Review Article

Sociocrinology: Impact of Social Media on Endocrine Health – A Review

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Abstract

Social media (SM) refers to social networking sites (SNSs), which are defined as online services that enable individuals to build a public or semi-public profile and give them the opportunity to create a network of contacts and interact. SM affects all aspects of life and may offer new opportunities to explore new experiences and perspectives of life because of its feasibility. But several times, because of feasibility, misinformation is generated intentionally or unintentionally, which spreads rapidly, and such misinformation can affect all aspects of life. However, health-related misinformation can be life-threatening to individuals. Endocrinology is the branch of medicine that deals with endocrine glands and hormones, which regulates mood, growth, development, metabolism and the way our organ works to maintain internal homeostasis. SM usage and endocrine health impact each other in both positive and negative ways. So, in this review, we will discuss about the effect of SM on Endocrine health.

Keywords: Cognitive bias, endocrine health, neurotransmitters, social media, sociocrinology

Introduction

Social media (SM) refers to social networking sites (SNSs), which are defined as online services that enable individuals to build a public or semi-public profile and give them the opportunity to create a network of contacts, as described by Boyd and Ellison in 2007.[1] According to recent data, 3.81 billion of the global population maintain an account in at least one SNS, while worldwide internet users spend 144 min per day in SNSs (Global Digital Population, 2020).[2,3]

SM affects all aspects of life and may offer new opportunities to explore new experiences and perspectives of life because of its feasibility. But several times, because of feasibility, misinformation is generated intentionally or unintentionally, which spreads rapidly. Although misinformation can affect all aspects of life, health-related misinformation can be life-threatening to individuals.[4]

Social interactions can take many different forms and can now occur both physically and on SM platforms. With SM, interaction has become easy and may increase stress among individuals due to uncalled competition or unrealistic expectations. These interactions may differ but could be critical to be encoded in the brain, neuronal activity and trigger lasting changes in gene expression. The hypothalamus serves as a neuroendocrine relay centre central to the integration of stress physiology.[5]

Endocrinology is the branch of medicine which deals with endocrine glands and hormones. Hormones are released from endocrine glands and traverses to all parts of the body and regulate mood, growth, development, metabolism and the way our organ works to maintain internal homeostasis.

The pattern of SM usage is also affected by the diurnal variation and affected by circadian rhythm, as described by Fabon Dzogang *et al*.[6] in their article 'Diurnal variations of psychometric indicators in Twitter content.'

Access this article online

Quick Response Code:

Website: https://journals.lww.com/indjem/

DOI: 10.4103/ijem.ijem_250_23

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Submitted: 12-Jun-2023 **Revised:** 09-Sep-2023
Accepted: 27-Nov-2023 **Published:** 11-Jan-2024

How to cite this article: Khare J, Kalra S, Jindal S. Sociocrinology: Impact of social media on endocrine health – A review. Indian J Endocr Metab 2023;27:480-5.

Circadian expression of genes regulates many physiological processes, including sleep/activity cycles, body temperature and metabolism. Although the suprachiasmatic nucleus in the hypothalamus is the master clock coordinating many of these activities, the circadian activity of the glucocorticoid hormones also markedly affects many neural circuits, and the circadian activity of melatonin is an essential part of the sleep-wake system.[6]

SM and endocrine health impact each other in both positive and negative ways. So, in this review, we will discuss about the effect of SM on endocrine health.

Social Networking Sites or Social Media

SNSs or SM are defined as online services through web software or websites that provide a platform for individuals to share perspectives, content, insights, experiences, opinions, and other types of information.[7]

SM is now a cornerstone of everyday life and offers a far-reaching communication tool. There are various categories of SM platforms, which include collaborative projects (Wikipedia), blogs (WordPress and Wix), microblogs (Twitter and Weibo), content communities (YouTube, TikTok, Snapchat, and Instagram), and social network sites (Facebook and LinkedIn).[8]

WhatsApp, also called WhatsApp Messenger, is a freeware, cross-platform, centralised instant messaging and voice-over-IP service which allows users to send text, voice messages and video messages, make voice and video calls, and share images, documents, user locations, and other content. It became the world's most popular messaging application by 2015,[9,10] and had more than 2 billion users worldwide by February 2020.[11] Being very popular, there comes a price too, in the form of several controversies and criticism and banned in a few countries. WhatsApp has been updated regularly from time to time to make it more secure and user-friendly in ways like imposing limits on message forwarding to restrict the spread of misinformation and making it more secure with end-to-end encryption.

Endocrine Health

Endocrinology is the branch of medicine which deals with endocrine glands and hormones.

The endocrine system is a complex network of glands and organs which uses hormones to control and coordinate your body's metabolism, sleep, energy level, reproduction, growth and development, and response to injury, stress, and mood.

Thus, a healthy endocrine system is important for a healthy, happy life.

Social Media and Endocrine Health

As many as 80% of internet users seek health information online. Specifically, seeking health information regarding diet/nutrition, physical activity, signs, symptoms and treatment of disease, and public health interventions are some common examples of online activities.[12]

SM provides a platform for health information and real-time peer interaction for social and emotional support, sharing the challenges of long-term condition management.[8]

Diabetes has become one of the most prevalent chronic diseases throughout the world. Wenwen Kong *et al.* reported in their study that the overall quality of the information in the diabetes videos on TikTok is acceptable, but TikTok might not fully meet the health information needs of patients with diabetes. Thus, caution must be taken when using TikTok as a source of diabetes-related information.[13]

Also, there are closed Facebook groups for diabetes, like Blue Circle and many more, which give an opportunity to people with diabetes to interact with questions, answers, and comments on diabetes care.

SM has profoundly impacted the practice of assisted reproductive technology (ART). Blakemore,[14] in their study, reported on the emerging phenomenon of 'influencers' in the field of infertility. Of the many SM platforms, Twitter and Instagram, are mainly used by reproductive endocrinology and infertility specialists. Fertility webspace is becoming a highly active and growing area of SM because of increasing infertility in the population. SM can have several fake information, but Quaas AM *et al.* concluded that SM is the reality and is going to stay, so physicians should not act as bystanders or relatively passive participants but should be more proactive to provide correct information and harness the enormous potential benefits of SM.[15]

However, SM use by patients provides not just beneficial effects. It also incurs the increased risk of disseminating misinformation and also has some limitations: lack of reliability, quality concerns, lack of confidentiality and privacy, risks of disclosing personal information online, and harmful or incorrect advice.

A. Positive Impact

As a positive mediator of health, SM can be used for health promotion, health information, and a community support network. SM platform can be used for peer group intervention, as Rachel Gruver *et al*.[16] conducted Facebook-based peer group intervention for mothers to prevent obesity and promote healthy growth from infancy.

Faisal S Malik *et al*.[17] described in their study that adolescents with type 1 diabetes expressed interest in the use of SM as a tool to support diabetes management and increased engagement with their diabetes care team.

SM provides a platform for patients and their relatives to access information regarding rare diseases. Timely and quality information and education empower patients and help them cope with the sense of social isolation after

getting diagnosed with a rare disease.[18,19] Violeta Iotova *et al*.[20] in their study, described that the current patient information access survey provides a sound basis for further planning and execution of educational and teaching activities by the European Reference Network on Rare Endocrine Conditions (Endo-ERN) for endocrine disorders like adrenal, pituitary or thyroid disorders.

SM activities by individuals can be used to identify the disorders as these individuals will search for their symptoms online. Sungkyu Park *et al*.[21] in their study, identified activities on Facebook reveal the depressive state of users.

Physical inactivity is a global challenge, and is ranked as the fourth leading behavioural risk factor for global mortality. On the contrary, physical activity has manifested as one of the most effective methods for positively influencing the health of the general population across all ages and for different population groups. For example, it benefits people suffering from cancer, hypertension, type 2 diabetes, coronary heart disease, neurological disabilities, and mental health disorders. Héctor José Tricás-Vidal *et al*.[22] in their study, identified that physical fitness influencers have motivated and stimulated several individuals to follow healthy lifestyles through Instagram.

Several young individuals on SM, like Instagram, represent mindful and intuitive eating to portray healthy lifestyles without a focus on weight. Thus, Instagram holds the potential for health professionals to disseminate culturally/demographically inclusive, evidence-based health/nutrition information to youth, as described by Johanna K. Hoare *et al*.[23] in their study.

B. Negative Impact

SM have several benefits but also has several potential negative effects also, especially on younger people, which are well documented and include loss of productivity, sleep disruption, sedentary behaviour, social isolation, cyberbullying, and adverse mental health outcomes, including suicidal ideation and decreased empathy.[15,24]

The spread of misinformation is not recent and has been reported dating back to the early days of printing. The growth of the internet has, however, brought a drastic change in the method of communication and the spread of information. In 2013, the World Economic Forum warned that potential 'digital wildfires' could cause the 'viral spread' of intentionally or unintentionally misleading information (World Economic Forum, 2013).[4]

Although misinformation can affect all aspects of life, but health-related misinformation can be life-threatening to individuals. Misinformation spreads from micro to macro level. At the micro-level, individuals who receive misinformation form a judgement about the information, depending on the information source, narrative and context, and may spread it depending on their belief. At the macro-level, the patterns of misinformation cascade and characteristics of networks are observed.[4]

There is limited understanding of why certain individuals, societies and institutions are more vulnerable to misinformation about health. This is perhaps surprising, as health promotion and public health researchers now pay considerable attention to the potential of the internet as a tool to diffuse health-related information.

Although the internet provides immense opportunities, it also lowers the cost of generating and disseminating information, allowing misinformation and sensationalised stories to propagate. What was once spread locally can rapidly become global, with ideas no longer confined or delayed by geography. This deiminated misinformation may consequently lead to behavioural changes at individual or mass levels.

Common misinformation seen on SM pertaining to the health arena revolves around vaccines, communicable diseases, chronic noncommunicable diseases and others like diet, nutrition and exercise. Usually, much of this misinformation comes from individuals who are highly active in influencing opinions on various SM platforms, and rumours often garner higher popularity than evidence-based information.

In 2012, the journal *Vaccine* devoted a special issue to 'The Role of Internet Use in Vaccination', analysing some of the communication strategies used by both the anti-vaccination movement and public health professionals.[25,26] Reported widespread misinformation about side effects, as well as mistrust in government or pharmaceutical companies, is a major cause for non-vaccination.[27]

Though, most research on misinformation has focused on infectious disease, misinformation on chronic illnesses such as cancer, cardiovascular disease, endocrine diseases like diabetes, obesity, and thyroid disorders are not uncommon on SM.

Among chronic diseases like diabetes, Leong *et al*.[28] 2017, identified that SM mostly speculates on or promotes alternative treatments. Again, misleading videos are more viral and influential.

Several times with SM, unrealistic expectations develop in the individual, which affects their mental and physical health. SM may have adverse effects in several domains of life like satisfaction with life, as described by Satici in 2019, loneliness as described by Błachnio *et al*. in 2016; academic performance, as described by Al-Yafi *et al*. in 2018; and low self-esteem, as described by Hawi and Samaha in 2017.[29-33]

Social appearance anxiety is a type of social anxiety that is associated with body image perception and is exacerbated by the use of SM, leading to feelings of loneliness, as described by Triada Konstantina Papapanou *et al*.[34] in their study. Generally, for women the ideal body is lean, while for men it is muscular, and they frequently visit physicians to achieve this through hormonal treatment.

Several individuals have become addicted to SM, and according to research conducted by the Royal Society for Public Health

and the UK's Youth Health Movement, Instagram is considered the most negatively affecting SM platform in terms of its impact on young people's mental health.[35]

The emotion circuitry of the brain is complex and primarily involves the prefrontal cortex, amygdala, hippocampus, anterior cingulated cortex, and insular cortex, along with neurotransmitters like dopamine, serotonin, norepinephrine, melatonin and endorphins. The exact mechanism of physical and psychological addiction to SM is not known, but it may be due to the triggering of the brain reward system, which in turn causes the release of chemical dopamine, a feel-good chemical in the brain. Dopamine is a neurotransmitter that is a chemical messenger between neurons involved in neurological and physiological functioning. All pleasurable experiences, from eating a good meal to having sex, cause the release of dopamine. So also, the release of dopamine is part of what makes some things addicting, such as drugs, gambling, shopping and using SM.[36,37] In some users of SM, the neurotransmitter dopamine level may increase when they engage with Facebook, Snapchat, Instagram or other SM platforms and get a like, a retweet or an emoticon notification and activate the brain reward system, forming a dopamine loop. This cycle of happiness and reward makes SM users seek more such rewards and makes them addicted.[38]

Serkan Bilge Koca *et al*.[39] reported internet addiction and SM usage is significantly related to physical inactivity, sedentary lifestyle, unhealthy eating habits, and insufficient sleep time, which are a modifiable risk factor for childhood obesity.

Apart from misinformation, inappropriate use of SM may also interfere with circadian rhythm because of disturbed sleep and adversely affect hormonal homeostasis.

C. Medical Profession and Social Media

As SM is now a cornerstone of everyday life, so also the medical professionals are not untouched. Since SM can have both negative and positive impacts, it is important to prevent the misuse of SM among medical professionals. To implement the proper usage of SM in India, the National Medical Commission (NMC) has suggested points for governing the code of conduct among medical professionals. The first point suggests that medical professionals can provide information and announcements on SM, but the information should be factual and verified. It should not be misleading or exploit the patient's vulnerability or lack of knowledge. The second point advises that medical professionals should avoid discussing patient treatment or prescribing medicine on public SM. If a patient approaches them through SM, they should guide the patient towards a telemedicine or in-person consultation. The third point prohibits medical professionals from posting patients' photographs or scan images on SM as it later becomes data owned by the SM company or the general public. The fourth point emphasises that medical professionals on SM should follow general principles of medical ethics of professional behaviour towards their colleagues. The fifth point prohibits medical professionals from malpractices like purchasing 'likes,' 'followers,' or paying for higher ratings or soliciting patients through software programs or apps. The sixth point prohibits medical professionals from requesting or sharing patients' testimonials, recommendations, endorsements, or reviews on SM. The seventh point prohibits medical professionals from sharing images of healed/cured patients, surgery/procedure videos, or images displaying impressive results under any circumstances. The eighth point permits medical professionals to share educative material with the general public, but the communication should be limited to their expertise. The ninth point states that if medical professionals have web pages, then they should follow the same guidelines as above. The tenth point advises medical professionals to conduct themselves with dignity and decorum on SM and refrain from boundary crossings or violations. The eleventh point suggests that pursuing patients directly or indirectly through SM is unethical.[40,41]

D. Cognitive Biases and Endocrinology

Cognition is a term for mental processes, which include thinking, attention, language, learning, memory and perception, that allow us to make choices and function as healthy adults. However, while making judgments or decisions, people often rely on simplified information processing strategies called heuristics, which may result in systematic, predictable errors called cognitive biases, and several simple nonverified or falsified information is available on SM which can influence the decision-making capacity of people. Thus, SM can lead to cognitive bias, which can be of several types like anchoring bias, availability bias, confirmation bias, hindsight bias, omission bias, outcome bias, overconfidence bias, relative risk bias, and susceptibility to framing can affect the decision making by patients and medical professionals too.[42] For example, a parent might refuse to vaccinate their child after they see a media report of a child who developed autism after being vaccinated. Similarly, on SM, several nonverified or falsified information regarding the management of several endocrine disorders is available, which several times makes the patient doubt the management as advised by their treating doctor and may make wrong decisions.

E. Limitation of Use of Social Media

SM is generally used by the younger population and thus, the older population and those with limited health literacy and numeracy would be excluded from this education provision.

There are also groups who are from deprived backgrounds who would be digitally excluded and not using any form of SM will be excluded from this type of education.

There is also still some considerable resistance amongst healthcare professionals to interact with patients through SM due to ethical issues or other concerns.

Conclusion

Human beings are social beings, and social interaction is an important component of life and can now occur physically or/and on SM platforms. SM affects every aspect of life and

provides a feasible platform for interaction. SM offers new opportunities to explore new experiences and perspectives of life because of its feasibility. But several times, because of feasibility, misinformation is generated intentionally or unintentionally, which spreads rapidly. Such misinformation can affect all aspects of life, but health-related misinformation can be life-threatening to individuals. Endocrine health is also affected by SM in both positive and negative ways, and the term SOCIOCRINOLOGY may be used for this interaction.

SM is a powerful tool to improve quality of life but can be very harmful if misused. Thus, saying that with great power comes great responsibility stands true for SM.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

References

1. Boyd DM, Ellison NB. Social network sites: Definition, history, and scholarship. J Comput Mediat Commun 2007;13:210-30.
2. Adbe1a27-e2d2-5529-2f50-6872239bbff7.pdf. Available from: https://www.statistics.gr/documents/20181/adbe1a27-e2d2-5529-2f50-6872239bbff7. [Last accessed on 2020 Jul 15].
3. Dadiotis A, Bacopoulou F, Kokka I, Vlachakis D, Chrousos GP, Darviri C, *et al*. Validation of the Greek version of the Bergen social media addiction scale in undergraduate students. EMBnet J 2021;26:e975. doi: 10.14806/ej. 26.1.975.
4. Wanga Y, McKee M, Torbica A, Stuckler D. Systematic literature review on the spread of health-related misinformation on social media. Soc Sci Med 2019;240:112552. doi: 10.1016/j.socscimed. 2019.112552.
5. Weitekamp CA, Hofmann HA. Human population density and reproductive health: A changing world needs endocrinology. Endocrinology 2021;162:bqab198. doi: 10.1210/endocr/bqab198.
6. Dzogang F, Lightman S, Cristianini N. Diurnal variations of psychometric indicators in Twitter content. PLoS One 2018;13:e0197002. doi: 10.1371/journal.pone. 0197002.
7. Kaplan AM, Haenlein M. Users of the world, unite! The challenges and opportunities of social media. Bus Horiz 2010;53:59-68.
8. Thomas RL, Alabraba V, Barnard S, Beba H, Brake J, Cox A, *et al*. Use of social media as a platform for education and support for people with diabetes during a global pandemic. J Diabetes Sci Technol 2023;17:353-63.
9. Metz C. Forget apple vs. the FBI: WhatsApp just switched on encryption for a billion people. Wired. 2016. Available from: https://www.wired.com/2016/04/forget-apple-vs-fbi-whatsapp-just-switched-encryption-billion-people/.
10. Sun L. Facebook Inc.'s WhatsApp hits 900 million users: What now? The Motley Fool 2015. Available from: https://www.fool.com/investing/general/2015/09/11/facebook-incs-whatsapp-hits-900-million-users-what.aspx. [Last accessed on 2015 Oct 21].
11. "WhatsApp Blog" (https://blog.whatsapp.com/10000666/Two-Billion-Users--Connecting-the-World-Privately).whatsapp.com. Archived. https://web.archive.org/web/20200214043828/https://blog.whatsapp.com/10000666/Two-Billion-Users--Connecting-the-World-Privately) from the original on February 14, 2020. [Last accessed on 2020 Feb 14].
12. Forgie EME, Lai H, Cao B. Social media and the transformation of the physician-patient relationship: Viewpoint. J Med Internet Res 2021;23:e25230. doi: 10.2196/25230.
13. Kong W, Song S, Zhao YC, Zhu Q, Sha L. TikTok as a health information source: Assessment of the quality of information in diabetes-related videos. J Med Internet Res 2021;23:e30409. doi: 10.2196/30409.
14. Blakemore J. Infertility influencers: An analysis of information and influence in the fertility webspace. J Assist Reprod Genet 2020;37:1371-8.
15. Quaas AM. Social media in ART—#power or #peril? J Assist Reprod Genet 2020;37:1311-12.
16. Gruver RS, Bishop-Gilyard CT, Lieberman A, Gerdes M, Virudachalam S, Suh AW, *et al*. A social media peer group intervention for mothers to prevent obesity and promote healthy growth from infancy: Development and pilot trial. JMIR Res Protoc 2016;5:e159.
17. Malik FS, Panlasigui N, Gritton J, Gill H, Yi-Frazier JP, Moreno MA. Adolescent perspectives on the use of social media to support type 1 diabetes management: Focus group study. J Med Internet Res 2019;21:e12149. doi: 10.2196/12149.
18. Walton H, Hudson E, Simpson A, Ramsay AIG, Kai J, Morris S, *et al*. Defining coordinated care for people with rare conditions: A scoping review. Int J. Integr Care 2020;20:14. doi: 10.5334/ijic. 5464.
19. DeHoff BA, Staten LK, Rodgers RC, Denne SC. The role of online social support in supporting and educating parents of young children with special health care needs in the United States: A scoping review. J Med Internet Res 2016;18:e333. doi: 10.2196/jmir. 6722.
20. Iotova V, Schalin-Jäntti C, Bruegmann P, Broesamle M, De Graaf J, Bratina N, *et al*. Access to patient oriented information—a baseline Endo-ERN survey among patients with rare endocrine disorders. Endocrine 2021;71:542-8.
21. Park S, Lee SW, Kwak J, Cha M, Jeong B. Activities on Facebook reveal the depressive state of users. J Med Internet Res 2013;15:e217. doi: 10.2196/jmir. 2718.
22. Tricás-Vidal HJ, Vidal-Peracho MC, Lucha-López MO, Hidalgo-García C, Monti-Ballano S, Márquez-Gonzalvo S, *et al*. Impact of fitness influencers on the level of physical activity performed by Instagram users in the United States of America: Analytical cross-sectional study. Int J Environ Res Public Health 2022;19:14258. doi: 10.3390/ijerph 192114258.
23. Hoare JK, Lister NB, Garnett SP, Baur LA, Jebeile H. Mindful and intuitive eating imagery on Instagram: A content analysis. Nutrients 2022;14:3834. doi: 10.3390/nu14183834.
24. Berryman C, Ferguson CJ, Negy C. Social Media use and mental health among young adults. Psychiatr Q 2018;89:307-14.
25. Betsch C, Sachse K. Dr. Jekyllor Mr. Hyde? (How) the Internet influences vaccination decisions: recent evidence and tentative guidelines for online vaccine communication. Vaccine 2012;30:3723-6.
26. Kata A. Anti-vaccine activists, Web2.0, and the postmodern paradigm – an overview of tactics and tropes used online by the anti-vaccination movement. Vaccine 2012;30:3778-89.
27. Tustin JL, Crowcroft NS, Gesink D, Johnson I, Keelan J, Lachapelle B. User-driven comments on a Facebook advertisement recruiting Canadian parents in a study on immunization: Content analysis. JMIRPubl Health Surv 2018;4:e10090. doi: 10.2196/10090.
28. Leong AY, Sanghera R, Jhajj J, Desai N, Jammu BS, Makowsky MJ. Is YouTube useful as a source of health information for adults with type 2 diabetes? A South Asian perspective. Can J Diabetes 2018;42:395-403.
29. Satici SA. Facebook addiction and subjective well-being: A study of the mediating role of shyness and loneliness. Int J Ment Health Addict 2019;17:41-55.
30. Błachnio A, Przepiorka A, Pantic I. Association between Facebook addiction, self-esteem and life satisfaction: A cross-sectional study. Comput Hum Behav 2016;55:701-5.
31. Błachnio A, Przepiorka A, Rudnicka P. Narcissism and self-esteem as predictors of dimensions of Facebook use. Pers Individ Dif 2016;90:296-301.
32. Al-Yafi K, El-Masri M, Tsai R. The effects of using social network sites on academic performance: The case of Qatar. J Enterprise Inf Manag 2018;31:446-62.
33. Hawi NS, Samaha M. The relations among social media addiction, self-esteem, and life satisfaction in university students. Soc Sci Comput Rev 2017;35:576-86.
34. Papapanou TK, Darviri C, Kanaka-Gantenbein C, Tigani X, Michou M, Vlachakis D, *et al*. Strong correlations between social appearance anxiety, use of social media, and feelings of loneliness in adolescents and young adults. Int J Environ Res Public Health 2023;20:4296. doi: 10.3390/ijerph 20054296.

35. Zarenti M, Bacopoulou F, Michou M, Kokka I, Vlachakis D, Chrousos GP, *et al*. Validation of the Instagram addiction scale in Greek youth. EMBnet J 2021;26:e973. doi: 10.14806/ej. 26.1.973.
36. Loonen AJM, Ivanova SA. Evolution of circuits regulating pleasure and happiness with the habenula in control. CNS Spectr 2019;24:233-8.
37. Dfarhud D, Malmir M, Khanahmadi M. Happiness and Health: The biological factors- systematic review article. Iran J Public Health 2014;43:1468-77.
38. Macit HB, Macit G, Güngör O. A research on social media addiction and dopamine driven feedback. Mehmet Akif Ersoy Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi 2018;5:882-97.
39. Koca SB, Paketçi A, Büyükyılmaz G. The relationship between internet usage style and internet addiction and food addiction in obese children compared to healthy children. Turk Arch Pediatr 2023;58:205-11.
40. Available from: https://medicaldialogues.in/health-news/nmc/how-to-behave-on-social-media-nmc-releases-11-commandments-for-doctors-115773. (Web Page). [Last accessed on 2023 Sep 09].
41. Available from: https://www.nmc.org.in/rules-regulations/national-medical-commission-registered-medical-practitioner-professional-conduct-regulations-2023-reg/. (Web Page). [Last accessed on 2023 Sep 09].
42. Berthet V. The impact of cognitive biases on professionals' decision-making: A review of four occupational areas. Front Psychol 2022;12:802439. doi: 10.3389/fpsyg. 2021.802439.