

Parasitic Approach to the Development of Modern Cosmetic Industry

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Abstract: This is a literature review study focused on the connection between parasite stress and the development of the modern beauty industry. It is hypothesized that parasite stress may consequently result in contributing to females' consumption of cosmetic products and plastic surgeries. The research begins with how natural selection theory, sexual selection theory, and parasite stress theory are contributing to the shaping of human mate preferences. Two types of consequences of parasitic infections are introduced: facial-benefitting and facial-disrupting. These two types of impact on female faces all result in increasing and reinforcing social comparison among females. The social comparison evolved throughout time contributing to mate selection and modern times manifestations in the cosmetic industry. It is suggested that future research in this field can explore the connection between parasite stress and differences in self-esteem between males and females.

Keywords: Parasite stress, natural selection, sexual selection, social comparison, cosmetic industry.

1. Introduction

Why are women often the consumers of the cosmetic industry? Compared to men, women seem to pay more attention to and put more effort into their appearance in most researched societies. They often invest in their appearance by purchasing makeup products and undergoing plastic surgeries and tend to spend significant amount of time using digital filters and photoshop applications. What led to these common behaviors, and how did they develop in modern society? To explain the phenomenon, this study approaches the above-mentioned phenomena by using concepts of the natural selection theory and parasite stress theory through literature review. The study explores the relationship between the evolutionary hypothesis and modern cosmetic industry development. It is hypothesized that the parasite theory may have shaped women's beauty standards and indirectly contributed to the growth of modern society's beauty industry.

2. Natural Selection Theory and Parasite Stress Theory

As explained in Thornhill and Fincher's [1] article, natural selection theory hypothesizes that those with survival inherited traits will most likely pass on genes to succeeding generations. For successful survival and reproduction, humans must adapt to the environment to avoid existential risks. In fact, parasite diseases were one of the essential causes of death throughout the human evolutionary process

[2]. Therefore, according to natural selection theory, to ensure the survival rate of the current and next generation, humans had to build certain mechanisms in their regular life. Fincher and Thornhill [3] developed the parasite stress theory to further explore this. The theory explains the adaptation strategies humans developed to combat parasitic diseases, and they focused on its contribution to family ties and religion. They state that regions with higher prevalence of parasitic disease stress correlate positively with stronger family ties and religiosity. The results of their study revealed that it is possible for parasite stress to have an influence on human relationships, behaviors and society.

3. Mate Selection and Parasite Stress Theory

Many known phenomena related to mate selection can be explained by parasite stress theory. Based on the parasite stress theory, DeBruine et al. [4] expanded to explore the correlation with human mate preferences. They used Fincher and Thornhill's measures of parasite stress and conducted a linear regression with women's preferences for men's masculine and healthy facial features. Results revealed a significant positive relationship between parasite stress and both masculine and healthy facial characteristics, which indicates that parasite stress seems to be a determinant of mate selection. One possible explanation for the results seems to be various parasites' effects on human facial features and health conditions. In research conducted by El-Beshbishi et al. [5], showed that parasite infections could cause skin inflammation, cutaneous lesions, and facial polymyositis. Akst et al. [6] reported a case of dirofilariasis infection in their article that presented a symptom of a long-term facial mass on a female patient's right cheek. Such a facial mass can influence a patient's facial averageness and symmetry. Facial averageness and symmetry seem to be important characteristics of attractiveness [7]. Researchers collected data from eight male volunteers; they were required to evaluate the attractiveness of 62 female faces. Then, researchers measured the female faces for their averageness and symmetry. Finally, they conducted a test to examine the correlation between facial averageness and symmetry with attraction. The result indicated that there is a significant negative correlation; when the female face is more asymmetrical, males evaluate it as less attractive. Females showed a preference for symmetry in male faces as well [8]. This research used 15 pairs of asymmetrical and symmetrical male faces, and female participants were asked to judge their faces on scales of attractiveness. A one sample t-test was conducted to reveal the relationship between female preference and male facial symmetry. The results pointed out that there is a significant relationship, which states that females have a strong preference for symmetrical male faces. Referring these results back to instances of parasite infection, facial skin may present symptoms that would affect their averageness and symmetry. These unfavorable facial traits may negatively influence attraction to the opposite sex and lead to less sexual access [9]. This connection may add weight to the potential correlation of parasite stress theory to mate selection.

Nevertheless, researchers found that not all parasite infections would result in negative impact. In fact, some parasites may enhance one's attractiveness in order to ensure their survival. According to Thornhill and Fincher's study, natural selection theory [1], evolution always favors those who adapt successfully to the changing environment. If humans who carry parasites' attractiveness is negatively impacted, they may have a lower possibility of mate access and off-spring reproduction. Consequently, parasites may have fewer transmission routes and fewer potential hosts which could affect their survival rate. Therefore, it seems reasonable to theorize at least some types of parasites increase the hosts' attractiveness to improve their survival and transmission rates as well as raise the chances of reproduction for the next generation of parasites. Borráz-León et al. [10] confirmed toxoplasma is one of the parasites that may positively alter hosts' appearances and behaviors to achieve their transmission and reproduction objectives. In their research, 35 toxoplasma-infected and 178 non-infected participants reported their perception of their attractiveness, number of sexual partners, body weight, and facial fluctuating asymmetry. Another different group of participants is

asked to judge infected and noninfected participants' attractiveness and perceived health. Researchers conducted a multivariate Analysis of Covariance (MANCOVA) to explore the relationship between infected and noninfected participants' facial and health characteristics and evaluation given by the judging group. The results revealed that infected males have lower fluctuating asymmetry compared to non-infected males, infected females have lower body weight, lower facial fluctuating asymmetry, and higher number of sexual partners compared to non-infected females. In addition, infected males and females were generally valued as more attractive and healthier than non-infected. Therefore, it seems predictable that toxoplasma-infected people would have a higher possibility of mating success [9]. This research finding contributes to the adaptation hypothesis that parasites may manipulate hosts' appearance to "help" them increase their access to sexual partners, therefore creating an environment that is beneficial for their survival and reproduction.

According to previous analyses, the results may initially seem to be contradictory to each other. On the one hand, some parasites can negatively alter hosts' facial symmetry and averageness to reduce their attractiveness, therefore leading to less access to sexual partners. However, on the other hand, some parasites can enhance hosts' attractiveness by increasing their facial symmetry and perception of health to make their hosts more desirable to the opposite sex. Although parasites may alter hosts' appearance in both directions, they are all contributing to increase women's tendencies to compare with each other and are indirectly encouraging the modern cosmetic industries.

4. Parasites Leading to Social Comparison

Parasites may negatively or positively impact hosts' facial attractiveness but regardless the changes consequently lead to social comparison among females. Martin and Kennedy's [11] research focused on the influences of attractive female images on adolescents' beauty standards and comparison tendencies. The research participants were 145 female adolescents; their levels of self-esteem and perceptions of attractiveness were self-reported using questionnaires. They also provided attractiveness ratings for beautiful female images selected from various advertisements. A one-way ANOVA was conducted to examine the relationship between the exposure to beautiful female images and participants' self-esteem level, beauty standards, and tendency to compare. The results indicated that these exposures raised participants' beauty standards and dropped their self-esteem. Furthermore, the more the participants had aged, the greater the tendency for them to compare themselves with the beautiful models from the photos. Based on these findings one could conclude that there may be a connection between parasite stress theory and social comparison. Females' faces being negatively and positively impacted by parasitic infection may all result in increasing the tendency of social comparison among females. On one hand, females who experience negative impact from parasites on their attractiveness may form an upward social comparison towards other females who are healthy or infected by beauty enhancing parasites. Upward social comparison happens when an individual is comparing oneself with someone judged to be better than oneself. As previous mentioned research findings confirm, females who are exposed to extremely attractive female images may result in the increase of tendencies to compare themselves with these models. On the other hand, females infected by beauty enhancing parasites may affect other females due to their increased attractiveness. Females may raise their beauty standards when surrounding attractiveness benefiting parasite-infected peers, and then, likely to form the tendency to compare themselves with these peers.

Not only those females who felt less attractive than other females may lead to the forming of social comparison, but also those who are more attractive. Kowal et al. [12] and Wagstaff and Sulikowski's [13] research findings support this. Kowal et al. found that there is a U-shape relationship between one's physical attractiveness and time spend on enhancing their beauty. To be specific, females who perceive themselves as attractive and not very attractive tends to spend more time displaying cosmetic behaviors, and those who perceive themselves as average attractive spend the least amount of time

on beauty enhancing. Females who are confident in their attractiveness tend to be more aware of their own and other females' appearance. Wagstaff and Sulikowski's [13] research further revealed that females who are more intrasexually competitive and have higher level of self-attractiveness perception, may be more influenced by other females' appearances because they would desire to confirm their social standing by comparing with others. In the case of parasite-infected females, they may raise their awareness toward other female faces.

5. Social Comparison Evolved from Facial-Disrupting Parasites Promoting Modern Cosmetic Industry

Some parasites which negatively alter one's attractiveness may increase social comparison, and result in stimulating the demand in the modern cosmetic industry. As mentioned in Pazhoohi and Kingstone's [14] research, according to sexual selection theories, individuals who present traits that are related to good health and fertility seem to have more access to the opposite sex. Before anti-parasite medications were developed, parasitic infections were one of the most common factors leading to death [2]. Humans would benefit from presenting themselves as parasite-free in order to have greater access to mating opportunities. In regions with more intensive parasite stress, humans tend to develop combat strategies against parasitic infections to ensure their reproduction chances. One of the strategies that males use to show their health condition is to emphasize their facial masculinity [15]. Pazhoohi and Kingstone [14] focused their research on the relationship between male beardedness and parasite prevalence. Researchers interviewed 14,032 participants from 25 countries about their bearded status and used Fincher and Thornhill's [3] pathogen prevalence to conduct a multiple regression model. The results reveal that parasite prevalence is one of the significant predictors of beardedness. In other words, males from regions with high parasite stress are more likely to sport beards compared to those from low parasite stress regions. The researchers explained that the beard is used as an ornament to present males' health condition, vitality, and is an indicator of the ability to resist parasitic infections.

However, typically females have less body hair than males, so they cannot apply this strategy. Females developed other methods to combat parasitic infections throughout time. Prokop and Fedor [16] introduced in their article about the idea developed by Newton-Fisher and Less that grooming was one of the combat strategies against parasites used by various animals, and primates are one of the classic examples of this. Primates show a significant increase of amount of time in grooming when they are parasite infected. Grooming can be considered both self-care and enhancing attractiveness behaviors. Human females may use the same strategies to promote their physical attraction to potential partners. Kowal et al. [12] conducted a study to examine the predictors of time spent to enhance one's appearance, they aimed to research from 5 perspectives: mating market, pathogen prevalence, biosocial role, cultural media, and the individualism-collectivism continuum. The research included eight beauty enhancing behaviors: applying makeup, managing bodily hygiene, using cosmetic products, exercising, hair grooming, picking outfits, following specific diets, and others. The research collected data from ninety-three countries and 93,158 participants. The results indicated that females tend to spend more time on beauty enhancing behaviors with an average of 23 minutes more time spent per-day than males. This can probably be explained by females having less body hair than males which they lack natural attractiveness enhancing factor, therefore, they need to spend more time for active self-beautification. The results further revealed that there is a positive correlation between countries' pathogen prevalence and time spent on enhancing attractiveness, meaning the higher a country's pathogen prevalence index is, the higher amount of time participants reported spending on their appearance. Importantly, participants who have had severe pathogen-infected history show they spend more time on enhancing beauty then those who have not. All the

research findings discussed above seems to align with each other; they all contribute to explain the connection between parasitic infection and the modern cosmetic industry.

6. Social Comparison Evolved from Facial-Benefitting Parasites Promoting Modern Cosmetic Industry

Females with facial-benefitting parasitic infections may promote the modern cosmetic industry. Wagstaff and Sulikowski's [13] research about the connection between intrasexual competition and cosmetic purchases contributes to this idea. In the study, 220 female participants self-reported their makeup use attitudes, intensity of Instagram use, and intrasexual competitiveness. Then, participants were placed in a hypothetical makeup purchasing task to value their tendency to buy beauty items. The results of the multiple regression test indicated that the intensity of Instagram use and intrasexual competitiveness predict the purchase of products. Furthermore, the research reported that females who rated themselves higher on the physical attractiveness scale tend to invest more time in Instagram use. They may reaffirm their social standing by using social media platforms. With more exposure to ideal female images in social media, females may be motivated more to purchase cosmetic products to strengthen their appearance competitiveness further. Females who carry facial benefiting parasites may have a high perceived physical attractiveness due to their increased beauty. Therefore, according to the research findings, they may raise their awareness of their own and other females' appearances and invest more money into makeup products. Consequently, this will benefit the cosmetic industry.

Facial-benefitting parasites may promote the modern beauty industry by reinforcing the upward social comparison among females. In the previous "Parasites Leading to Social Comparison" section, it was mentioned that females who carry facial-benefitting parasites are likely to raise other females' beauty standards and promote upward social comparison from other females. This reinforcement of upward social comparison can contribute to the high demand of cosmetic industries. In addition, females who have less attractive faces tend to have lower self-esteem, are more likely to undergo cosmetic surgeries. Research shows that high exposure to upward social comparison may result in low self-esteem, leading to the stimulation of the modern cosmetic industry [17, 18]. Vogel et al.'s [17] research examined the relationship between upwards social comparison and self-esteem. Researchers developed an experimental website for participants and presented "ideal" human images to participants. Participants completed a self-esteem scale before and after viewing the website. Results indicated that there is a significant drop in self-esteem after exposure to such ideal human images. Brown et al. [18] focused their research on perceived physical attractiveness and the likelihood of accepting cosmetic surgery. Participants were asked to rate themselves' on their physical attractiveness and the likelihood of undergoing a range of 49 popular plastic surgeries. A regression was conducted to test the predictors of undergoing plastic surgeries. They found that low perceived physical attractiveness is one of the significant predictors of the high possibility to undergo plastic surgery. One may conclude that females with facial-benefitting parasitic infections are contributing to the cosmetic industry by reinforcing their social standing and upward comparison among females.

7. Conclusion

In modern society, although parasites seem controllable due to the developments of parasite tests and medications [19], the evolutionary legacies may still have an influence even now in the modern times. As the Natural Selection Theory, Sexual Selection, and Parasite Stress Theory suggest, parasites may have shaped humans' mate preferences and beauty standards. Due to the fact that parasitic infection was one of the top factors leading to death before, humans tend to choose mates whose faces are symmetrical and look healthy. Humans developed their own combat strategies to make their faces seem more parasite-free. Males sport beards to ornament their faces so the parasitic infection

symptoms are covered; however, females cannot apply this strategy. Therefore, they developed their own adaptation method to fit the sexual selection rules. They used hair grooming as one of the ways to protect themselves from infections when makeup and plastic surgeries were not invented. Another stimulative factor of the modern industry that evolved from parasite stress is the results of parasitic infections. Parasitic infections can impact an individual's facial appearance one either of the directions, disrupting or benefitting. These two directions consequently lead to social comparison and finally contribute to the modern cosmetic industry. For facial-disrupting parasites, females may form upward social comparisons due to their decreased physical attractiveness, leading to lower self-esteem. Infected females may seek cosmetic products and surgeries to improve their lowered attractiveness. For facial-benefitting parasites, they tend to increase hosts' facial symmetry and attractiveness, encouraging females to be more aware of their faces and reinforcing the upward social comparison among females. This research contributes to the understanding of the connection between parasite stress theory and the development of the modern cosmetic industry. Future studies in this field may dive deeper into the connection between parasites stress and differences in male and female self-esteem. Based on forementioned evidence from past research, males' "natural makeup" such as beard may encouraged males' belief in their ability to resists parasitic infection, therefore contributing to their confidence in attraction, leading to a stronger self-esteem in having access to more sexual partners.

References

- [1] Thornhill, R., & Fincher, C. L. (2014). The parasite-stress theory of sociality, the behavioral immune system, and human social and cognitive uniqueness. *Evolutionary Behavioral Sciences*, 8(4), 257–264. <https://doi.org/10.1037/ebs0000020>
- [2] Wolfe, N. D., Dunavan, C. P., & Diamond, J. (2007). Origins of major human infectious diseases. *Nature*, 447(7142), 279–283. <https://doi.org/10.1038/nature05775>
- [3] Fincher, C. L., & Thornhill, R. (2012). Parasite-stress promotes in-group assortative sociality: The cases of strong family ties and heightened religiosity. *Behavioral and Brain Sciences*, 35(2), 61–79. <https://doi.org/10.1017/s0140525x11000021>
- [4] DeBruine, L. M., Little, A. C., & Jones, B. C. (2012). Extending parasite-stress theory to variation in human mate preferences. *Behavioral and Brain Sciences*, 35(2), 86–87. <https://doi.org/10.1017/s0140525x11000987>
- [5] El-Beshbishi, S. N., Ahmed, N. N., Mostafa, S. H., & El-Ganainy, G. A. (2012). Parasitic infections and myositis. *Parasitology Research*, 110(1), 1–18. <https://doi.org/10.1007/s00436-011-2609-8>
- [6] Akst, L. M., Dipasquale, B., Berho, M., Greene, D., & Roberts, J. (2004). *Dirofilaria immitis* infection presenting as a facial mass: Case report of an emerging zoonosis. *American Journal of Otolaryngology*, 25(2), 134–137. <https://doi.org/10.1016/j.amjoto.2003.09.005>
- [7] Baudouin, J.-Y., & Tiberghien, G. (2004). Symmetry, averageness, and feature size in the facial attractiveness of women. *Acta Psychologica*, 117(3), 313–332. <https://doi.org/10.1016/j.actpsy.2004.07.002>
- [8] Little, A. C., Jones, B. C., DeBruine, L. M., & Feinberg, D. R. (2008). Symmetry and sexual dimorphism in human faces: Interrelated preferences suggest both signal quality. *Behavioral Ecology*, 19(4), 902–908. <https://doi.org/10.1093/beheco/arn049>
- [9] Rhodes, G., Simmons, L. W., & Peters, M. (2005). Attractiveness and sexual behavior: Does attractiveness enhance mating success? *Evolution and Human Behavior*, 26(2), 186–201. <https://doi.org/10.1016/j.evolhumbehav.2004.08.014>
- [10] Borráz-León, J. I., Rantala, M. J., Krams, I. A., Cerda-Molina, A. L., & Contreras-Garduño, J. (2022). *Are toxoplasma-infected subjects more attractive, symmetrical, or healthier than non-infected ones? evidence from subjective and objective measurements*. *PeerJ*, 10. <https://doi.org/10.7717/peerj.13122>
- [11] Martin, M. C., & Kennedy, P. F. (1993). Advertising and social comparison: Consequences for female preadolescents and adolescents. *Psychology & Marketing*, 10(6), 513–530. <https://doi.org/10.1002/mar.4220100605>
- [12] Marta Kowal et al. (2022). Predictors of enhancing human physical attractiveness: Data from 93 countries. *Evolution and Human Behavior*, 43(6), 455–474. <https://doi.org/10.1016/j.evolhumbehav.2022.08.003>

- [13] Wagstaff, D. L., & Sulikowski, D. (2023). The impact of sexual strategies, social comparison, and Instagram use on makeup purchasing intentions. *Evolutionary Behavioral Sciences*, 17(3), 307–321. <https://doi.org/10.1037/ebs0000285>
- [14] Pazhoohi, F., & Kingstone, A. (2020). Parasite prevalence and income inequality positively predict beardedness across 25 countries. *Adaptive Human Behavior and Physiology*, 6(2), 185–193. <https://doi.org/10.1007/s40750-020-00132-6>
- [15] Thornhill, R., & Gangestad, S. W. (1999). Facial attractiveness. *Trends in Cognitive Sciences*, 3(12), 452–460. [https://doi.org/10.1016/s1364-6613\(99\)01403-5](https://doi.org/10.1016/s1364-6613(99)01403-5)
- [16] Prokop, P., & Fedor, P. (2013). The effects of parasites on human behaviour: An evolutionary perspective. *Problems of Psychology in the 21st Century*, 5(1), 46–65. <https://doi.org/10.33225/ppc/13.05.46>
- [17] Vogel, E. A., Rose, J. P., Roberts, L. R., & Eckles, K. (2014). Social Media, social comparison, and self-esteem. *PsycEXTRA Dataset*. <https://doi.org/10.1037/e512142015-699>
- [18] Brown, A., Furnham, A., Glanville, L., & Swami, V. (2007). Factors that affect the likelihood of undergoing cosmetic surgery. *Aesthetic Surgery Journal*, 27(5), 501–508. <https://doi.org/10.1016/j.asj.2007.06.004>
- [19] Stephenson, I., & Wiselka, M. (2012). Drug treatment of tropical parasitic infections. *Drugs*, 60(5), 985–995. <https://doi.org/10.2165/00003495-200060050-00002>