The influence of menstrual cycle and impulsivity on risk-taking behavior

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Abstract

The present study aims at exploring how both menstrual cycle phase and impulsivity affect risk behavior. Sixty-eight normally cycling women, who were previously assigned to "fertile" and "non-fertile" condition depending on their menstrual cycle phase at time of participation, were asked to complete the Dickman Impulsivity Inventory (DII) and to play a computerized version of the IOWA Gambling Task (IGT). Results indicate a significant interaction between the menstrual cycle phase and the dysfunctional impulsivity level on the total amount of IGT gains, with low dysfunctional impulsivity women during their "fertile" phase winning the largest amount of money. Implications of the results are discussed within the evolutionary theoretical perspective.

Keywords: Menstrual cycle; Dysfunctional impulsivity; Risk behavior; IOWA Gambling Task

1. Introduction

Effects produced by hormones on human behavior has been extensively studied over the last years (Neave, 2008). The effect of sex hormones on specific behaviors, such as risk behavior, is a good example. Literature has focused mainly on the risk within sexuality (Gangestad, Thorndill & Garver-Apgar, 2006), whereas little attention has been paid to the risk linked to economic behavior. Studying the correlation between menstrual cycle phase and risk-taking behavior leads to mixed evidence. Some authors reported that women are more risk-averse during their fertile period (Chavanne & Gallup, 1998;

Bröder & Hohmann, 2003), whereas others suggested that women's avoidance of risk is typical of their non-fertile phases (Shipper, 2014).

Risk-taking behavior is also affected by specific personality characteristics, such as impulsiveness: risk-taking behavior and impulsivity has actually been referred to as different but related constructs (Eysenck & Eysenck, 1978). Different definitions have been used to describe impulsivity (McCrown, Johnson & Shure, 1993), most of them refer to the negative consequences of impulsive behavior. Dickman (1990), however, suggested that not all impulsive behaviors are reckless and disadvantageous, differentiating between two dimensions of impulsivity: functional and dysfunctional. Individuals with high levels of dysfunctional impulsivity tend to act without reflecting. Individuals with high levels of functional impulsivity succeed in taking advantage of unexpected opportunities, when it is necessary to act quickly. Functional and dysfunctional impulsivity has been proved to be independent, thus being treated separately. Specifically, functional impulsivity is associated with enthusiasm, spontaneity, and activity, whereas dysfunctional impulsivity with the tendency to ignore signals from the environment and low persistence.

The present study aims at exploring how both hormones fluctuations across menstrual cycle and individual impulsivity level influence risk-taking behavior.

2. Methods

2.1. Participants

One-hundred psychology major women were recruited from the campus of Catholic University of Milan. They were asked to fill in a questionnaire about the most recent menstrual cycle, the length of their menstrual cycle, and their use (if any) of hormonal contraception. Of the 100 initial participants, 32 reported using hormonal contraception and, as a consequence, were excluded from the sample for this study. The remaining 68 women (mean age = 24; SD = 2.5) were divided into two subgroups depending on their menstrual cycle phase at time of participation ("fertile" group: N = 23, mean age = 23.8, SD = 1.9; "non-fertile" group: N = 45, mean age = 24.1, SD = 2.6). Participants' menstrual cycle phase was calculated individually for each woman by using a count-back method from the day of estimated menstruation beginning to the day of the beginning of the previous cycle.

The "fertile" phase was conceived as 7 days before ovulation until 1 day after ovulation, making a total of a 9-day fertile window. The "non-fertile" phase includes all other days of the menstrual cycle, including the early follicular phase, the luteal phase, and menses itself (Rosen & Lopez, 2009).

2.2. Materials

The *Dickman Impulsivity Inventory* (DII; Dickman, 1990) is a self-report questionnaire aimed at measuring two types of impulsivity, functional and dysfunctional. The DII consists of 23 items, 11 were designed to measure functional impulsivity and 12 dysfunctional impulsivity.

The *IOWA Gambling Task* (IGT; Bechara, Damasio, Damasio & Anderson, 1994) was created to assess the deficits related to decision-making. In our study we used a computerized version. Subjects had to draw cards by choosing from four decks (A, B, C, D) trying to figure out, over the course of the 100 available picking, which were the most advantageous decks and the most disadvantageous ones. Purpose of the task is to increase the winnings, limiting losses.

2.3. Procedure

Participants took part on a voluntary basis and anonymity was guaranteed. They were informed about the aims and the procedure of the study. After written informed consent was obtained, participants were asked to fill in the questionnaire about menstrual cycle information. After excluding participants who reported to use hormonal contraceptives, the other women filled in the DII and played the IGT.

3. Results

The functional impulsivity level reported by participants was considered as "high" (M = 37.1; SD = 2.8) or "low" (M = 29.9; SD = 2.1), depending on the median values of DII. The same procedure was used to differentiate between "high" (M = 30.4; SD = 5.9) and "low" dysfunctional impulsivity (M = 20.3; SD = 2.3).

A 2 (menstrual cycle phase) X 2 (functional impulsivity level) factorial ANOVA was conducted to identify any differences in the IGT total gains.

Results did not indicate main effects (Menstrual cycle phase: $F[1, 61] = 0.13$, n.s.; Functional impulsivity level: $F[1,61] = 0.06$, n.s.) or interaction effect ($F[1, 61] = 0.72$, n.s.).

A 2 (menstrual cycle phase) X 2 (dysfunctional impulsivity level) factorial ANOVA on the IGT total gains was conducted. Results revealed a significant main effect of dysfunctional impulsivity level ($F[1, 61] = 6.05$, $p < .05$), with low dysfunctional impulsivity women winning a larger amount of money (M = 1531.3; SD = 167.4) than high dysfunctional impulsivity women (M = 1017.4; SD = 124.9). No main effect of menstrual cycle phase emerged, whereas the interaction effect was significant ($F[1, 61] = 5.05$, $p < .05$) (*Figure 1*).

Figure 1 suggests that being in a specific cycle phase does not affect the monetary profits *per se*. Women in their non-fertile phase win almost the same amount of money as compared to women in their fertile phase, but this only applies to those "fertile" women who has a high dysfunctional impulsivity level. Women with low dysfunctional impulsivity actually tend to choose the most advantageous desks, winning the largest amount of money. This means that in a decision context characterized by uncertainty of outcomes, two variables intervene together in promoting a "calculated" risk-taking behavior by women: the fertile menstrual phase and a low dysfunctional impulsivity level.

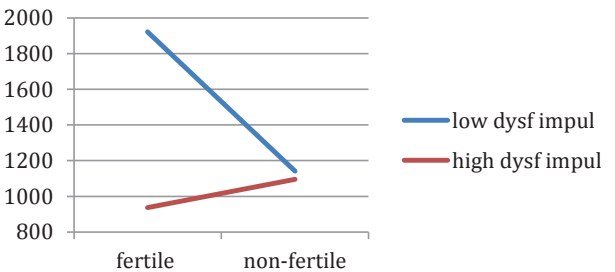

Figure 1. Interaction effect (dysfunctional impulsivity-mestrual cycle phase) on total IGT gains

4. Discussion and conclusions

Starting from these results, and consistently with literature, we hypothesize that women in the fertile phase of their cycle, in situations of uncertainty and risk, tend to behave wisely, increasing their possibilities to reach their targets. According to the strong focus-oriented attitude linked to the fertile phase, they pay greater attention to signals and messages from the social

environment (Maner & Miller, 2014): this helps realizing, immediately and effectively, which situations are more favorable. For instance, in economic decision-making fertile women proved to be more inclined to choose advantageous decks. But this is true only when low levels of dysfunctional impulsivity are present. This result could be interpreted with reference to the specific behavioral task – the IGT, in which some features connected to functional impulsivity (e.g., spontaneity, enthusiasm, activity) are not elicited. On the contrary, the IGT elicits the individual tendency to consider signals from environment which is a feature connected to dysfunctional impulsivity. In this case, it may be possible that high levels of estrogens promote and strengthen a shrewder attitude in women. From an evolutionary standpoint, this is consistent with the need to take the greater advantage of opportunities and at the same time to protect themselves from reckless risks (Fleischman & Fessler, 2011), in order to maximize the reproductive profit.

An important limitation of this study is the method used for cycle phase estimation. We used a "count-back" method, which is based on self-reports of the date of the most recent menstrual cycle, rather than on salivary hormonal testing. However, it has been proved that the two methods – self-reports and hormonal testing – yield similar results (Brown, Calibuso & Roedl, 2011). A second limitation of the work is the sample size, which could have influenced the effect size of the statistical analyses.

Despite these limitations, the present study provides an important point to be considered. This work suggests that risk behavior is influenced by hormones level, but not in a direct and deterministic way. What seems to be crucial is the interaction between hormones and impulsivity levels, indicating that risk behavior is affected by different factors, which pertain to distinct domains. We can derive that, whereas the hormones levels that characterized each menstrual cycle phase could not, obviously, be modified (at least in naturally cycling women), the individual tendency to be impulsive, being in part a learned characteristic, could be modified, albeit partially.

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