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Pornography Addiction on Adolescent: A Systemic Review of Reported Impact on Brain and Sexual Behavior

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Abstract

This review aimed to systematize empirical research published between 2014 to present on the implications of adolescents' use of pornography. As the phenomenon of pornography addiction among adolescents today is increasing significantly it raises the question of the impact of exposure to pornography on adolescents. Specifically, the influence on the development of adolescent brain function and sexual behavior. To achieve the goal of the study, a systematic search was conducted, and a simple thematic analysis approach was used to identify the effects of pornography addiction as discussed by previous researchers on similar topics on Scopus, ProQuest, PubMed, and Google Scholar throughout August 2021 to determine the latest evidence and observations. A literature review of 20 relevant studies was thoroughly proved that the effects of pornography addiction on adolescents is a hotly debated topic, it can be addicted and stimulated the reward pathway in the brain, and negatively associated with increased sexual behavior. As several empirical studies definitively examine this problem. Some themes and implications of these findings are discussed.

Keywords: Addiction, Adolescents, Brain, Pornography, Sexual Behavior

Introduction

Adolescent's curiosity about sexuality is a normal aspect of human development. However, the development of internet technology in recent decades has revolutionized the easier distribution of materials containing sexually explicit content, thus changing the way adolescents understand sex and sexuality. At this time, the lives of adolescents are heavily influenced by technology and the development of the internet (Dong et al., 2020), because it provides many information and conveniences for adolescents (Chao et al., 2020), such as education, entertainment, and social communication. However, it also has the risk of trapping adolescents as problematic internet users and can attack every aspect of their lives, especially during the COVID-19 pandemic that occurs at this time of extraordinary scientific progress and global digitalization (Serra et al., 2021). The coronavirus continues to spread which causes

long-distance socialization and quarantine become the core to control pandemics, but it can also increase loneliness and stress that can lead adolescents have a risky behavior towards pornographic habits because they can use the internet without control (George et al., 2019). Besides, as it is known easy access to online pornographic content causes the percentage of exposure to internet pornography among adolescents to be higher compared to other internet services (Kim et al., 2020) and the impact of its exposure becomes a very serious problem (Suwarni et al., 2019) and worrying (Allen et al., 2017) because some of them need to seek treatment (Gola et al., 2017) and rehabilitation.

The study on pornography addiction remains a topic of discussion by scientists and health practitioners and it is becoming increasingly popular. However, there is no specific diagnostic for pornography addiction as it has not been included in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association, 2017), despite a 2006 longitudinal study of internet addiction concluded that of the various internet-related activities, pornography has the greatest potential to become addictive (Allen et al., 2017; Meerkerk et al., 2006), and there is neuroscience evidence related to that (Love et al., 2015). Therefore, more in-depth empirical studies are highly demanded because the nature of the addiction has the potential to bring negative effects (Awan et al., 2021). These include modeling and imitating negative interpersonal behaviors (Sniewski & Farvid, 2020), emotional disturbances (Dong et al., 2020), stimulation of premature sexual activity (Gola et al., 2017), sexual identity damage that can influence sexual behavior (Lin et al., 2020), as well as influencing neuropsychological mechanisms (Markert et al., 2021).

As many studies explain the effects of pornography addiction among adolescents, as well as the increasing number of publications, an updated systematic review is needed. Therefore, the purpose of writing this article is to conduct systematic review the latest literature (i.e., 2014 to present) related to the effects of pornography on adolescents. This study aims to raise awareness that there is easy access and abundance of online pornographic content exposed to adolescents and its potentially addictive. In addition, this study is expected to increase comprehension about the effects of pornography addiction on the development of adolescents who use it. Specifically, first, we reviewed the common question of the influence of pornography on developmental changes in adolescent brain function that can lead to addiction, and secondly, we investigated the extent to which pornography relates to adolescent sexual attitudes and beliefs, and sexual behavior. By summarizing, analyzing, and synthesizing a group of literature we can conclude to what extent the findings related to pornography and its impacts on adolescents' brain and their sexual behavior (Xiao & Watson, 2019).

Methodology

For this study, we employed descriptive review as this the most common and easily recognizable review (Xiao & Watson, 2019) and suit to beginning researchers in conducting systematic review. "A descriptive review examines the state of literature as it pertains to a specific research question, topical area, or concept" (Xiao & Watson, 2019, p. 95)

Literature Search and Evaluation

We search and evaluate research articles from 4 search engines to serve first objective; how the influence of pornographic in adolescent brain function can lead to addiction, and this will be recognized as theme one. Secondly, this study understands to what extent sexual attitude and belief, and sexual behavior relate to adolescent, and this will be recognized as theme two.

Inclusion criterion. We only include all the studies that provide pornographic addiction on adolescent. Literature review research focusing on previous reviews was conducted using a simple thematic analysis approach to identify the effects of pornography addiction as discussed by previous researchers on similar topics. A systematic literature review (SLR) was performed to identify, select, and critically evaluate to answer clearly formulated questions (Dewey & Drahota, 2016), by following a clear protocol or plan in which criteria were clearly stated before studies were conducted. Several themes have been identified; however, priority is given to articles that contain main theme to be analyzed and discussed in this study. The main theme is the most worrying effect in adolescent development. Study selection was done in two stages. First, titles and abstracts from all potentially relevant publications were carefully reviewed for eligibility according to inclusion and exclusion criteria. Second, the full text of studies selected in the first stage were reviewed for eligibility, using the same admission and exclusion criteria as in the first stage.

Literature identification. Once we determined the objectives of the study, we searched for literature in following databases including Scopus, ProQuest, PubMed, and Google Scholar throughout August 2021 with the search terms (pornography AND effect AND adolescent), or (pornography AND adolescent's AND brain) or (pornography AND adolescent AND sexual AND behavior) for empirical studies on adolescence and pornography published in the period 2014 to 2021. In the database, we searched for search terms that appeared in the title, abstract and key concept field. We reviewed methodological features from various studies. Knowledge of the methodology is critical in giving an assessment as we want to focus on the methodological features of the study we reviewed with an outline of the theoretical model on the use of adolescent pornography and its implications accurately and critically. Our initial search turned into 493 articles on Scopus, 51 articles on ProQuest, and 9 articles on PubMed, and 32 articles from Google Scholar. Altogether, four sources combined, we identified 585 potential studies, including 193 duplicates that we decided to remove it later.

Screening for inclusion. We only selected studies written in English. Then, we screened out articles that did not focus exclusively on the adolescent population and excluded articles that had little to do with the use of adolescent pornography. Third, because of our focus in this study on the effects of pornography addiction on the brain and behavioral development of adolescents, we excluded articles that had only a peripheral relationship with it in our search.

Quality and eligibility assessment. We speed-read all the full-text articles to further estimate the quality and eligibility of the studies. We only considered journal articles by reputable publishers as high-quality research, and therefore, included them in the review. In our search, the technical reports and on-line presentations are excluded from the review because of the lack of peer-review process that may affect the eligibility and quality into this study. After careful review, only sixty-one full text articles were selected that met the quality and eligibility for this study. A total of forty-one articles were excluded; Eleven studies were excluded because the methodology was irrelevant to pornographic on adolescent studies. We could not find the full text for ten studies, five studies were excluded because the article was not written in English, and fifteen studies removed because the study focus on specific study. In summary, there are 20 articles that deserve to be included in the review of this study.

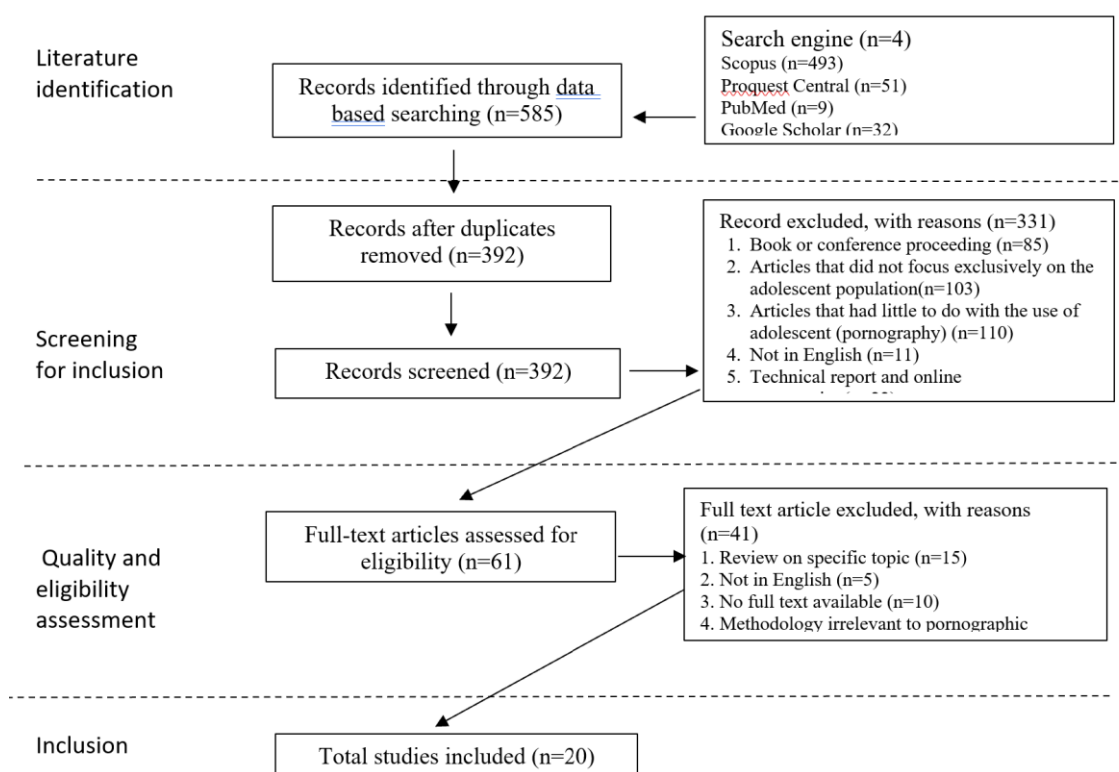


Figure 1: Literature search and evaluation for inclusion. Adapted from Xiao and Watson (2019)

Data Extraction and Analysis

From each article, we extracted information on the following two objectives of study: (1) how the influence of pornographic in adolescent brain function can lead to addiction. (2) to what extent sexual attitude and belief, and sexual behavior relate to adolescents. All the literature review process is further broken down into thematic analysis on formulating the research problem, developing and validating the review protocol, searching literature, screening for inclusion, assessing quality, extracting data, analyzing and synthesizing data and finally we report the study outcomes (Xiao & Watson, 2019).

Results

Numerous studies have shown concerns related to the increased use of the internet and pornography among adolescents during this pandemic. As expected, adolescents who reported more frequent use of pornography showed high negative effects (De Alarcon et al., 2019) and concluded that of the many internet-related activities, pornography had great potential to become addictive and need treatment (Allen et al., 2017; Gola et al., 2017; Meerkert et al., 2006). Through this review study, several analyzes related to the effects of pornography on brain development and its influence on adolescent sexual behavior were performed. Overall, the results of the study indicate that pornography addiction has a significant impact on adolescent development. The results of the study discuss two main points namely 1. The effects of pornography on the brain of adolescents, and 2. The influence of pornography on adolescent behavior.

The Effects of Pornography Addiction on the Adolescent Brain

Pornography addiction known as a type of internet -mediated addiction and a component of hyper sexuality, online pornography addiction is quickly turning into a topic that demands more in-depth empirical researchers because of its potentially addictive nature and perceived negative outcomes. There are 10 previous studies meeting the criteria to prove the effects of pornography addiction on the adolescent brain as a result of continued pornography use.

Several study findings have found that frequent use of pornography has been shown to have a variety of negative effects on adolescents including its influence on their brain development similar to what can be seen in drug addiction (George et al., 2019; De Alarcon et al., 2019), this is because there are alignment with other theories and studies made in the field of addiction (Cuesta et al., 2020), and its addiction framework has a basic mechanism similar to substance addiction (Love et al., 2015) in which mirror neuron systems may be involved, through empathy mechanisms, that can provoke representative eroticism. More clearly the findings of the JAMA Psychiatry study (May 2014) they found a relationship between the number of hours a person spends watching pornography per week and the total amount of gray matter in their brain, with a negative correlation between pornography use and striatum volume. The longer a person is exposed to pornography, the smaller the volume of their striatum, this means that frequent use of pornography damages the reward system (Kühn & Gallinat, 2011). The striatum is the part of the brain that plays a role in motivation, social interaction, coordinating various aspects of cognition, including motor and action planning, decision making, memory, and organizing the reward system which is the brain circuit that causes feelings of pleasure at the time (Yager et al., 2015).

Meanwhile, the study of Brown and Wisco 2019, proved that the adolescent brain may be more sensitive to sexually explicit material, but due to the lack of empirical studies, this question cannot be answered. However, they highlight several components of the adolescent brain that are different from the adult brain such as, immature pre-frontal cortex, excessive response from the limbic and striatum systems, active dopamine system, unique effects of steroid hormones, and increased testosterone hormones. Therefore, they suggest that specific observations need to be made regarding the effects of expulsive sexual substances, as there is an overlap of key areas associated with unique adolescent brain development. In parallel, Markert et al (2021) as a whole concluded their study findings contributed to researcher's understanding of the neuropsychological mechanisms of sexual signal reactivity and the development of pornographic addictive effects, where there is general agreement that addictive nerve substrates comprise brain regions that are part of reward networks. such as midbrain dopamine neurons, striatum, and prefrontal cortex (Kalivas & Volkow, 2005), areas involved in drug reaction and cravings in addictive disorders (Voon et al., 2014).

Thus, similar to the theory drawn from drug addiction research that the striatum is thought to be involved in habit formation as continued use develops toward compulsive behavior., Even time spent on pornography can lead to conflicting behaviors and beliefs (Awan et al., 2021). In the meantime, problematic pornography use is categorized as behavioral addiction (Gola et al., 2017 and interventions in various aspects of the addictive process mechanism, such as desire, inhibitory control, decision making should be fully considered when helping individual problems related to pornography addiction in order to provide optimal interventions and treatments (Brand et al., 2019). In conclusion, in this literature review shows that adolescent brains are indeed more sensitive to sexually explicit material, and the use of pornography stimulates appreciation pathways in the brain that can release dopamine and lead to self-satisfaction and impulsiveness (Brown & Wisco, 2019), therefore watching pornography

causing problems in brain activity and there is a relationship of responses to adolescent sexual stimuli. The findings of their study are fully explained in Table 1.

Table (1)

Summary of studies reporting the impact of pornography addiction on adolescents' brain

Theme	Authors	Findings
Impact of pornography addiction on Adolescent's brain.	(Kuhn & Gallina, 2014)	A significant negative association between watching more pornographic content per week and right caudate volume, and between cue-reactivity and left putamen was also found, which could be the result of constant stimulation of the reward centers or a neuroplasticity change allowing for greater pleasure while consuming pornographic content.
	(Love et al., 2015)	The pornography addiction framework has a basic mechanism similar to that of substance addiction, it has substantial overlap of the brain's reward systems.
	(Gola et al., 2017)	Problematic pornography use subject, when compared to control subjects, showed increased activation of the ventral striatum specifically for cues predicting erotic pictures.
	(De Alarcon et al., 2019)	The negative effects of pornography on adolescents including its effects on their brain development are similar to what can be seen in drug addiction
	(Brand et al., 2019)	An imbalance between structures of front-striatal circuits, particularly between ventral striatum, amygdala, and dorsolateral prefrontal areas, may be particularly relevant to later stages of addictive processes.
	(George et al., 2019)	Pornography is an expression of fantasies and is said to have the potential to rewire pleasure centers of the brain and alter structures and function. Pornography can bring about significant changes in the brain similar to what can be seen in drug addictions.
	(Brown & Wisco, 2019)	Pornography use stimulates the reward pathway in the brain, which releases dopamine, leading to self-gratification and impulsivity
	(Cuesta et al., 2020)	Found study findings consistent with other addiction studies and concluded that mirror neuronal systems may be involved, through empathy mechanisms, that may provoke representative eroticism.
	(Markert et al., 2021)	Overall, the findings showed higher anterior cingulate cortex (ACC), ventral striatal, and amygdala activity as well as higher functional connectivity of the ACC–striatal–amygdala network during watching of sexually explicit cues in hypersexual individuals.

	(Calvo et al., 2021)	The reviews have identified certain cognitive that are directly or indirectly linked to pathological and dysfunctional pornography use.
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The Effects of Pornography on Adolescent Sexual Behavior

Risky sexual behaviors among adolescents at their critical developmental stage continue to increase every year and become a concern. These problematic sexual attitudes and behaviors are influenced by several factors such as biological, environmental, and lifestyle risks associated with the advancement of information technology, especially in internet use, which is currently dominated by the 15-19 age group (Yunengsih & Setiawan, 2021). Due to the process of developing sexual feelings, adolescents continue to seek information and guidance about what is appropriate and expected, yet because perhaps psychologically adolescents are still immature, they face challenges in choosing positive messages and are overly influenced (Brown, 2001). To that end, we formulated these 10 literatures, with a particular focus on the category of problematic sexual behavior to prove the influence of pornography addiction on adolescent sexual behavior.

Allen et al. 2017, expressed concern related to pornographic exposure to children and adolescents as it can cause negative psychological problems in their development and encourage higher acceptance of sexual problems, as well as lead to risky early sexual activity, this because adolescence (12–18 years) is an important time for sexual exploration, development of sexual identity and orientation, and the formation of patterns of sexual behavior (Brown, 2001). Further, after reviewing 130 studies, Grubbs et al. 2019 found that pornography is most often used for the purpose of seeking pleasure-oriented sexual behavior, because in adolescence phase, the brain is highly responsive to perceived rewards, whereas impulse control and response inhibition do not develop completely, thus producing poor results (Brown & Wisco, 2019), then it becomes strong evidence showing that pornography use is becoming a problem and addiction to pornography is increasing especially in adolescents.

Moreover, Jochen Peter and Patti M. Valkenburg (2016) concluded the findings of the last 20 years of research on adolescents and pornography, their findings show that more permissive sexual attitudes and stronger gender stereotyped sexual beliefs among adolescents are related to their involvement with pornography. Furthermore, the frequency of internet use to access sexual material was found to be a predictor for being sexually active and the likelihood of having multiple sexual partners (Olarinmoye et al., 2014). Furthermore, another study that positively linked sexual behavior with pornography viewing resulting in serious problems in the adolescent population was a study conducted by Yunengsih and Setiawan (2021) who found a significant relationship between risky sexual behavior in students and age of first pornography exposure. times, so too the effect on cognition is shown from their obsessive-compulsive thinking about sexual content. They always have a desire to see the photo or video repeatedly, which causes them to experience sleep disturbances due to visualizing the scene of sexual intercourse (Setyawati & Suryanto, 2020).

Overall, the results of the study indicate that there is no benefit from pornography to adolescents, hence there is a significant relationship between exposure to pornographic material and risky sexual behavior (Awaluddin et al., 2015; Shallo & Mengesha, 2019; Grubbs et al., 2022), which not only does it affect physical or behavioral conditions, but the greatest implications of pornography can be seen on adolescent personality development, especially adolescent spiritual development (Kohut & Stulhofer, 2018). However, due to its addictive

behavior in nature, the needs to fulfill the immediate gratification and a sense of pleasure is strongly influencing in particular to adolescent population (Awaluddin et al., 2015). The summary of this literature review conducted as in the Table 2

Table (2)

Summary of studies reporting the impact of pornography addiction on risky sexual behavior

Theme	Authors	Findings
The impact of pornography addiction on adolescent's behavior	(Asekun-Olarinmoye et al., 2014)	Frequency of internet use for accessing sexual materials was found to be a predictor of being sexually active and of the likelihood of having multiple sexual partners
	(Grubbs et al., 2015)	The high degree of interrelatedness between compulsive pornography use and hyper sexuality more generally.
	(Awaluddin et al., 2015)	Risky behaviors were positively associated with adolescent sexual activity in this survey
	(Peter & Valkenburg, 2016)	Review of the past 20 years of research on adolescents and pornography has shown that adolescents use pornography although prevalence rates vary greatly. Pornography use is associated with more permissive sexual attitudes and stronger gender-stereotypical sexual beliefs. Adolescents' pornography use is also related to the occurrence of sexual intercourse, greater experience with casual sex behavior, and more sexual aggression, both in terms of perpetration and victimization.
	(Allen et al., 2017)	The exposure of children and adolescents to Internet pornography can cause negative psychological problems in the development of such individuals and stimulate higher acceptance of sexual permissiveness, as well as lead to sexual activity at an early age, sexual compulsivity, pornography addiction, and engagement in risky sexual behavior.
	(Grubbs et al., 2019)	Reviewing over 130 studies, the present work demonstrates that pornography is most often consumed for pleasure-seeking purposes, that it associated with increases in casual or impersonal approaches to sexuality, and that it predicts more pleasure-oriented approaches to sexual behavior.
	(Ashraaf et al., 2019)	The results of the study show that pornography not only affects one's physical or behavioral state but the greatest implications of pornography can be seen in the development of adolescent personality.
	(Shallo & Mengesha 2019)	There is a significant association between exposure to SE electronic materials and risky sexual behaviors.

	(Setyawati et al., 2020)	The impact of cognition is shown from their obsessive-compulsive thoughts on sexual content. They always have the desire to see those photos or video over again, which lead them to sleep disorders due to visualizing scenes of sexual intercourse.
	(Yunengsih & Setiawan, 2021)	A significant relationship was found between risky sexual behavior in students and the age of the first-time exposure to pornography

Discussion

Recently, interest in pornography among adolescents reportedly continued to increase during the implementation of the Movement Control Order in all countries (Zattoni et al., 2020) because pornography that contains the elements of sex is often used as a survival mechanism to overcome their symptoms of loneliness and depression, considered for mood management and stress relief (Baltazar et al., 2010) and overcome the negative emotion (Reid et al., 2010). Several studies show the existence of the Internet has become a strategic means of disseminating and exposing negative content such as pornography during this pandemic, which has been shown to influence psychological and mental health problems such as low self-esteem, poor life satisfaction, feelings of insecurity, low quality of life and depression (Manaf et al., 2014) influencing attitudes as well as the onset of negative sexual behaviors (Olarinmoye et al., 2014), and unsafe sexual activities (Awaluddin et al., 2015).

Thus, we reviewed and compiled the evidence obtained from 20 studies that reported the effects of pornography addiction, particularly on brain development and its influence on adolescent sexual behavior, including in Malaysia. There are several literatures available in Malaysia that has shown a positive relationship between pornography exposure and early sexual onset, permissive attitudes towards premarital sex, premarital sexual activity, multiple sexual partners, and unsafe sexual practices (Manaf et al., 2014).

Current studies confirm that the internet as the easiest source of pornography for adolescents to use is the highest internet access population is most vulnerable to the dangers of pornography. This is because they easily incorporate what they see and hear online about sex into themselves and their sexual lives, so much so that many research findings prove it factors in deviant sexual behavior because the more teens view porn the more often they think about sex, interest in sex, and increasingly they are distracted by thoughts about sex (Peter & Valkenburg, 2016).

Consistent with a review of the literature on pornography addiction and adolescent brain development that is ultimately predicted to be a factor in triggering various negative effects in adolescent life, a study by Bostwick and Jeffrey (2008) pointed out that brain reward center damage has been suggested as a reason for turning this behavior into addiction. This is because there is a significant correlation for individuals who view a lot of pornography and right caudate volume, as well as left caudate and putamen responses are also found, where continuous stimulation results from central rewards or neuroplasticity changes that make it possible to feel more fun and more frequent viewing of pornographic content. This severe effect occurs because it is a complex process involving the brain, body, emotions, psychology, sexual behavior, and social relationships. Because there are theoretical similarities drawn from other addiction studies, that the striatum is thought to be involved in habit formation when continued pornography use will stimulate reward pathways in the brain, which release

dopamine that causes satisfaction, and progress toward compulsive behavior (Brown & Wisco, 2019).

As explained by Goldstein and Volkow (2002) where addiction occurs when the motivation system and the prefrontal cortex control system give excessive value to the substance seen repeatedly, so that the individual is unable to inhibit the behavior that produces immediate reward and begins to ignore the risk of this addiction. Further, pornographic exposure to adolescents and sexual pleasure is defined as strong cognitive involvement in sexual problems, due to incomplete and immature adolescent brain development being a factor in their engaging in risky behaviors (Peter & Valkenburg, 2016) as noted by Cuesta et al. 2020 where addiction is one of the largest public health problems in the world today, and a large number of addictions can cause death, physical and psychological illness, as well as behavioral, personality, affective and social integration disorders. In conclusion, studies related to pornography addiction and sexual activity are increasing around the world, including Malaysia. Awaluddin et al (2015) concluded that sexual activity in Malaysian adolescents is positively related to several internal factors, such as watching pornography, and low religiosity and masturbation.

Conclusion & Future Scope

Overall, the internet has its advantages in terms of providing the necessary information for teenagers about sexual health and healthy sexual relationships, but many studies show that the internet has a negative influence on adolescent's sexual behavior. The above findings support the assumption that pornography addiction has an effect on the brain and influences adolescents' sexual behavior negatively. By viewing pornography, adolescents may encounter emotional, psychological, problematic sexual behavior, physiological disorders, and problems that potentially illustrate the effects on adolescent brain development, this is because some current studies have reported a decrease in striatal volume that may be due to neurotoxic effects from the use of pornography.

Therefore, we assume that the use of pornography even at a non-addictive level, can affect the structure and function of the brain, and adolescent brains may indeed be more sensitive to sexually explicit material, but due to the lack of empirical studies, this question cannot be answered definitively. We suggested studies on pornographic activity among adolescents in more detail, such as elucidating the causal relationship between functional and structural effects observed with pornography use, and also intervention studies should be conducted to investigate those at high risk of having sex before marriage are needed in the future to strengthen sex education at the school and community levels. This study could provide an interesting opportunity to explore changes in the structure of addiction similar to drug abuse, gambling behavior, or video games to aid classification efforts and the development of better prevention and treatment approaches and to help people understand problems and initiate important dialogues with adolescents about the negative effects of viewing sexually explicit material. Finally, we hope this study can be an eye opener for conservative countries such as Malaysia where uncontrolled exposure to pornography especially during this epidemic can pose a high risk for adolescent sexual behaviors such as unprotected sex and sex with multiple partners.

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