

## EFFECT OF AVOCADO ON CANCER CELL IMMUNOTHERAPY AND VITAMIN-B 17

<sup>\*1</sup>Dr. Sumanta Bhattacharya, <sup>2</sup>Dr. Swarupananda Mukherjee, <sup>3</sup>Rituparna Mazumder,  
<sup>4</sup>Dr. Sparsha Moni Chatterjee

<sup>1</sup>Research Scholar At Makaut, Public-Foreign-Defence Policy Analyst, C.E, Ch.E, Ccio, M.Tech, Ma In Development Studies, Llb, Dia & D, Dg & Gs, Pgcpp & A, Mpi(Oxford University) Orcid Id: 0000-0003-2563-2787.

<sup>2</sup>Assistant Professor, Department of Pharmaceutics Nshm Knowledge Campus, Kolkata, West Bengal.

<sup>3</sup>B.Pharm, M.Pharm(Pursuing), Bengal School of Technology.

<sup>4</sup>Ex Vice Chancellor of IIT Shipbur, Member of Executive Council Aicte, Former Director of Technical Education, Chairman of Boaa, Iiit, Ministry of Textile (Govt of India). Member of Development Commission (Govt of India).

Article Received on  
22 Aug. 2021,

Revised on 11 Sept. 2021,  
Accepted on 01 Oct. 2021

DOI: 10.20959/wjpr202112-21971

### \*Corresponding Author

**Dr. Sumanta Bhattacharya**

Research Scholar At  
Makaut, Public-Foreign-  
Defence Policy Analyst,  
C.E, Ch.E, Ccio, M.Tech,  
Ma In Development Studies,  
Llb, Dia & D, Dg & Gs,  
Pgcpp & A, Mpi(Oxford  
University) Orcid Id: 0000-  
0003-2563-2787.

[sumanta.21394@gmail.com](mailto:sumanta.21394@gmail.com)

### ABSTRACT

A generalized overview of cancer immunotherapy has been provided. Pharmacological usage of avocado and related products has been defined alongside providing a composition table of avocado oil. Usage of such compounds in cancer cell immunotherapy has also been discussed. Research methodology undertaken involves a secondary qualitative data collection and analysis approach, while following a positivism research philosophy, deductive research approach and conclusive research design. The main findings of the research article revolve around the fact that avocado is a beneficial fruit that contains high nutritional value and assumed as effective for immunotherapy in cancer cells. Avocado has several benefits that includes reduction of blood pressure along with treating cancer.

**KEYWORDS:** Immunotherapy, immune system, cancer cells, cancer treatment, healthy cells, avocado-based products.

### INTRODUCTION

Cancer, even though popularly rendered as a highly fatal disease, can be effectively cured using a wide range of medical developments in recent years, especially in case such disease is

diagnosed during the earliest stages. In this regard, immunotherapy has been determined to be one of such prominent developments and by far, has proved to be highly effective in curing a wide range of cancer types, including breast cancer and leukaemia. This study deals with analysing this medical procedure particularly in terms of the viability of avocado fruit and vitamin b-17 in speeding up the treatment process while increasing the chances of success.

## AIM AND SCOPE

**Aim:** This study intends to attain a definite analysis regarding the overall impact of avocado fruit and vitamin b17 in treating various types of cancer through immunotherapy process. In that respect, certain objectives have been established as well and is provided as follows.

- To evaluate the pharmacological functions and compositions of avocado cancer immunotherapy treatment.
- To analyses the impact of avocado on cancer cell immunotherapy and Vitamin B-17.

**Scope:** The scope of this study involves providing a thorough idea regarding immunotherapy-based cancer treatment procedure. As the core focus of this study, the impact of using avocado fruit and other related avocado-based products upon cancer cell immunotherapy has been discussed. A number of journals has been reviewed that serves to explore this topic on a wide dimension based upon various aspects. The review provides a critical overview of every presented aspect and thus highlights any knowledge gap that requires further research into.

## Systematic Review

Citation	Key Findings	Significance	Keywords
Alkhalaf <i>et al.</i> 2019	Avocado seed extracts have higher composition of sterol compounds than fruit extracts Extracts produced strong anti-cancer activities towards colon cancer	Serves to justify the application of seed extracts to be more beneficial than fruit extracts, particularly in colon cancer treatment	Anticancer, antioxidant, fatty acids, anti-inflammatory
El-Masry <i>et al.</i> 2019	Antioxidant and vitamin b17's antineoplastic properties have a high potential in reducing oxidative-induced stress due to Ehrlich solid tumour (EST) induced bodily changes	Emphasizes the necessity of vitamin b17 in daily diet to prevent tumour risks while highlighting the negative impacts of various cancer treatments upon EST	Ehrlich solid tumour, oxidative stress, vitamin B17, DNA damage, DNA proliferation
Abubakar, Achmadi & Suparto, 2017	Triterpenoid compound isolated from avocado seeds displays significant cytotoxic activity against every form of malignancy line, specifically	Provides insight regarding the potential of avocado seeds as exceptional anticancer agents upon further developments	Persea americana, Triterpenoid, MCF-7, HepG2

	MCF-7 and HepG2 cell line		
Lara-Marquez <i>et al.</i> 2020	Mexican native avocado seed produce lipid extracts that drive apoptosis upon Caco-2 cells within colorectal cancer	Provides insight based on the development of various functional food products that reduce cancer development risks	Colon cancer, apoptosis, long-chain lipids
Guzmán-Rodríguez <i>et al.</i> 2016	PaDef defensin from avocado causes apoptosis within human breast cancer cell line, MCF-7 PaDef defensin produced no effect upon normal mononuclear cells of human blood	Suggests that avocado defensin could serve as a potential molecule to be used within cancer treatment	Breast cancer, avocado, apoptosis
Hantash, 2018	Vitamin b-17's D-amygdalin form serves to inhibit growth of cancer cells and tumours through apoptosis This also increases white blood cells and effectiveness within the immunity system	A newly therapeutic drug has been formulated based on vitamin b-17 and a wide range of additives like GAG that has immense cancer treatment potential	Polysaccharides, monosaccharides, vitamin b-17, prostate cancer
Liczbiński & Bukowska, 2018	Amygdalin within renal cancer cells increased p-19 protein activity, resulting in inhibition of cell proliferation	Amygdalin compound have been suggested to be highly applicable across various types of cancer treatments	Amygdalin, cell proliferation, apoptosis
Shi <i>et al.</i> 2019`	Amygdalin exerts antitumor effect by impacting the cell cycle via inducing apoptosis and cytotoxicity while regulating immunity system	Demonstration of different antitumor activities by amygdalin facilities compound applicability across various cancer treatment drugs	Amygdalin, antitumor, apoptosis
Blaheta <i>et al.</i> 2016	No concrete evidence found against induction of tumour regression via application of amygdalin	Emphasizes the importance of further research required based on viability of amygdalin usage in cancer treatment	Amygdalin, complementary and alternative medicine, Cancer treatment
Qadir & Fatima, 2017	No steady anticancer effect of amygdalin has been found	Emphasizes the importance of further investigation within amygdalin mechanism and pharmacological activity upon cancer treatment	Amygdalin, antitumor, Toxicity
Barrie, Gushue & Eskander, 2019	No therapeutic effect among cancer patients could be determined upon application of laetrile-based compounds	Expresses the importance of discussing optimum cancer treatment methods with patients	Cannabidiol, Laetrile, Low grade ovarian cancer
Abboud <i>et al.</i> 2019	Generation of malondialdehyde in amygdalin treated cells presented higher glutathione production as compared to untreated cells	Provides support regarding amygdalin mechanism's antitumor action against breast cancer cells	Malondialdehyde, Amygdalin, antitumor

## Critical Review of the articles

### Overview of Cancer cell immunotherapy

Alkhalaf *et al.* (2019) opined that immunotherapy is defined as a type of cancer treatment procedure that makes use of an individual's immune system to fight cancerous cells. In a normal scenario, the immune system within a body helps in fighting any sort of infection or disease. This system is entirely made up of white blood cells, alongside various tissues and organs within the lymph system. In this regard, immunotherapy can be regarded as a certain form of advanced biological therapeutic procedure that modifies one immune system to effectively fight and mitigate the presences of various cancerous cells as well, with such being usually impossible by a normal immune system (El-Masry *et al.* 2019).

Abubakar, Achmadi & Suparto (2017) argued about a specific form of treatment procedure, substances from different living organisms are introduced within one's body to enable such immune system modifications that would effectively repel cancerous cells. Even though not used as widely as other cancer treatment methods like chemotherapy and radiation therapy, immunotherapy has been determined to cure multiple types of common cancers, including breast cancer and leukaemia. However, immunotherapy suffers from a major drawback involving the immune system harming healthy cells as well, often leading to autoimmune disease that can prove to place severe impact upon one's health (Lara-Marquez *et al.* 2020).

### Pharmacological functions of Avocado

Guzmán-Rodríguez *et al.* (2016) mentioned that pharmacology deals with the study of a wide range of drugs and the impact such drugs have upon individual bodies, with the primary aim of mitigating various health issues. Being a highly nutritious fruit, Avocado is rich in a wide range of vitamins and minerals, thus forming the main ingredient of guacamole, a popular and healthy spread cum salad within the international cuisine. Avocados are exceptionally rich in potassium, being significantly higher as compared to bananas. This makes the fruit a significant part of any individual's daily diet, serving around 14% of requisite minerals, primarily potassium, as per recommended daily allowance (RDA). Owing to such rich mineral composition, avocados serve to be exceptionally useful in reducing blood pressure, thereby significantly reducing the chances of heart attacks and other common hypertension-based diseases, particularly among adult and old age populaces.

Hantash (2018) argued that avocados also consist of rich amounts of fibre, thereby serving to be extremely useful in appropriately regulating one's digestion system. Additionally, this also

helps in maintaining insulin levels within an optimum stage, thereby reducing risks of diabetes, while contributing considerably towards weight loss. Avocado also has a high composition of lutein, thereby proving to be extremely beneficial for eyes. Having a diet that is rich in lutein and other crucial carotenoids, like zeaxanthin, helps in appropriate maintenance of eye health while significantly eliminating the risks of cataracts and eye-muscle degeneration issues, especially during old age. Additionally, application of avocado oil provides the requisite amount of fat required for appropriate absorption of such carotenoids within the body, including beta-carotene and lycopene as well.

#### Evaluation of composition of Avocado oil

Fatty acid	Quantity (%)
Palmitic acid	28.21
Palmitoleic acid	5.69
Stearic acid	0.69
Oleic acid	50.95
Linoleic acid	13.87
Linolenic acid	0.58

**Figure 1: Composition of Avocado oil.**

(Source: Shi *et al.* 2019)

Liczbiński & Bukowska (2018) stated that avocado is exceptionally rich in various monounsaturated fatty acids, having a smoke point that allows the oil to be used in cooking. Specific to the avocado oil extracted via Hass cold-pressed mechanism, a unique emerald green colour is observed upon extraction. This unique colour can be particularly attributed to the rich presence of various chlorophylls and carotenoids. The profile based on avocado oil fatty acids is largely similar to that of olive oil and thus, include high concentration of oleic acid. In that respect, the overall composition of Avocado oil comprises around 76% monounsaturates, including both oleic and palmitoleic acids, and 12% polyunsaturates, including both linolenic and linoleic acids. Additionally, around 12 % saturates, including palmitic and stearic acids, are also involved within the main composition of Avocado oil. One of the primary antioxidants present in this oil is  $\alpha$ -tocopherol, being present in levels of around 70 to 190 mg/kg oil. Minor amounts of  $\beta$ - tocopherols,  $\gamma$ - tocopherols and  $\delta$ - tocopherols can be observed within the composition as well (Shi *et al.* 2019).

**Effect of usage of avocado on cancer cell immunotherapy and Vitamin B-17**

Blaheta *et al.* (2016) opined that a diet being highly MUFA-rich has been determined to significantly prevent risks of various cancer types, including colon, prostate, pancreatic, stomach and cervical cancers. Avocados and related avocado-based products, like avocado oil, have a significant composition of a wide range of crucial phytochemicals. These elements, as proved by various researchers, are exceptional in inhibiting the growth of cancerous cells within the body. Additionally, these elements also serve to prevent any sort of pre-cancerous growths, like tumours while inducing apoptosis in cancerous cells. Furthermore, phytochemicals drive lymphocyte proliferation procedures within one's body, thereby helping in killing existing tumour cells. In regards to chemotherapeutic treatment for cancer, avocados also include various chemotherapeutic effects and hence prevents various negative impacts of chemotherapy caused by certain chemical agents like cyclophosphamide. Moreover, owing to the presence of an acute concentration of a wide range of vitamins and minerals, the immune system within one's body is significantly boosted, as has been mentioned above, thus facilitating immunotherapy-based treatments (Qadir & Fatima, 2017).

**MATERIALS AND METHODOLOGY**

As per the requirements of this study, a significant amount of quantifiable data is required to be included. A positivism research philosophy justifies validity of acquired data based on such data being quantifiable and to be represented by various standards measurement procedures, thereby rendering this philosophy to be most suitable for this study. Accordingly, a deductive research approach is to be undertaken since known data variables, collected from appropriate data sources, are being analysed in this study in order to provide definite results and a conclusive report. As per research design, a conclusive design would prove to be most suitable since a highly structured form of data is included in this study that presents the key findings and overall significance of each collected data source as per research objectives. Additionally, since a conclusion is being drawn through a deductive approach, undertaking a conclusive design would be most viable. In respect of data collection, a secondary qualitative method is to be undertaken, with data being entirely collected from a wide range of online journals. Furthermore, a secondary qualitative-based data analysis has been conducted, including a theme-based approach related to each respective research objective.



## DISCUSSION AND RESULTS

### Evaluating the Effect Avocado Fruit extracts upon cancer cell immunotherapy

Different avocado extracts, including ethanol, petroleum, ethyl acetate and chloroform extracts, have been determined to produce varied levels of impact upon the growth of carcinoma cells based on oesophageal squamous. In addition, the impact of each such extract differs widely upon implementation within adenocarcinoma cell lines as well, with such impacts being measurable via usage of control groups within an MTT test. Upon being tested upon three specific cell lines, including the above two mentioned alongside peripheral blood mononuclear cells, it has been determined that compared to normal cells, every such extract had a significant inhibition activity upon cancerous cells. Among every taken extract, petroleum-based extracts have been determined to be most effective and hence, is highly suggested to be considered among future cancer immunotherapy treatments (Barrie, Gushue & Eskander, 2019).

### Viability of Laetrile/Amygdalin as natural cancer treatment agents

Laetrile/amygdalin is a naturally forming compound within fruits like apricots and raw nuts and is commonly used as a natural cancer treatment agent. Amygdalin produces hydrogen cyanide that is further broken down into cyanide upon entering a body and this cyanide element is believed to kill cancer cells. Amygdalin is also referred to as vitamin b-17, although no such approval was provided by American Institute of Nutrition Vitamins. Amygdalin's viability to be an effective anticancer agent has been readily denied by numerous anecdotal and case reports. As per case reports received within National Cancer Institute, only 2 out of 67 patients have shown somewhat positive responses with regards to cancer treatment, while 4 of such patients have been observed to have slight tumour growth reduction. Furthermore, direct intake of amygdalin causes a number of side effects ranging from nausea to even coma and death. Hence, this compound has been practically banned for cancer-treatment usage by the U.S.-based Food and Drug Administration (FDA) (Abboud *et al.* 2019).

## CONCLUSION

As per the provided discussions supported with relevant literary articles, the applicability and effectiveness in utilizing avocado-based products and extracts upon appropriate cancer immunotherapy treatments have been validated. However, the same is not applicable in case

of vitamin b-17 or Laetrile and effectiveness of such among cancer treatment has been largely denied.

## REFERENCES

1. Abboud, M. M., Al Awaida, W., Alkhateeb, H. H., & Abu-Ayyad, A. N. (2019). Antitumor action of amygdalin on human breast cancer cells by selective sensitization to oxidative stress. *Nutrition and cancer*, 71(3): 483-490. <https://doi.org/10.1080/01635581.2018.1508731>
2. Abubakar, A. N. F., Achmadi, S. S., & Suparto, I. H. (2017). Triterpenoid of avocado (*Persea americana*) seed and its cytotoxic activity toward breast MCF-7 and liver HepG2 cancer cells. *Asian Pacific Journal of Tropical Biomedicine*, 7(5): 397-400. <https://doi.org/10.1016/j.apjtb.2017.01.010>
3. Alkhalaf, M. I., Alansari, W. S., Ibrahim, E. A., & ELhalwagy, M. E. (2019). Anti-oxidant, anti-inflammatory and anti-cancer activities of avocado (*Persea americana*) fruit and seed extract. *Journal of King Saud University-Science*, 31(4): 1358-1362. Retrieved on 1 August 2021, from: <https://doi.org/10.1016/j.jksus.2018.10.010>
4. Barrie, A. M., Gushue, A. C., & Eskander, R. N. (2019). Dramatic response to Laetrile and cannabidiol (CBD) oil in a patient with metastatic low grade serous ovarian carcinoma. *Gynecologic oncology reports*, 29, 10. <https://dx.doi.org/10.1016%2Fj.gore.2019.05.004>
5. Blaheta, R. A., Nelson, K., Haferkamp, A., & Juengel, E. (2016). Amygdalin, quackery or cure?. *Phytomedicine*, 23(4): 367-376. <https://doi.org/10.1016/j.phymed.2016.02.004>
6. El-Masry, T. A., Al-Shaalan, N. H., Tousson, E., Buabeid, M., & Alyousef, A. M. (2019). The therapeutic and antineoplastic effects of vitamin B17 against the growth of solid-form Ehrlich tumours and the associated changes in oxidative stress, DNA damage, apoptosis and proliferation in mice. *Pak. J. Pharm. Sci*, 32(6): 2801-2810. Retrieved on 1 August 2021, from: <https://www.pnu.edu.sa/ar/Faculties/Pharmacy/Documents/badria2412/published%20research%202.pdf>
7. Guzmán-Rodríguez, J. J., López-Gómez, R., Salgado-Garciglia, R., Ochoa-Zarzosa, A., & López-Meza, J. E. (2016). The defensin from avocado (*Persea americana* var. *drymifolia*) PaDef induces apoptosis in the human breast cancer cell line MCF-7. *Biomedicine & Pharmacotherapy*, 82: 620-627. <https://doi.org/10.1016/j.biopha.2016.05.048>



8. Hantash, J. (2018). The use of polysulfated polysaccharides heparin like compounds, glycosaminoglycans and Vitamin B17 as a possible treatment for prostate cancer. *Medical hypotheses*, 112: 1-3. <https://doi.org/10.1016/j.mehy.2018.01.001>
9. Lara-Marquez, M., Baez-Magana, M., Raymundo-Ramos, C., Spagnuolo, P. A., Macias-Rodriguez, L., Salgado-Garciglia, R., ... & Lopez-Meza, J. E. (2020). Lipid-rich extract from Mexican avocado (*Persea americana* var. *drymifolia*) induces apoptosis and modulates the inflammatory response in Caco-2 human colon cancer cells. *Journal of Functional Foods*, 64: 103658. <https://doi.org/10.1016/j.jff.2019.103658>
10. Liczbiński, P., & Bukowska, B. (2018). Molecular mechanism of amygdalin action in vitro: review of the latest research. *Immunopharmacology and immunotoxicology*, 40(3): 212-218. <https://doi.org/10.1080/08923973.2018.1441301>
11. Qadir, M., & Fatima, K. (2017). Review on pharmacological activity of amygdalin. *Archives in Cancer Research*, 5(04): 160. <https://doi.org/10.21767/2254-6081.100160>
12. Shi, J., Chen, Q., Xu, M., Xia, Q., Zheng, T., Teng, J., ... & Fan, L. (2019). Recent updates and future perspectives about amygdalin as a potential anticancer agent: a review. *Cancer medicine*, 8(6): 3004-3011. <https://doi.org/10.1002/cam4.2197>