past 50 years (Carlsen et. al., 2000). Studies suggested that congenital and acquired urogenital abnormalities, infections of the genital tract, increased scrotal temperature (Varicocele), endocrine disturbances, genetic abnormalities and immunological factors might lead to a reduction in male fertility (WHO, 2000). However, no causal factor is reported in 60-75% of cases, the condition that defined as idiopathic male infertility (Dohle et. al., 2007). These men have no previous history associated with fertility problems and present with normal findings on physical examination and endocrine laboratory testing (Dohle et. al., 2007). Semen analysis demonstrates a decreased number of spermatozoa (oligozoospermia) defined as <20 million spermatozoa/mL, reduced motility (asthenozoospermia) defined as <50% motile spermatozoa and various abnormal forms on morphological examination (teratozoospermia) defined as <14% normal forms (Dohle et. al., 2007). These abnormalities usually occur together and are described as the oligoasthenoteratozoospermia (OAT) syndrome (Dohle et. al., 2007). Infertility caused by idiopathic oligoasthenoteratozoospermia syndrome without any female factor, constitutes one of the greatest patient groups in the daily practice of urologists (Safarinejad et. al., 2010). In spite of major advances in the field of infertility, many cases of male infertility have been diagnosed as idiopathic with no particular treatment (Safarinejad et. al., 2010). However, it has been suggested that chronic stress, endocrine disruption due to environmental pollution, reactive oxygen species, genetic abnormalities as well as occupational and lifestyle factors may be particularly linked with the pathophysiology of infertility (Connor et. al., 2012). Eating habits, as principle lifestyle factors, in terms of both macro- and micro-nutrients

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intake has major effects on normal reproductive function (Connor et al., 2010; Batra and Bansal, 2004). Due to swift changes in eating behavior, the expansion of unhealthy dietary patterns, specifically higher intakes of saturated fat, trans fatty acids and sodium and lower consumption of antioxidant-rich foods such as fruit and vegetables, has an upward trend in reproductive age people (Liores et al., 2012). Meanwhile, several studies indicate that higher consumption of fruit, vegetables, poultry, sea foods, skim milk and shellfish as well as lower intake of full-fat dairy, sweets and processed meat specifically with high-saturated fat foods are linked with higher sperm quality (Eshtamian et al., 2012). The main aims of the present study was to examine the relationship between dietary intake of antioxidant (Vitamins C,E, and selenium) with semen quality.

MATERIALS AND METHODS

A case-control study was applied between November and December 2013 in the outpatient clinic of infertility in Mosul city, Iraq. The case group consisted of 35 men (20-40 years) with primary infertility due to idiopathic oligo and/or astheno and/or teratozoospermia (WHO 1999) and 35 age matched normal healthy donors who referred for premarital tests and considered as control ones. The diagnosis of primary infertility was made after medical assessment, which included medical history, clinical examination, semen analysis. Infertility is defined as the inability to conceive after 12 months of unprotected intercourse. Exclusion criteria were: smoking, alcohol consumption, occupational chemical exposure, history or presence of endocrine disorders, testicular disease such as cryptorchidism, orchitis and varicocelle, infectious genital disease, treatment with drugs or using antioxidant supplements within the 3 months before enrollment, leukocytospermia seminal white blood cells (WBC) > 1×106/ml) and azoospermia. The study has been performed in accordance with the ethical standards laid down by the appropriate version of the 1964 declaration of Helsinki and the study protocol was approved by clinical Nursing Sciences Department, College of Nursing, University of Mosul. All participants were given written informed consent. Two questionnaires were completed for each person. The first questionnaire ascertained socio-demographic characteristics and anthropometric data. Anthropometric assessment included measurements of height and weight. BMI was calculated as weight (Kg) divided, height (squared, meter, m2). Dietary information was collected by using a semiquantitative food-frequency questionnaire (FFQ) with 116 food items. Participants were asked to state the portion size of given food and how often they had consumed each of the foods and beverages included in the FFQ during the previous year. The questionnaire had 9 options for frequency of intake, ranging from < 1 time per month to ≥ 6 times per day. Nutrient intakes were estimated by summing the nutrient contribution of all food items in the questionnaire. Then the average for daily energy and nutrient intakes was calculated by using food processor software version II (ESHA Research, 1999, Salem, OR). Semen samples were obtained by masturbation after 48-72 hours of abstinence. Samples were collected into sterile containers and allowed to liquefy at 37°C for 20 minutes, and evaluated immediately, according to the WHO recommendation (ejaculate volume, pH, sperm concentration, motility and morphology) (WHO 1999). Sperm concentration was expressed as 106 per milliliter of semen, in which motility and morphology expressed as a percentage. Sperm concentration ≥ 20×106 per milliliter of semen, motility ≥ 50% and normal forms ≥ 30% were considered as normal sperm parameters according to WHO criteria (16). Statistical methods: Statistical analyses were performed using SPSS 16.0 for Windows statistical software (SPSS Inc. Chicago, IL, USA). Differences between control and infertile groups were assessed using independent t-test. The correlations between sperm parameters and antioxidant nutrient intakes were evaluated by the Pearson correlation coefficient. The results were given as mean ±SD, and correlation coefficients, and p<0.05 considered statistically significant.

RESULTS

The mean age of case and control group were (34.66) and (33.91) respectively. Regarding some characteristics of study subject the finding reveals that there no significant differences between case and control groups in relation to their age, Body Mass Index (BMI) (Table 1). The case group in comparison with control had significantly higher sperm concentration, motility and morphology (Table 2). The correlation between (selenium, vitamin E,C) and semen parameter shows significant differences (Table 3).
Table (1): characteristics BMI and Seminal Fluid Parameter for case and control group.

<table>
<thead>
<tr>
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<th>Case</th>
<th>Control</th>
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<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Age</td>
<td>34.66</td>
<td>2.1</td>
<td>33.91</td>
<td>3.4</td>
</tr>
<tr>
<td>BMI</td>
<td>24.2</td>
<td>3.7</td>
<td>25.1</td>
<td>2.4</td>
</tr>
<tr>
<td>Since diagnosis, years</td>
<td>4.1</td>
<td>0.1</td>
<td>3.8</td>
<td>2.8</td>
</tr>
<tr>
<td>Volume (ml)</td>
<td>2.92</td>
<td>1.25</td>
<td>3.19</td>
<td>2.6</td>
</tr>
<tr>
<td>Sperm count (million/ml)</td>
<td>36.46</td>
<td>29.02</td>
<td>45.7</td>
<td>19.02</td>
</tr>
<tr>
<td>Non motile (%)</td>
<td>34.00</td>
<td>20.25</td>
<td>24.37</td>
<td>10.68</td>
</tr>
<tr>
<td>Abnormal morphology (%)</td>
<td>48.40</td>
<td>14.77</td>
<td>35.2</td>
<td>0.96</td>
</tr>
</tbody>
</table>

p<0.05

Table (2) Comparison between (Vita C ,Vita E , Selenium level) for both groups .

<table>
<thead>
<tr>
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<th>Case</th>
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<th>t value</th>
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<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>34.66</td>
<td>2.1</td>
<td>33.91</td>
<td>3.4</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>24.2</td>
<td>3.7</td>
<td>25.1</td>
<td>2.4</td>
</tr>
<tr>
<td>Selenium</td>
<td>4.1</td>
<td>0.1</td>
<td>3.8</td>
<td>2.8</td>
</tr>
</tbody>
</table>

*significant at p<0.05

Table (3): Correlation between (Vita C, Vita E, selenium level) and Seminal fluid parameter

<table>
<thead>
<tr>
<th></th>
<th>Vitamin C</th>
<th>Vitamin E</th>
<th>Selenium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Volume (ml)</td>
<td>0.002</td>
<td>0.1</td>
<td>.086</td>
</tr>
<tr>
<td>Sperm count (million/ml)</td>
<td>0.14</td>
<td>0.2</td>
<td>.270*</td>
</tr>
<tr>
<td>Non motile (%)</td>
<td>0.06</td>
<td>0.5</td>
<td>-0.207*</td>
</tr>
<tr>
<td>Abnormal morphology (%)</td>
<td>0.03</td>
<td>0.30*</td>
<td>-0.204*</td>
</tr>
</tbody>
</table>

*significant at p<0.05

DISCUSSION

This study showed that a low intake of selenium as an antioxidants may have a negative effect on sperm motility and morphology. (Eskenazi et al., 2005) found an association between antioxidant intake and sperm numbers and motility in a healthy population of nonsmoking men. Similarly, Mendiola et al found a positive association between semen quality and vitamin C intake (Mendiola et al., 2010). There was a significant difference in zinc and folate intake between oligo/ astheno/ teratozoospermic and healthy donors (p<0.000). He also found a positive association between folate intake and semen quality. Likewise, in study by Young et. al. (2008) states that healthy nonsmoker men with high folate intake (≥ 75th percentile) had lower frequencies of sperm aneuploidy compared to men with lower intake (≤ 25th percentile). Some interventional studies showed that oral supplementation with vitamin E, folate and zinc sulfate improve semen quality in infertile patients (Wong et.al, 2002-Greco et.al., 2005). Folate is an essential micronutrient for DNA synthesis and repair. Inadequate 5, 10-methylenetetrahydrofolate has been shown to cause massive misincorporation of uracil into human DNA (Blount et.al.,1997). Moreover, we did not find any association between selenium and semen quality, which is in agreement with Hawkes and Iwanier et al., in which selenium supplementation did not improve semen quality in healthy and subfertile men (Hawkes, 2001-
Iwanier, 1995). Finally, there was a significant negative correlation between sperm concentration and beta-carotene. Since we did not assess the concentration of this nutrient in body fluids, our data were not enough to explain the effect. This unexpected result implies that the effect of a single food, nutrient, or food group is not always clear; foods and nutrients are consumed in combination and as a result may have a synergistic effect (Rahman et al., 2002). Analysis of overall dietary patterns may provide a comprehensive correlation with their overall effects on oxidation, inflammation, and disease risk. In spite of the fact that the main sources of beta-carotene and vitamin C are fruits and vegetables, the quantification of antioxidant consumption may be further complicated by food storage, handling, processing, and preparation (Price et al., 1997). Water-soluble antioxidants such as vitamin C are released into high temperature cooking water and discarded. It has been suggested that high levels of betacarotene might induce DNA damage due to oxidative stress (Murata et al., 2000). Van Helden et al. (2009) demonstrated that the anti or pro oxidant effect of beta carotene, is dependent on the type of radicals involved. In their study showed that beta carotene is an anti-oxidant against vitamin C and it can significantly reduce the M1dG levels in vitro as well as in vivo. However, it was not capable to scavenge. The OH agent and even resulted in an increased ROS production in lung epithelial cells.

CONCLUSION

The results of this case-control study suggest that the risk of poor sperm concentration, motility, and morphology are associated with low intake of some antioxidant agents in a group of oligo/ astheno/ teratozoospermic men.

REFERENCES


