Journal of Cardiovascular Disease Research
ISSN:0975-3583,0976-2833 VOL10,ISSUE04,2019

ROLE OF VITAMINS FOR THE CONTROL OF HIV AND AIDS

Ankit Kumar Saini[1], Meenakshi Jaiswal[2*]

[1]Principal, Roots Institute of Professional Education, Bijnor, Uttar Pradesh-246701, India

[2]Assistant Professor, Department of Pharmacy, Guru Ghasidas Vishwavidyalaya (A Central University) Bilaspur, 495009, India

***Corresponding author:** Meenakshi Jaiswal, Assistant Professor, Department of Pharmacy, Guru Ghasidas Vishwavidyalaya (A Central University) Bilaspur, 495009, India; Email: meenakshi_123123@rediffmail.com, Mobile:0 9770166557

ABSTRACT:

HIV is spread by numerous agents and routes. Viruses cause minor to severe diseases in humans and animals. Some infections can be treated with existing drugs, while others require new ones. Unfortunately, there are no cures for HIV, but quality of life increases symptom alleviation and life expectancy. Antiretroviral treatment (ART) is available to control this infection, although negative effects increase with dose. These negative effects can be reduced, and nutritional supplements can boost immunity to combat viruses. HIV destroys immunological cells like WBC. Each obstacle is unique. This lowered patients' immunity, leading to further infections. Low immunity causes opportunistic illnesses. As noted, there is no proper therapy or cure for AIDS; however ART medicines can treat it. Researchers have lately shed light on the nutraceuticals used in AIDS patients. They may improve quality of life and life expectancy. Multivitamin therapy before ART improves clinical results and enhances immunity to fight HIV and other opportunistic infections, according to a report. This review focuses on HIV patients' multivitamin-boosted immunity. We'll also look at how these supplements increase patients' immunity and associated data.

KEYWORDS: Viral infections, Vitamins, HIV and AIDS.

INTRODUCTION:

In the less developed parts of the world, AIDS has long been considered taboo. According to estimates from 2007, 33 million people worldwide are thought to be affected by this illness, and as contemporary medications and medicines have advanced, people's quality of life is expanding significantly. There are several theories that have been published, but one of them is really amazing and factual and adheres to science.[1] Researchers have discovered that certain HIV patients regularly take multivitamins, and unexpectedly, those who do not and are infected are more likely to develop a severe form of disease too soon. Vitamins D, A, E, and C have been proven to play a significant impact in boosting patient immunity and immunity to already treated diseases. Scientists have shown that taking multivitamin pills, which contain various vitamins and other nutrients, can help maintain immunity and play a significant role in guarding against HIV.[2] A significant part of the same is played by vitamin C, vitamin E, vitamin B1, vitamin B2, vitamin B6, vitamin B12, and folate. Again, it is unclear how much of these multivitamins should be taken to obtain desired results, and patients must follow their doctor's instructions to do so.[3] For supplemental treatment of HIV infection, researchers are focusing on

the accurate estimation of vitamin doses for each vitamin and vitamin combinations. Researchers came to the conclusion that taking multivitamins (Vitamin B complex, C and E) daily for 18 months improved immunity, increasing weight, and improving quality of life, as well as CD4 cells count (which declines significantly in HIV infection).[4] Individual vitamin doses of 18 mg niacin, 70 mg of vitamin C, 1.4 mg of B1, 1.4 mg of B2, 1.9 mg of B6, 2.6 mcg of B12, 10 mg of vitamin E, and 0.4 mg of folic acid were additionally administered. According to Figure 1, taking a combination of ART and multivitamin therapy in the proper amounts and proportions can help lower viral loads and slow the progression of illness. Table 1 lists the vitamins found in multivitamin therapy along with their food sources and their roles in viral infections. Figure 2 shows patients with HIV receiving supplemental multivitamin treatment.[5, 6]

This review covers numerous crucial vitamins that have demonstrated their worth in the past and considerably improved the lifestyle of HIV patients.[7] Here, we additionally emphasised the specific water- and fat-soluble vitamins that are crucial to the treatment of HIV patients. The researcher also explains each vitamin dose and its unique function in the therapy of HIV.[8] According to the available research, it is recommended that HAART therapy in conjunction with supplemental multivitamin therapy be planned for HIV-infected patients.[9] Vitamins/nutritional therapy for ART-naive HIV-infected children is shown in Figure 3. This article primarily sheds insight on how malnutrition affects children with HIV and how hosts can get secondary opportunistic illnesses.[10]

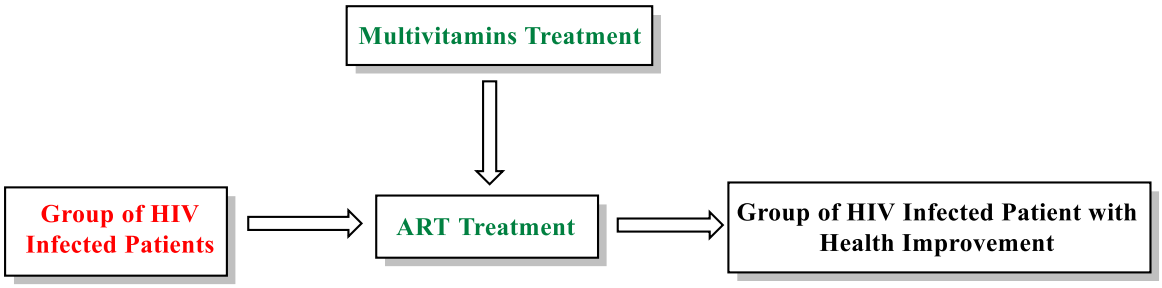

Figure 1: ART and multivitamin combination improve the health of HIV infected patients (Self created with software ChemBioDraw Ultra 14.0. PerkinElmer, Waltham, Massachusetts, United States)

Table 1: Vitamins rich foods for the management of HIV and AIDS [11-15]

Sr. No.	Vitamin	Food source	Disease
1	Vitamin A	Dairy products, meat and fish,	Human immunodeficiency virus infection
2	Vitamin D	Beef liver, Fatty fish, orange juice dairy products, cereals, egg yolks and cheese	Human immunodeficiency virus infection
3	Vitamin E	Sunflower seeds, Avocado Almonds, Peanuts and Mango	Human immunodeficiency virus infection
5	Vitamin B1	Peas, whole grain breads, fresh fruits and nuts	Human immunodeficiency virus infection

6	Vitamin B2	Dark-green vegetables Milk and dairy products	Human immunodeficiency virus infection
9	Vitamin B6	Fish, potatoes, fruit and vegetables	Human immunodeficiency virus infection
12	Vitamin B12	Milk, Meat, Fish, Eggs and Cheese	Human immunodeficiency virus infection
13	Vitamin C	Orange, Citrus fruit, sprouts, broccoli and potatoes.	Human immunodeficiency virus infection

COMMONLY USED FAT SOLUBLE VITAMINS IN THE TREATMENT OF THE HIV AND AIDS:

According to the literature, here are some lists of the fat-soluble vitamins actually studied for the treatment of HIV and AIDS

Vitamin A: For a very long time, vitamin A has been thoroughly examined for its impact on AIDS. It is also tested for effectiveness in HIV-positive youngsters, and more frequently than not, the results are unexpected from a therapeutic standpoint. Researchers have demonstrated that it dramatically lowers mortality and morbidity and plays a protective function in HIV infection in children.[16] Overall, patients are always better off with multivitamin therapy rather than just one vitamin. There is no proof that vitamin A supplements given to HIV-infected pregnant women and children cure HIV infection, but they do reduce the majority of causes of morbidity and mortality in the patients.[17] According to research, viruses like the hepatitis B virus and the human papilloma virus (HPV) have the ability to cause cancer but not the HIV virus itself. The most organic form of the vitamin is Retinoic Acid, also known as Vitamin A. In addition, retinoic acid is crucial in the development of embryonal cancer.[18] The prevalence of HIV infection and its treatment continue to be serious issues for developing nations. The effect of vitamin A in preventing HIV infection in children from mothers during pregnancy is discussed in reported literature. Although the exact function of vitamin A is unknown, researchers believe that it has boosted lymphoid cell differentiation.[19]

Vitamin D: The lack of vitamin D in HIV/AIDS patients has long been recognized. According to research, people with HIV have a reduced antimicrobial response when they are vitamin D deficient. When people with HIV experience vitamin D insufficiency, the illness is known as hypovitaminosis D. Vitamin D typically works by attaching to vitamin D receptors and has a built-in inherent resistance to the HIV-1 pathway. According to the research, vitamin D insufficiency in HIV-infected individuals increases the likelihood of pathogenesis by adversely affecting the innate and adaptive immune systems. HIV patients who have low vitamin D levels are more likely to experience morbidity and inflammation, but this risk can be decreased by taking vitamin D supplements as a preventative measure. [20, 21]

Vitamin E: According to recent studies, HIV individuals who use ART experience an 8–10 fold reduction in death. These statistics showed how ART medication is extending the lives of individuals who are HIV-positive. Patient mortality in AIDS has decreased 90-fold. Numerous studies have revealed the multiple health benefits

that vitamin E has on the body, but its primary immunomodulatory activity. In people with HIV, vitamin E is efficacious and well tolerated, according to the research.[22] In their research, some scientists mention vitamin E insufficiency in HIV-positive patients. Some researchers concentrate on highly active antiretroviral medication, which may have an immediate effect on the body's vitamin E levels. Researchers also discovered that patients receiving HAART therapy, particularly those taking novel medications, have low levels of alpha tocopherol. As a result, it is recommended that doctors check vitamin E levels in HIV-positive individuals before even starting the HAART treatment.[23]

COMMONLY USED WATER SOLUBLE VITAMINS IN THE TREATMENT OF HIV AND AIDS:

According to the literature, here are some lists of the water-soluble vitamins actually studied for the treatment of HIV and AIDS.

Vitamin B1: HIV and AIDS have been linked to vitamin B1. Numerous research teams are working on the aforementioned subject, and several articles have already been published on it. Thiamine deficiency has been discovered in HIV-positive people. Numerous studies have linked vitamin B1 to HIV, and thiamine has been shown to reduce the risk of HIV infection. In this situation, genetic factors also offer several beneficial criteria that can be used to connect thiamine's function in HIV pathogenesis. It is intriguing to see that thiamine also influences HIV pathogenesis at non-genomic levels, while the underlying mechanism is unknown. Thiamine levels in HIV-positive patients were found to be low, according to studies. With the aid of scientific instruments, these hypotheses have still to be clarified.[24-26]

Vitamin B2 and B6: Deficit in vitamins B2 and B6 damages the humoral and cell-mediated immune systems, according to studies. The differentiation and maturation of lymphocytes are processes that these vitamins help. The fundamental mechanism for the same thing is something that researchers are working to understand. Vitamin B2 and B6 levels should be at their maximum for the body to demonstrate their immunomodulatory effects, and it has been seen that patients with immunity-related diseases experience issues due to low vitamin B2 and vitamin B6 levels.[27] Days after HIV infection, CD4 T cell counts rapidly decline in HIV-infected patients, and immunity deteriorates. Additionally, according to research, immunomodulatory therapies have promising outcomes and a promising future for treating HIV in addition to HAART therapy.[28]

Vitamin B12: It's customary to discuss vitamin deficiencies in HIV patients, but vitamin B12 has also been linked to significant improvements in HIV patients' health. Additionally, it is strongly advised that patients with HIV infection undergo a vitamin B12 deficiency test before beginning any therapy because it has been noted by numerous researchers that HIV-positive patients frequently suffer from vitamin B12 insufficiency. Around 39% of the patient population has a vitamin B12 deficiency, according to one meta-analysis.[29] Researchers discovered in another investigation that patients receiving ART medication may have low levels of vitamin B12. On the other hand, some researchers found that in the early stages of HIV infection, six out of 57 patients had low serum B12 levels. Additionally, researchers noted that over time following the start of ART, serum vitamin B12 levels rise.[30] Only 6% of the HIV-infected patient population had normal corpuscular volumes, according to the results of an analysis of iron, folate, and vitamin B12 in the patients.[31]

Vitamin C: A powerful natural antioxidant, vitamin C can be found in a variety of foods. Vitamin C is a powerful natural antioxidant that may be found in many commercially available nutritional supplements. It is well known that people with HIV infection are oxidatively stressed. In studies they did, a team of researchers discovered that patients taking vitamin supplements had higher plasma concentrations than the control group. In comparison to other groups, this group also displayed a decline in viral load. Researchers observed that vitamin C and vitamin E have antioxidant activity since the patient's viral load was reduced.[32] Total antioxidant capacity was proposed as a new, early-detectable biochemical marker of oxidative stress in HIV-infected patients in a 2009 publication written by a group of researchers. The study's findings indicate that HIV-1 seropositive patients had significantly higher MDA levels than patients in the control group, and vitamin C, a potent antioxidant, may one day be employed to treat these patients' oxidative stress.[33, 34]

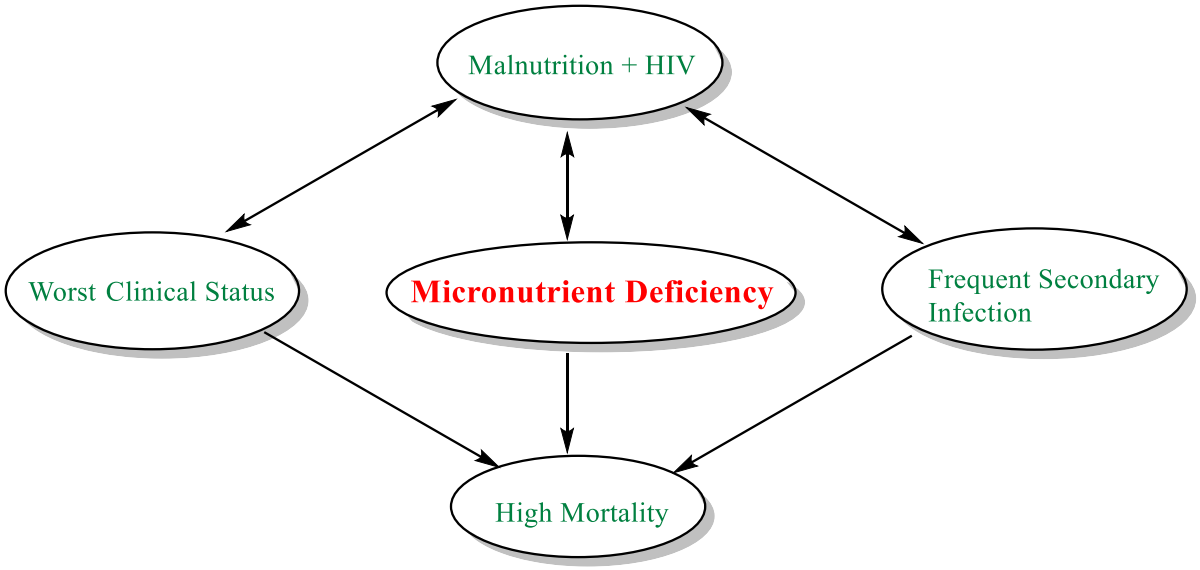

Figure 2: Vitamins/nutritional treatment for ART-naïve HIV infected child (Self created with software ChemBioDraw Ultra 14.0. PerkinElmer, Waltham, Massachusetts, United States)

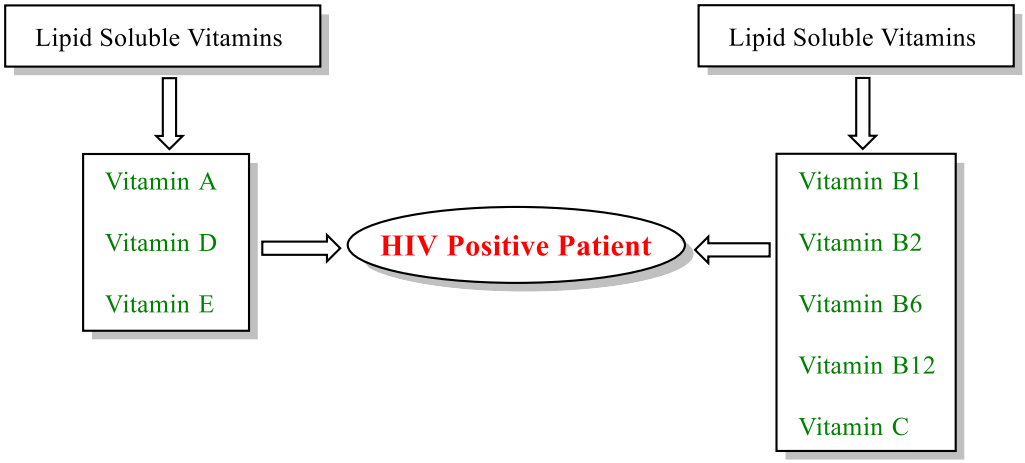

Figure 3: Multivitamin supplementary therapy in HIV infected patients (Self created with software

ChemBioDraw Ultra 14.0. PerkinElmer, Waltham, Massachusetts, United States)

CONCLUSION:

To sum up, the most effective therapy for HAART patients is multivitamin therapy. Researchers and scientists from all over the world have suggested combining these for the treatment of HIV-positive individuals. To prevent associated adverse effects and keep costs down, research is being done to determine the precise dosage of these vitamins. HIV patients already have compromised immune systems, thus if therapies have side effects, patients will need to take additional medications to treat them. However, in the last ten years, multivitamin therapy has been a common practise to specifically treat the negative effects of HAART treatment. Studies have shown that these treatments are widely accepted and quite successful. The HAART therapy, the function of a particular vitamin, and information from the literature has been the main topics of this chapter. Additionally, we have included graphics to shed light on how these two approaches can be used in tandem. The HIV-positive individuals included in this chapter have reportedly suffered from a number of vitamin deficiencies. Before beginning HAART treatment, doctors must do a vitamin deficiency screening on their patients. The future is promising for multivitamin supplements combined with conventional therapies. Multivitamin therapies are expected to become the gold standard treatment for AIDS in the near future, according to certain researchers and the literature that has been published to date.

DECLARATIONS:

Ethics approval and consent to participate:

Not applicable.

Consent for publication:

All the authors approved the manuscript for publication.

Availability of data and material:

All required data is available.

Competing interests:

All authors declare no competing interests.

Funding:

Not applicable.

Acknowledgment:

REFERENCES:

1. Mehta, S. and Fawzi, W., 2007. Effects of vitamins, including vitamin A, on HIV/AIDS patients. *Vitamins & Hormones*, *75*, pp.355-383.
2. Makinde, O., Rotimi, K., Ikumawoyi, V., Adeyemo, T. and Olayemi, S., 2017. Effect of vitamin A and vitamin C supplementation on oxidative stress in HIV and HIV-TB co-infection at Lagos University Teaching Hospital (LUTH) Nigeria. *African health sciences*, *17*(2), pp.308-314.
3. Lake, J.E. and Adams, J.S., 2011. Vitamin D in HIV-infected patients. *Current Hiv/aids Reports*, *8*, pp.133-141.
4. Villamor, E., 2006. A potential role for vitamin D on HIV infection?. *Nutrition reviews*, *64*(5), pp.226-233.
5. Chun, R.F., Liu, N.Q., Lee, T., Schall, J.I., Denburg, M.R., Rutstein, R.M., Adams, J.S., Zemel, B.S., Stallings,

V.A. and Hewison, M., 2015. Vitamin D supplementation and antibacterial immune responses in adolescents and young adults with HIV/AIDS. *The Journal of steroid biochemistry and molecular biology*, *148*, pp.290-297.

6. Keservani, R.K. and Sharma, A.K., 2014. Flavonoids: emerging trends and potential health benefits. *Journal of Chinese Pharmaceutical Sciences*, *23*(12), pp.815-822.
7. Keservani, R.K., Sharma, A.K. and Kesharwani, R.K., 2016. Nutraceutical and functional foods for cardiovascular health. In *Food Process Engineering* (pp. 291-312). Apple Academic Press.
8. Allard, J.P., Aghdassi, E., Chau, J., Tam, C., Kovacs, C.M., Salit, I.E. and Walmsley, S.L., 1998. Effects of vitamin E and C supplementation on oxidative stress and viral load in HIV-infected subjects. *Aids*, *12*(13), pp.1653-1659.
9. Keservani, R.K., Sharma, A.K. and Kesharwani, R.K., 2016. Medicinal effect of nutraceutical fruits for the cognition and brain health. *Scientifica*, *2016*.
10. Tang, A.M., Graham, N.M., Chandra, R.K. and Saah, A.J., 1997. Low serum vitamin B-12 concentrations are associated with faster human immunodeficiency virus type 1 (HIV-1) disease progression. *The Journal of nutrition*, *127*(2), pp.345-351.
11. Surana, K., Chaudhary, B., Diwaker, M. and Sharma, S., 2018. Benzophenone: A ubiquitous scaffold in medicinal chemistry. *MedChemComm*, *9*(11), pp.1803-1817.
12. Tang, A.M., Graham, N.M., Chandra, R.K. and Saah, A.J., 1997. Low serum vitamin B-12 concentrations are associated with faster human immunodeficiency virus type 1 (HIV-1) disease progression. *The Journal of nutrition*, *127*(2), pp.345-351.
13. Keservani, R.K., Kesharwani, R.K., Vyas, N., Jain, S., Raghuvanshi, R. and Sharma, A.K., 2010. Nutraceutical and functional food as future food: a review. *Der Pharmacia Lettre*, *2*(1), pp.106-116.
14. Hepburn, M.J., Dyal, K., Runser, L.A., Barfield, R.L., Hepburn, L.M. and Fraser, S.L., 2004. Low serum vitamin B12 levels in an outpatient HIV-infected population. *International journal of STD & AIDS*, *15*(2), pp.127-133.
15. Keservani, R.K., Sharma, A.K. and Kesharwani, R.K., 2017. An overview and therapeutic applications of nutraceutical and functional foods. *Recent advances in drug delivery technology*, pp.160-201.
16. Thornalley, P.J., 2005. The potential role of thiamine (vitamin B1) in diabetic complications. *Current diabetes reviews*, *1*(3), pp.287-298.
17. Ehrenpreis, E.D., Carlson, S.J., Boorstein, H.L. and Craig, R.M., 1994. Malabsorption and deficiency of vitamin B12 in HIV-infected patients with chronic diarrhea. *Digestive diseases and sciences*, *39*(10), pp.2159-2162.
18. Veilleux, M., Paltiel, O. and Falutz, J., 1995. Sensorimotor neuropathy and abnormal vitamin B12 metabolism in early HIV infection. *Canadian journal of neurological sciences*, *22*(1), pp.43-46.
19. Keservani, R.K., Sharma, A.K. and Kesharwani, R.K., 2016. Nutraceutical and functional foods for cardiovascular health. In *Food Process Engineering* (pp. 291-312). Apple Academic Press.
20. Keservani, R. K., Kesharwani, R. K., Sharma, A. K., & Jarouliya, U. (2015). Dietary supplements, nutraceutical, and functional foods in immune response (immunomodulators). *Nutraceutical and functional foods in human life and disease prevention. Boca Raton: CRC Press, Taylor and Francis*, 343-60.
21. Dhir, S., Tarasenko, M., Napoli, E. and Giulivi, C., 2019. Neurological, psychiatric, and biochemical aspects of

thiamine deficiency in children and adults. *Frontiers in psychiatry*, *10*, p.207.

22. Podszun, M.C. and Frank, J., 2019. Vitamin E-drug interactions. *Vitamin E in Human Health*, pp.247-260.
23. Gay, R. and Meydani, S.N., 2001. The effects of vitamin E, vitamin B6, and vitamin B12 on immune function. *Nutrition in clinical care*, *4*(4), pp.188-198.
24. Rule, S.A.J., Hooker, M., Costello, C., Luck, W. and Hoffbrand, A.V., 1994. Serum vitamin B12 and transcobalamin levels in early HIV disease. *American journal of hematology*, *47*(3), pp.167-171.
25. Stephensen CB, Marquis GS, Jacob RA, Kruzich LA, Douglas SD, Wilson CM. Vitamins C and E in adolescents and young adults with HIV infection. The American journal of clinical nutrition. 2006 Apr;83(4):870-9.
26. Stephensen, C.B., Marquis, G.S., Jacob, R.A., Kruzich, L.A., Douglas, S.D. and Wilson, C.M., 2006. Vitamins C and E in adolescents and young adults with HIV infection. *The American journal of clinical nutrition*, *83*(4), pp.870-879.
27. Keservani, R.K., Kesharwani, R.K., Vyas, N., Jain, S., Raghuvanshi, R. and Sharma, A.K., 2010. Nutraceutical and functional food as future food: a review. *Der Pharmacia Lettre*, *2*(1), pp.106-116.
28. Keservani, R.K., Sharma, A.K. and Kesharwani, R.K., 2016. Medicinal effect of nutraceutical fruits for the cognition and brain health. *Scientifica*, *2016*.
29. Keservani, R.K., Kesharwani, R.K., Sharma, A.K., Gautam, S.P. and Verma, S.K., 2017. Nutraceutical formulations and challenges. In *Developing New Functional Food and Nutraceutical Products* (pp. 161-177). Academic Press.
30. Sharma, A.K., Keservani, R.K. and Kesharwani, R.K. eds., 2018. *Nanobiomaterials: applications in drug delivery*. CRC Press.
31. Singh, P., Kesharwani, R.K. and Keservani, R.K., 2017. Protein, carbohydrates, and fats: Energy metabolism. In *Sustained Energy for Enhanced Human Functions and Activity* (pp. 103-115). Academic Press.
32. Keservani, R.K., Sharma, A.K. and Kesharwani, R.K. eds., 2018. *Nutraceutical and functional foods in disease prevention*. IGI Global.
33. Keservani, R.K., Sharma, A.K. and Kesharwani, R.K. eds., 2017. *Drug Delivery Approaches and Nanosystems, Volume 1: Novel Drug Carriers*. CRC Press.
34. Yadav, D., Tripathi, Y.B., Singh, P., Kesharwani, R.K. and Keservani, R.K., 2017. Roles of AMP, ADP, ATP, and AMPK in healthy energy boosting and prolonged life span. In *Sustained Energy for Enhanced Human Functions and Activity* (pp. 31-51). Academic Press.