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ARTICLE

The impact of food intake and social habits on embryo quality and the likelihood of blastocyst formation

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Abstract The aim of this study was to evaluate the influence of patients' lifestyle factors and eating habits on embryo development. A total of 2659 embryos recovered from 269 patients undergoing intracytoplasmic sperm injection cycles were included. The frequency of intake of food items and social habits were registered and its influences on embryo development evaluated. The consumption of cereals, vegetables and fruits positively influenced the embryo quality at the cleavage stage. The quality of the embryo at the cleavage stage was also negatively correlated with the consumption of alcoholic drinks and smoking habits. The consumption of fruits influenced the likelihood of blastocyst formation, which was also positively affected by the consumption of fish. Being on a weight-loss diet and consumption of red meat had a negative influence on the likelihood of blastocyst formation. The likelihood of blastocyst formation was also negatively influenced by the consumption of alcoholic drinks and by smoking habits. The consumption of red meat and body mass index had a negative effect on the implantation rate and the likelihood of pregnancy. In addition, being on a weight-loss diet had a negative influence on implantation rate. Our evidence suggests a possible relationship between environmental factors and ovary biology.

KEYWORDS: eating habits, female infertility, food intake, intracytoplasmic sperm injection, lifestyle

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Introduction

Infertility affects between 8 and 16% of reproductive-aged couples (Stephen and Chandra, 2006). Over the past 2 decades, the use of assisted reproduction techniques has increased dramatically worldwide, and has made pregnancy possible for many infertile couples. Although high-quality embryos may be available for transfer, however, most in-vitro-produced embryos fail to implant (de Mouzon et al., 2012).

The identification of factors that may influence the implantation of in-vitro-produced embryos is one of the most studied areas in assisted reproduction techniques. Special attention has been paid to the effects of the patient's lifestyle on the outcomes of assisted reproduction techniques. Lifestyle factors and nutritional status are known to be critical determinants of normal reproductive function (Chavarro et al., 2008). Menopause has been reported to occur earlier (Midgette and Baron, 1990) and conception to be delayed for over 1 year (Baird and Wilcox, 1985) among smokers compared with non-smokers. Moreover, cigarette smoking may impair sperm motility, decrease antioxidant activity in the seminal plasma (Pasqualotto et al., 2008) and lead to increased thickness of the zona pellucida (Shiloh et al., 2004).

Obesity and low body weight may also impair fertility. A high body mass index (BMI) has been shown to adversely affect the outcomes of assisted reproduction technique treatment (Fedorcsak et al., 2004; Nichols et al., 2003), and physical activity positively affects embryo implantation and the chance of pregnancy (Ferreira et al., 2010). Other aspects of the patient's diet may affect fertility, such as certain vitamins and food groups that could have a greater effect on reproductive health for both males and females (Chavarro et al., 2007, 2008; Keskes-Ammar et al., 2003; Mendiola et al., 2010; Silver et al., 2005).

Extended embryo culture and the transfer of blastocyst-stage embryos are associated with increased implantation rates compared with cleavage-stage embryo transfer (Blake et al., 2007; Papanikolaou et al., 2008). Prolonging the culture period allows for a better selection of embryos for transfer because laboratory assessment is undertaken after the embryonic genome has begun to be expressed (Tesarik et al., 1988). Moreover, because of their high implantation rate, single-blastocyst transfers may increase the pregnancy rate and reduce the frequency of multiple gestations (Gardner et al., 2004; Ryan et al., 2007). The proportion of embryos that develop to the blastocyst stage, however, is still variable (Mercader et al., 2003; Schoolcraft and Gardner, 2001; Westphal et al., 2003), and eventually, embryo transfer cancellation may occur in extended embryo culture programmes.

Different factors may be responsible for the variation in the rate of blastocyst formation, such as the culture media (Biggers and Racowsky, 2002; Macklon et al., 2002; Sepulveda et al., 2009), laboratory conditions (Lane et al., 2008; Meintjes et al., 2009; Waldenstrom et al., 2009), oocyte quality (Catala et al., 2012; Lin et al., 2003) or sperm origin (Nilsson et al., 2007). Less is known, however, about the influence of patients' lifestyle on embryo quality and blastocyst formation. Therefore, the goal of the present study was to evaluate whether patients' lifestyle factors and eating habits can influence embryo quality, the likelihood of blastocyst formation and clinical outcomes in patients undergoing assisted reproduction techniques.

Materials and methods

Study design

The study included 2659 embryos recovered from 269 patients undergoing intracytoplasmic sperm injection (ICSI) cycles between January 2012 and July 2013. All patients completed a questionnaire with multiple-choice questions before the beginning of the treatment. The women were asked about the frequency of their consumption of many food items and about their social habits.

The effects of dietary and social habits on embryo quality on day three and the likelihood of blastocyst formation were evaluated. To evaluate the effects of dietary and social habits on the likelihood of blastocyst formation, 1400 embryos cultured until day 5 of development were evaluated. Moreover, the influence of dietary and social habits on clinical pregnancy rates was also investigated.

Clinical pregnancy was defined as the presence of fetal heart activity by ultrasound at 6 to 7 weeks of gestation after embryo transfer. Written informed consent was obtained, in which patients agreed to share the outcomes of their own cycles for research purposes, and the study was approved by the local Institutional Review Board on 19 December 2012.

Food consumption and social habits frequency questionnaire

All patients were interviewed face-to-face before the beginning of the treatment. The modified validated questionnaire (Ribeiro et al., 2006) contained multiple-choice questions about the average frequency of consumption of food items during the past year.

The food categories investigated in the present study were cereals, vegetables, legumes, fruits, red and pork meat, chicken, fish, dairy products, chocolate, soft drinks, caffeine-containing soft drinks, alcoholic drinks, dietary sweetener and coffee.

The frequency of food consumption was registered on a scale with five values, ranging from no consumption to repeated daily consumption. The specific categories were never or less than once per month; one to three times per month; once per week; two to four times per week; and every day.

The questionnaires were completed by the same interviewer, and a different questionnaire recorded information on exercise, weight-loss dieting in the past 3 months, the number of meals eaten per day and smoking habits. In addition, BMI was measured.

Exercising was recorded on the following scale: less than 1 h per week; 1 h per week; 2 h per week; 3 h per week; 4 h per week; and 5 h or more per week. Smoking habits were recorded as the number of cigarettes smoked per day, and BMI was measured based on weight/height^2 and expressed as Kg/m^2.

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