

An Evolutionary Perspective on Female Food Choice: A Theoretical Discussion Based on Sexual Selection Processes

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Abstract

Sexual selection has played an important role in the evolution of human psychology, behavior, and other phenotypes, yet its influence on female food choice has received relatively little attention. Sexual selection has shaped distinct mating strategies in men and women; men's focus on women's physical attractiveness during mate selection leads women to place greater emphasis on physical attractiveness cues such as body shape. The close relationship between female body shape and diet further suggests that sexual selection processes should influence female food choice. Building upon this foundation, examining changes in female food choice that may be triggered by the activation of mating motivation, as well as variations in food choice across different stages of the female menstrual cycle, can help elucidate the impact of sexual selection on female food choice. Future research that further analyzes these influences and underlying mechanisms at behavioral, hormonal, and neural levels will be of significant importance for the long-term development of this field.

Full Text

Examining Female Food Choice from an Evolutionary Perspective: The Role of Sexual Selection

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Abstract: Sexual selection has played an important role in shaping human psychology and behavior, yet its influence on female food choice has received relatively little attention. Sexual selection has shaped distinct mating strategies for men and women, with men's mate selection focus on women's physical attractiveness leading women to place greater emphasis on bodily attractiveness

cues. Given the close relationship between female physique and dietary habits, sexual selection likely influences women's food choices as well. Building on this foundation, examining how mating motivation activation may alter female food selection and how food choice varies across different menstrual cycle phases can help illuminate sexual selection's impact on female dietary behavior. Future research that investigates these effects and underlying mechanisms across behavioral, hormonal, and neural levels will be crucial for the long-term development of this field.

Keywords: sexual selection, food choice, mating motivation, ovulation, female

1 Introduction

Throughout evolutionary history, food selection—a activity intimately linked to survival—has accompanied human evolution. Evolutionary processes involve two core pressures: survival and reproduction (Lummaa & Clutton-Brock, 2002). While the survival function of food choice is obvious, its potential connection to human reproduction has received less attention. Although various foods can satisfy survival needs, people consistently exhibit preferences, assigning different weights to different foods. This suggests that food choice carries value beyond mere survival function. So does reproduction, or more specifically sexual selection, play a role in this process as well? Existing research shows that sexual selection has produced different courtship strategies for men and women. For women, physical appearance represents important information that men attend to during mate selection, which has led women to focus more on their own physical attractiveness (Buss & Schmitt, 1993). Given the close connection between women's physique and daily diet, their food choices are likely influenced by reproduction-related cues. Current research on food choice primarily considers proximate factors, focusing on the roles of social and individual-level variables. Based on this, the present study explores the potential evolutionary foundations underlying female food choice, analyzing the role of sexual selection to reveal deeper mechanisms and provide theoretical reference for future research.

2 Sexual Selection and Mating Strategies

Sexual selection is a form of natural selection involving two core processes: attracting mates and competing with same-sex rivals. The former is often termed intersexual selection, while the latter is called intrasexual selection. Intersexual selection leads to the evolution of “ornaments,” such as the peacock's beautiful feathers, to attract potential mates; intrasexual selection leads to the evolution of “weapons,” such as the rhinoceros' s horn, to win in same-sex competition (Zhang, 2007). In human society, traces of both intersexual and intrasexual selection exist. For example, male creativity may have evolved as an “ornament” to attract females, while aggression may be a “weapon” evolved under pressure from same-sex competition (Chen & Chang, 2015). Additionally, features such as facial contours, body hair distribution, and sex differences in vocal pitch are

considered important manifestations of sexual selection in shaping human phenotypes (Dixson et al., 2005). The strength of sexual selection's influence on a species can typically be reflected through sexual dimorphism—stronger dimorphism indicates stronger sexual selection pressure.

Sexual selection directly influences mating strategies in different sexes. For women, mate selection primarily focuses on three aspects: whether the potential partner has good genes, can provide sufficient resources, and would be a good father (Lu et al., 2015). Good genes are often reflected in specific physiological and behavioral characteristics that are closely linked to testosterone levels in men (Gangestad & Simpson, 2000). Physiologically, these include symmetrical faces, muscular bodies, and deep voices; behaviorally, they are reflected through “ornaments” such as humor and risk-taking propensity (see Lu et al., 2015). Regarding resources, women prefer men with greater resources, with power, status, and wealth being important indicators. Additionally, higher dominance, achievement motivation, generous behavior, and education level are positively associated with resources and thus serve as reference indicators when assessing a potential mate's resource availability (Huberman et al., 2004). To acquire resources, men must compete with same-sex rivals using evolved “weapons,” with male violence and male-dominated warfare considered manifestations of such competition. For instance, research shows that activating mating motivation promotes men's processing of war-related concepts (Chang et al., 2011). Correspondingly, men have also shown adaptations for violent conflict. Compared to women, men have more robust and developed muscles, stronger aggression, and denser beards evolved to intimidate opponents (Puts, 2010; Puts et al., 2015). Numerous studies demonstrate that in both traditional and modern industrialized societies, male dominance and social status enhance mating and reproductive success (Hill et al., 2013). Consequently, women also prefer men with higher dominance traits during mate selection (Gildersleeve et al., 2014). Finally, women favor men with good father qualities. Throughout human evolution, paternal investment in offspring care has been crucial for offspring survival, including reducing mortality and enhancing competitiveness (Geary, 2000). This has made good father characteristics desirable regardless of resource provision, creating selective pressure on men. Indeed, research shows that under modern conditions, women value good father traits even more than good genes or resource provision when selecting mates (Lu et al., 2015).

Compared to women, men place greater emphasis on physical attractiveness when selecting mates. Key indicators of physical attractiveness include facial contours, skin tone, and physique. Facial information effectively reflects a woman's age, which is closely related to reproductive capacity (Conroy-Beam & Buss, 2019). Correspondingly, feminine faces reflect reproductive capacity, health, and other reproduction-related traits, while also indicating maternal investment in offspring, making them important references for male mate selection (Singh, 2002). Similar functions are served by skin firmness and hair quantity (Gangestad & Scheyd, 2005). Another critical factor affecting female attractiveness is physique, specifically lower waist-hip ratio and BMI, which are

important factors men attend to and are key indicators of female reproductive capacity (Singh et al., 2010). Men's focus on female physical attractiveness has been demonstrated in numerous studies. For example, research has found that activating men's mating motivation changes their attentional processing of female facial and bodily information (Lu & Chang, 2012). Correspondingly, male mate preferences create selective pressure on women, shaping relevant phenotypes. For instance, human female body shape can be seen as an important manifestation of sexual selection. From a physiological perspective, human female fat distribution is suboptimal, yet it makes women more attractive to men, becoming a reproduction-related feature (such as fat deposition in breasts and buttocks). Although specific preferences for body types vary across cultures and eras, these differences are largely quantitative rather than qualitative (Dixson et al., 2011; Wheatley et al., 2014). Similarly, after mating motivation activation, women become more attentive to their physique, clothing, and other attractiveness-related information (Jones et al., 2019).

Overall, in the process of sexual selection, men more often acquire mates through same-sex competition, while women more often do so by attracting the opposite sex. Sexual selection has led men and women to evolve different mating strategies. Compared to men's greater emphasis on reproductive cues such as appearance and physique, women place more importance on a potential partner's ability to provide resources and good father characteristics. Meanwhile, male mating strategies also create pressure for women to enhance their physical attractiveness and shape their physique to gain competitive advantages in the mating market.

3 Body Information and Female Food Choice

As an important reproductive cue, women's physique represents a key component of their mate value in the marriage market. This is influenced by both evolved biological factors and contemporary culture that promotes thinness as the beauty ideal and media that emphasizes body-related content. A survey of American college students found that compared to men, women have lower obesity rates but higher weight loss intentions (Lowry et al., 2000). Similarly, a 2011 survey by the China Youth Daily Social Survey Center showed that 34.9% of women had tried long-term dieting, induced vomiting, or taking large amounts of weight-loss drugs, compared to only 23.2% of men (Zhang & Xiang, 2011). These data further confirm that women pay more attention to their physique than men.

Regarding specific aspects of female physique, one widely studied indicator is the waist-hip ratio (WHR). Numerically, WHR for Caucasian women ranges roughly between 0.67 and 0.80 (Marti et al., 1991). When researchers presented participants with figures representing WHRs of 0.7, 0.8, 0.9, and 1.0, they found that a WHR of 0.7 was rated most attractive, with cross-gender and cross-age consistency (Singh, 1993). A later cross-cultural study involving samples from Cameroon, Indonesia, and New Zealand showed that lower WHRs were rated

as more attractive across different cultures (Singh et al., 2010). Lower WHR is not only an important cue for female attractiveness but also associated with various health risks. A World Health Organization report shows that WHR is closely linked to cardiovascular disease, type 2 diabetes, and mortality (World Health Organization, 2011). These studies suggest that women's physique information is not only an important reference for opposite-sex attractiveness judgments but also contains biological value. Indeed, WHR as an indicator of female reproductive value has received multiple lines of support. For example, WHR begins to decrease at puberty and remains low until menopause, a pattern consistent with reproductive age (Kosková et al., 2007). Additionally, low WHR is directly related to appropriate sex hormone levels (Jasieńska et al., 2004) and optimal cervical pH (Jenkins et al., 1995). Cervical pH also affects sperm transport within the cervix, directly influencing conception. Regarding in vitro fertilization, women with lower WHRs have higher conception rates (Wass et al., 1997). Lassek and Gaulin (2008) further found that women with lower WHRs bear children with better cognitive abilities.

In addition to WHR, BMI (body mass index) is another indicator linked to both female attractiveness and physiological health. The mainstream cultural ideal of thinness highlights the importance of relatively low BMI for female attractiveness. Meanwhile, high BMI is often associated with negative pregnancy outcomes such as gestational diabetes, hypertension, preterm birth, ovarian dysfunction, infertility, miscarriage, and menstrual irregularities (Mitchell & Fantasia, 2016; Silvestris et al., 2018; Zain & Norman, 2008). Furthermore, children born to obese mothers often have lower Apgar scores, are more likely to enter intensive care, and have greater perinatal mortality risk (Chandrasekaran & Neal-Perry, 2017). These findings suggest that BMI is not only an important factor affecting female attractiveness but also a key indicator of female fertility.

The important biological value embedded in physique information has led to corresponding adjustments in women's cognition and behavior. Compared to men, women are more sensitive to body cues, more concerned about weight, more dissatisfied with their physique, and more motivated to achieve an ideal body shape (Cho & Lee, 2013; Joseph et al., 2016). How then do women shape their physique to gain competitive advantages in the mating market? Current evidence suggests that dieting or controlling one's diet is a common method. To better manage their physique, women often restrict high-calorie food intake while consuming more fruits and vegetables (Gaylis et al., 2020). In daily life, compared to men, women more frequently choose low-calorie foods, fiber-rich vegetables, and fruits (Arganini et al., 2012). These gender differences in food choice patterns are evident not only in survey results but also in experimental studies (Lowry et al., 2000; Ristovski-Slijepcevic et al., 2010). Current research on the relationship between physique management and food choice has focused primarily on restrained eating and the link between food craving and female obesity (Sinha, 2018). Restrained eating refers to long-term strict control of food intake for weight management purposes (Herman et al., 2019). Restrained eaters are chronic dieters who control their weight long-term, predominantly

women, often motivated by physique control or dissatisfaction with their body (Schnettler et al., 2017). Research shows that restrained eaters exhibit specific processing of food cues (Fedoroff et al., 2003). Compared to non-restrained eaters, restrained eaters show higher sensitivity and cognitive bias toward food cues, particularly high-fat palatable foods (Roefs et al., 2005).

These findings suggest that the biological value embedded in female physique information has been shaped by sexual selection, which in turn influences women's cognitive processes and behaviors. For example, to maintain or achieve a better physique, women adjust their food selection and intake to avoid high-calorie foods. Correspondingly, women with strong mating intentions in daily life also pay relatively more attention to their attractiveness features such as physique (Ko & Suh, 2019). Based on such evidence, it is reasonable to hypothesize that sexual selection plays some role in female food choice.

4 From Sexual Selection to Female Food Choice

Although theoretically plausible, research directly examining female food choice from a sexual selection perspective remains in its early stages. Specifically, two main lines of research exist in this area: studies measuring changes in food choice after activating mating motivation, and investigations examining differences in food choice across menstrual cycle phases.

4.1 Mating Motivation and Female Food Choice

Mating motivation is an important concept closely related to sexual selection, which can be understood as reproduction-related motivation or more specifically as the psychological state of seeking to establish intimate relationships with the opposite sex (Su & Su, 2017; Kenrick et al., 2010). Activation of mating motivation triggers a series of psychological and behavioral changes that are directly related to mate selection mechanisms shaped by sexual selection. Specifically, mating motivation activation leads individuals to exhibit stronger mate competition strategies and to display more traits valued by potential mates. The former is exemplified by women showing more indirect aggression toward same-sex competitors with mating advantages (e.g., attractive appearance) when mating motivation is activated, such as social exclusion, rumor spreading, and derogation (Ding et al., 2017). The latter is exemplified by men exhibiting more conspicuous consumption when mating motivation is activated (Griskevicius et al., 2007).

Theoretically, the relationship between mating motivation activation and displaying more opposite-sex-preferred traits is often explained by costly signaling theory. This theory was originally developed to explain two seemingly contradictory biological phenomena: on one hand, natural selection favors the evolution of more efficient phenotypes, yet some phenotypes with no practical survival value and even increased survival risks (e.g., peacock feathers) persist; on the other hand, despite widespread conflicts of interest between individuals, honest

communication has evolved (Zahavi, 1975). The theory posits that if communication content (i.e., signals) can convey information of interest to observers, then communication between individuals with conflicting interests can be evolutionarily stable. Correspondingly, if the information conveyed during communication is closely linked to the signaler's characteristics, and the benefits of sending truthful information outweigh those of sending false information, then honest signals will benefit both parties (Bird et al., 2001). The frequently cited example of male peacocks' ornate feathers represents such a signal—increasing predation risk while honestly conveying superior genetic information to attract potential mates and gain more mating opportunities, thus being preserved through evolution. Psychologists and human ecologists have further introduced this concept to human research, suggesting that human male hunting ability and risk-taking behavior, female appearance and physique, and general altruistic behavior have all functioned as signals to some extent during human evolution (Bereczkei et al., 2010; Stibbard-Hawkes, 2019). Research shows that after mating motivation activation, humans exhibit more of such signals. For women, physique information is an important signal of reproductive potential; correspondingly, better presentation of relevant signals becomes an important option after mating motivation activation. For example, studies show that when mating motivation is activated or at relatively high levels, women choose more revealing clothing to appear more sexually attractive (Durante et al., 2011; Grammer et al., 2004).

Does mating motivation activation affect women's food choices? Theoretically, mating motivation makes women more attentive to their physical attractiveness, and the close relationship between physique and food choice leads us to hypothesize that mating motivation activation should also influence women's food selection. However, relevant direct research is limited. Desirable opposite-sex individuals often activate mating motivation. One study found that compared to dining with uninteresting men, women consumed fewer calories and chose less high-calorie food when dining with desirable men (Mori et al., 1987). Similar results have been replicated in subsequent research (Baker et al., 2019; Young et al., 2009). Additionally, presenting female participants with attractive male faces to activate mating motivation can increase their desire to take weight-loss medication, showing behavior consistent with food choice modification (Hill & Durante, 2011). A recent study further demonstrated that after mating motivation activation, women showed less willingness to purchase junk food and spent more money on healthy foods like fruits and vegetables, with this effect being more pronounced in women with higher restrained eating scores (Otterbring, 2018). Chan and Zlatevska (2019) similarly found that women in a mating motivation activation state tended to choose less meat, while men consumed more meat—a gender difference that also reflects sexual selection's role. Moreover, when dining with men, women's food intake significantly decreased, and this change was not due to anxiety or tension from conversing with men but rather from women's desire to present a more “feminine” image in such situations (Leng et al., 2017).

Overall, although theoretically promising, direct research examining mating mo-

tivation' s effect on female food choice remains scarce. Future research using multiple methods to manipulate mating motivation and examine subsequent food selection and consumption patterns, while exploring underlying mechanisms, will be important for dissecting mating motivation' s role in female food choice.

4.2 Female Ovulation and Food Choice

Across different menstrual cycle phases, women' s mating-related psychological components may change. Compared to other cycle phases, ovulating women are more attracted to men with masculine features (e.g., angular faces, symmetrical faces, deep voices), more open to short-term relationships, report more sexual fantasies in self-reports, and are more easily attracted to opposite-sex individuals (for a review, see Gangestad et al., 2005). Researchers argue that these cyclical changes exist because women are more likely to conceive during ovulation, and corresponding response characteristics would have higher fitness during evolution (Gangestad & Thornhill, 2008). Importantly, these cyclical changes also affect women' s behavior—ovulating women are relatively more sociable, wear more attractive clothing, and pay more attention to their physical attractiveness (Durante et al., 2011). Such behaviors help women attract potential mates and gain advantages in same-sex competition.

Just as mating motivation activation leads women to focus more on their physical attractiveness and triggers changes in food choice, differences in attention to physical attractiveness across menstrual cycle phases may further trigger food choice variations. Some studies have found that compared to other cycle phases, women consume fewer calories during ovulation (Saad & Stenstrom, 2012) and have stronger desires to lose weight to achieve a more ideal physique (Meltzer et al., 2015). These changes may stem from enhanced mating motivation during ovulation, which in turn affects food choice. Roney and Simmons (2017) found that during ovulation, women have stronger mating desires accompanied by decreased food intake. Furthermore, different menstrual cycle phases involve hormonal changes that affect women' s mating motivation intensity (Gangestad et al., 2010; Roney & Simmons, 2013). This implies that specific hormones play a role behind mating motivation effects, and incorporating hormonal considerations into understanding how mating motivation influences female food choice will greatly benefit the field' s development. Estradiol and progesterone appear to be two hormones worth considering. Animal model studies show that estradiol positively predicts sexual behavior, while progesterone negatively predicts it (Michael et al., 1978; Zumpe et al., 1983). Human studies similarly show that these hormone levels are closely linked to mating motivation intensity and interest in interacting with opposite-sex individuals (Gangestad et al., 2010; Roney & Simmons, 2013).

On the other hand, women also show differences in food cravings across menstrual cycle phases. Compared to other phases, women experience stronger food cravings during the luteal phase, with greater desire for high-fat foods (McNeil

et al., 2013), consumption of more high-calorie foods including sweets and fatty foods (Martini et al., 1994; McNeil et al., 2013), and willingness to spend more money on food (Saad & Stenstrom, 2012). Notably, luteal phase food cravings may differ by food type—some studies show that luteal phase cravings are more pronounced for sweets, while desires for salty and sour foods do not change across cycle phases (Alberti-Fidanza et al., 1997). Recently, researchers examined women’s preferences for genetically modified foods across cycle phases and found that preference ratings for genetically modified foods significantly decreased during the luteal phase (Chen et al., 2020). The researchers interpreted this as potentially reflecting a reproductive protection mechanism, as the luteal phase is the preparatory stage for conception, requiring avoidance of food-related risks to reduce potential harm to the conception process (Chen et al., 2020). This study suggests that sexual selection’s shaping of female food choice may serve not only mating functions but also offspring care. Similarly, luteal phase food cravings may be closely linked to hormones. Specifically, the antagonistic relationship between estrogen and progesterone may play an important role. When progesterone decreases, estrogen exerts greater regulatory effects, reducing dietary motivation and food intake (Asarian & Geary, 2013). When progesterone levels rise and take effect, it inhibits estrogen’s action and enhances binge eating tendencies (Klump et al., 2013, 2014).

Overall, empirical research examining the relationship between menstrual cycle and female food choice remains relatively limited, and findings require replication in future studies. Many questions behind their connection need answers. For example, do decreased food intake during ovulation and increased food cravings during the luteal phase share the same underlying mechanisms? If hormones play a central role, which brain regions regulate these hormonal changes? What is their adaptive significance? Answering such questions requires integrating perspectives from neuroscience, evolutionary biology, and other fields through interdisciplinary collaboration to better reveal the possible reasons and adaptive significance of differences in female food choice across menstrual cycle phases.

5 Discussion and Outlook

The inhibition of high-calorie food choice by mating motivation and reduced food intake during ovulation both reflect, to some extent, sexual selection’s shaping of female food choice. However, overall, relevant empirical research remains scarce, which does not match the high theoretical plausibility of such connections. This article first theoretically analyzes the possibility of such links, then reviews existing evidence to provide reference for exploring female food choice from a sexual selection perspective. It should be noted that from an evolutionary perspective, humans have a generalized preference for high-calorie foods because such foods helped our ancestors obtain energy. In environments where survival resources were relatively scarce and variable over time, high-calorie foods better satisfied human survival needs (Ahlstrom et al., 2017). This

means that although sexual selection leads women to reduce high-calorie food choice when reproductive cues are salient, these psychological and behavioral responses should be regulated by other psychological components, such as inhibitory control (suppressing high-calorie food choice when reproductive cues are salient). Future research should employ evidence from different levels to better reveal sexual selection's influence on female food choice.

From a behavioral perspective, sexual selection has shaped differentiated reproductive strategies across sexes (Puts, 2016). These strategies are generally universal at the macro level, causing individuals to display more traits that attract potential mates when mating-related psychological components are activated. However, at the detailed level, they are sex-specific, causing men and women to highlight different categories of traits to attract potential mates. Both the universal and sex-specific strategies affect individuals' food choices. However, it should be noted that the above explanations regarding food choice have not incorporated proximate explanations. Mayr's (1961) famous proximate-ultimate causation framework suggests that both proximate and ultimate causes are necessary when analyzing phenomena. From a proximate perspective, factors influencing female food choice may involve situation, dining environment, individual emotion, cognition, and social factors (for reviews, see Ariely & Norton, 2009; Drewnowski, 1997). So do these factors interact with evolutionary factors affecting food choice to jointly influence female food selection? Existing research suggests this is highly likely. For example, although activating mating motivation reduces women's high-calorie food choice, this effect is more pronounced in women with higher restrained eating scores (Otterbring, 2018), suggesting that women's attitudes toward food may moderate this relationship. Correspondingly, whether factors such as emotion and situation moderate the effects of mating motivation or menstrual cycle on female food choice await further investigation.

Behavioral mechanisms are often supported by more physiological underpinnings. As we have mentioned, hormones likely play an important role. Hormones are intimately linked to sexual selection, with common examples including estrogen, progesterone, and testosterone. Research shows that women's hormone levels change across menstrual cycle phases, affecting mate preferences and mating motivation. These changes are theoretically explained by the dual mating strategy hypothesis, which posits that women have different mating strategies across cycle phases. During ovulation when fertility is higher, women prefer individuals who may be less committed but have better genetic advantages (characterized by traits like more symmetrical faces); during non-fertile phases, they prefer men who invest more in relationships and are more prosocial (Pillsworth & Haselton, 2006). Notably, while the dual mating strategy hypothesis is appealing and can explain some observed phenomena, some findings do not support it. For example, a recent large-scale longitudinal study showed no significant relationship between openness to intimate relationships and women's steroid hormone levels across the cycle (Jones et al., 2018). Based on this, some researchers propose that across different cycle phases, women may

not show refined characteristic changes in mate preferences (i.e., preferring one type of man during ovulation and another during non-fertile phases), but rather general changes in mating motivation intensity accompanying cycle changes, proposing the estrous model (Jones et al., 2019). This model suggests that like non-human primates, human females experience stronger mate-seeking motivation during ovulation, which may not serve reproductive success but other functions, such as facilitating better food acquisition (Roney, 2021). Both the dual mating strategy hypothesis and estrous model differ in details but share a consensus: different menstrual cycle phases are accompanied by hormonal changes that affect women's mating motivation intensity. This implies that specific hormones play a role behind mating motivation effects, and incorporating hormonal considerations such as estrogen into understanding how mating motivation influences female food choice will greatly benefit the field. Moreover, beyond sex hormones, oxytocin and vasopressin also play important roles in intimate relationships. Researchers suggest these hormones have cross-species consistency in their roles in social and sexual behavior, indicating an ancient evolutionary history (Johnson & Young, 2015). Whether these hormones play any role in sexual selection's shaping of female food choice is also worth considering.

Beyond behavioral mechanisms and hormonal influences, brain-level exploration is indispensable for better understanding these phenomena. On one hand, rapid developments in neuroscience in recent years have provided a foundation for such research; on the other hand, these evolutionary-level effects have specific biological underpinnings that must be reflected in brain structures or activation patterns. In relevant studies, researchers typically have participants view photos of their romantic partners and record corresponding brain activity. These studies find that viewing partner photos activates regions including the striatum, mid-insula, dorsal anterior cingulate cortex, hippocampus, and hypothalamus (Bartels & Zeki, 2004). These brain regions are clearly linked to social cognition, emotional processing, and reward functions. From a food choice perspective, food intake itself is a rewarding stimulus that necessarily involves reward-related brain regions. Research shows that compared to low-calorie foods, high-calorie foods produce greater activation in reward circuits (Frank et al., 2010). Correspondingly, men and women often show different responses to food. Compared to men, women are more concerned about food, have more knowledge about food ingredients, are more likely to diet or overestimate their weight and feel they need to lose weight, and pay more attention to dietary health (Uccula & Nuvoli, 2017). These behavioral differences are naturally reflected in brain circuits. For example, when viewing food-related stimuli, women show greater activation than men in brain regions related to behavioral control and self-reference, including dorsolateral, ventrolateral, and ventromedial prefrontal cortex, middle and posterior cingulate cortex, and insula (Killgore & Yurgelun-Todd, 2010). Compared to low-calorie foods, high-calorie foods more strongly activate the posterior right superior temporal sulcus (Manippa et al., 2017). So which brain regions play important roles in the connection between mating motivation and female food choice? From the perspective of overlapping brain regions activated

by mating and food choice, reward circuits likely play some role; for decisions regarding high- versus low-calorie foods, brain regions related to inhibitory control may be important. On the other hand, women's responses to food stimuli may also differ across menstrual cycle phases, which awaits future investigation. Overall, constructing a brain-hormone-behavior three-dimensional model is important for examining how mating motivation and menstrual cycle affect female food choice.

It should be noted that one premise of sexual selection influencing female food choice is that human females were subject to sexual selection pressures in the environment of evolutionary adaptedness (EEA), because according to Leda Cosmides and colleagues, human psychological mechanisms are adaptations to recurrently encountered pressure environments in the EEA rather than to current environments (see Barkow et al., 1992). However, since the EEA cannot be accurately reconstructed, whether human females experienced sexual selection pressures during human evolution remains uncertain. Yet existing evidence suggests sexual selection pressures have played important roles in human female evolution: First, many studies suggest that female breasts, skin tone, vocal pitch, and other features have evolved as important products of sexual selection, affecting women's value in the mating market (see Clutton-Brock, 2009). Second, in humans' close relatives such as chimpanzees and bonobos, female phenotypes and behaviors are shaped by sexual selection pressures (see Stanyon & Bigoni, 2014). Finally, in hunter-gatherer societies, researchers have found that men prefer women with specific characteristics during mate selection, indicating this preference has an ancient evolutionary history (Apicella & Feinberg, 2009; Marlowe, 2004). For women, men's preferences constitute a sexual selection pressure that shapes relevant psychology and behavior. Regarding the connection between physique and food choice, we focused on two indicators: WHR and BMI. The relationship between BMI and food choice is relatively direct, with numerous studies showing that low-calorie, low-sugar foods are associated with relatively lower BMI (Blundell & Gillett, 2001). This leads individuals to choose specific food types to shape or maintain a more ideal BMI (Chmurzynska et al., 2021). The relationship between WHR and food choice is relatively indirect. Due to women's relatively wider pelvis, thinner women have relatively lower WHRs than heavier women, making BMI and WHR naturally positively correlated to some degree in female populations (Göger & Cingil, 2020). This means individuals can change their WHR through food selection. It should be noted that few studies have directly examined the link between food intake and WHR, and whether food choice can directly affect WHR awaits future research.

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