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# Adverse Health Effects of Tobacco and Role of Ayurveda in their Reduction

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Tobacco in all forms is dangerous for human health and caused various diseases such as heart attacks, hypertension, strokes, pulmonary disease and cancer. Smoking is a leading cause of lung cancer whereas mouth cancer is mainly caused by chewing of tobacco. Similar to the first hand smoking, passive smoking also affects a healthy human. Various researches confirmed the presence of about 600 ingredients in cigarettes which produced about 69 carcinogenic compounds after burning. Ayurveda is however helpful in the reduction of side-effects of tobacco by various ways including the use of Rasayana such as Ashwagandha, Shatavari, Bala and Ginseng. Moreover, Yoga can help in releasing tension and stress and increase the strength and vitality without using any form of tobacco. Herein, an evidence-based report is prepared from various earlier important studies to aware public for the dangerous health effects of tobacco. This report mainly highlights major facts of the use of tobacco, its adverse effects globally and role of Ayurveda in their reduction.

**Key words:** Cigarette smoking, lung cancer, carcinogenic compounds, toxicity, genetic mutations

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## INTRODUCTION

Tobacco was introduced in India by the Portuguese nearly 400 years ago and since then it rapidly became a part of socio-cultural milieu in various communities. India is the second largest producer and consumer of tobacco next only to China (Sridharan, 2014). According to Maps of World (2014) the worlds' top 10 tobacco producing countries are China, India, Brazile, USA and Indonesia, Malawi, Argentina, Tanzania, Zimbabwe and Pakistan and their annual production in metric ton (Mt) is given in Fig. 1. However, the top 10 smoking (cigarette consumption only) countries are China, Russia, USA, Indonesia, Japan, Germany, India, turkey, South Korea and Vietnam (Eriksen *et al*., 2012; Armbrecht, 2015).

In India, around 1 million new cancer cases are diagnosed per year while the prevalence being 2.5 million. Out of the total mortalities of around 7,00,000 per year, cancer causes 6% adult deaths in the country (Ali *et al*., 2011). According to Mallath *et al*. (2014), the number of deaths per year is projected to shoot up to 1.2 million by 2035. The most common cancers in men are lung and oral while breast and cervix cancers are common in women. A research from King's College London found that almost 3 of 5 cancer deaths in India are associated with tobacco or infectious diseases (Gill *et al*., 2015). Moreover, tobacco use alone accounts for about 40% of all cancers in India. Interestingly, this report claims that by as early as 2050 no one under 80 will experience cancer. However, as per Harvard Medical School's report (Colditz *et al*., 2002), around 275 million Indians, in which 35% adults and 14% children aged 13-14 years, are tobacco users.

In recent days, the fact "tobacco causes cancer" is controversial in Indian media because of lack of awareness among people including some politician about the adverse effects of tobacco use. Some people think that tobacco is not a causative agent for cancer and it does not harm human health in any ways (Pandey, 2015). Many people accept that there are no research reports in India supporting dangerous health effects of tobacco. However, this explanation is unjustified because it is scientifically proven by scientists and health practitioners globally that tobacco is a causative agent for many diseases including life killing cancer. The primary aim to write this article is to aware public for the dangerous effects of tobacco on human health. The use of tobacco is risky for the health and it can be reduced or even stopped with the help of Indian ancient system of medicine i.e., Ayurveda and Yoga.

## MAJOR FACTS ABOUT THE USE OF TOBACCO

According to the World Health Organization (WHO., 2015), the consumption of tobacco in all forms including secondhand or passive smoke is the single greatest cause of preventable death globally. Tobacco is the cause of around 6 million deaths per year which is expected to rise to 10 million per year by the 2020 or early 2030, with 7 million deaths occurring in developing countries. It affects the heart, liver and lungs and leads to heart attacks, strokes, chronic obstructive pulmonary disease, hypertension and cancer. The stages of these diseases in a man depend on the quantity and time period of tobacco consumption. Secondhand or passive smoke also causes dangerous adverse health effects in human beings (Vainio, 1987). It causes lung cancer, heart problems, eye infections and skin disorders in human (Fig. 2). In fact, tobacco is important cause of premature death worldwide mostly in developed countries. WHO also stated that there are approximately 1.1 billion regular smokers in the world, which is one-third of the global population aged 15 years and older.

## RELATIONSHIP BETWEEN TOBACCO AND CANCER

A report published in Cancer Facts and Figures (ACS., 2014a) showed that, in United States, cigarette smoking is the major single cause of cancer (mostly lung cancer) and

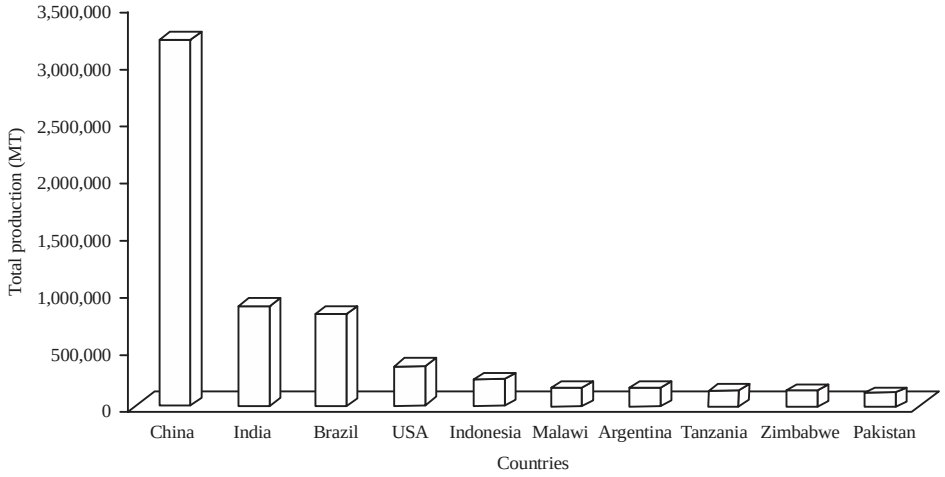


Fig. 1: Top 10 tobacco producing countries in the world

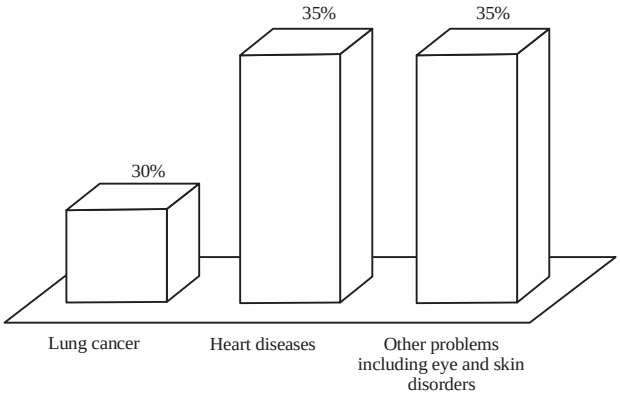


Fig. 2: Harmful effects of passive smoke in human health

responsible for nearly 1 in 5 deaths, this equals about 480,000 deaths each year and since the lung cancer is caused by tobacco hence most preventable form of cancer by stopping smoking. However, another report published in BioMed Research International (Janssen and van Poppel, 2015), revealed that smoking is responsible for 2 out of 3 deaths of >50 years old women in the Netherlands as well as in the United Kingdom. Among them most of the deaths were due to lung cancer. The Institute of Medicine (IOM., 2007) reports that tobacco kills more Americans annually than AIDS, alcohol, cocaine, heroin, homicides, suicides, car accidents and fires combined. Shockingly, each year, about 3,400 non-smoking adults die of lung cancer as a result of breathing secondhand smoke. Each year secondhand smoke also causes about 42,000 deaths from heart disease in people who are not current smokers. This report demonstrates that cigarette smoking reduces at least 10 years of lifespan (ACS., 2014b).

Cigarette smoking is not the cause of only lung cancer but it also increased the risk of other cancers (National Cancer Institute, 2003) such as mouth, throat, esophagus kidney, cervix, liver, stomach, colon and pancreas. Oral, esophageal and pancreatic cancers are mostly caused by smokeless tobacco such as Gutkha, Pan Masala, Chewing Tobacco and Jarda. An informative article published in Cancer Prevention and Early Detection Facts and Figures (ACS., 2010), revealed that smokeless tobacco is a major source of cancer-causing nitrosamines. It causes mostly mouth, throat, esophagus and pancreas cancers.

A US Surgeon General Report (Surgeon General, 2014) stated that both men and women smokers are around 25 times more likely than who never smoked to develop lung cancer. At least 30% of all cancer deaths are caused by tobacco in which around 87% of lung cancer deaths in men and 70% in women. A research conducted at the University of California, USA found that around 8 out of 10 oral cancer patients were smokers (Boschetti, 2014). This study including various other researches confirmed that there is an absolute link between the tobacco and oral cancer. It has been found that the combined use of tobacco and alcohol increases the risk of oral cancer by 15 times than non-users of tobacco and alcohol. In Asian American, oropharyngeal cancer is the leading cancer in men, while third most frequent cancer site in women. Due to late detection of the cancer, the average 5 years survival rate of patients with oral cancer is approximately 50% (Siegel *et al*., 2014).

## HARMFUL CHEMICALS OF TOBACCO

According to American Lung Association (ALA., 2015), cigarettes contain about 600 ingredients. When they burn, they generate more than 7,000 chemicals and 69 of them can cause cancer. Many researches confirmed that "Tar" present in the cigarettes increases the risk of diseases. This tar contains many carcinogenic pyrolytic products that bind to DNA and cause many genetic mutations (Shen, 2014). Moreover, nicotine present in smoke causes physical and psychological dependency. Interestingly, nicotine is addictive and its level is found comparable high in the blood of tobacco users. It is absorbed through the mouth tissues directly into the blood and reaches to the brain. Even after the tobacco is removed from the mouth, nicotine continues to be absorbed into the bloodstream. Main culprit of addiction of cigarettes is nicotine, which alters the balance of chemicals in a smoker's body such as dopamine and noradrenaline (Audrain-McGovern and Benowitz, 2011). When nicotine changes the levels of these chemicals, the person's mood and concentration level change and smokers find this enjoyable. The changes happen very quickly, when the smoker inhales the nicotine, it immediately has the effect and this is why smokers enjoy the nicotine rush and become dependent on it. Once can quit smoking by getting the levels of dopamine and noradrenaline returning to the normal state with the help of Ayurveda (Gupta and Gupta, 2002). The detail of harmful chemicals as per FDA (FDA., 2012) is as following;

**Carcinogens:** The chemicals responsible for cancer are called as carcinogens. In tobacco, almost 70% chemicals are carcinogens those are including benzene (from pesticides and gasoline), formaldehyde (from preservatives), N-nitrosamines (1), vinyl chloride (from cigarette filters) and various

pesticides. Other carcinogens approved by FDA in various tobacco products are acetaldehyde, acetone, acrylonitrile, aflatoxin B1 (2), 4-aminobiphenyl, 1 and 2-aminonaphthalene, o-anisidine (3), arsenic, a-alpha-c (2-amino-9H-pyrido[2,3-b]indole) (4), benz[a]anthracene, benz[j]aceanthrylene (5), benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[b]furan, benzo[a]pyrene, benzo[c]phenanthrene, beryllium, 1,3-butadiene, cadmium, caffeic acid, catechol, chlorinated dioxins (6), furans, chromium, chrysene (7), cobalt, o-, m- and p-cresol, crotonaldehyde (8), cyclopenta[c,d]pyrene (9), dibenz[a,h]anthracene, dibenzo[a,e]pyrene, dibenzo[a,h] pyrene, dibenzo[a,i]pyrene, dibenzo[a,l]pyrene (10), 2,6-dimethylaniline, urethane (11), ethylbenzene, ethylene oxide, furan, glu-p-1 (2-amino-6-methyldipyrido[1,2-a:3',2'-d] imidazole) (12), glu-p-2 (2-aminodipyrido[1,2-a:3',2'-d] imidazole), hydrazine, indeno[1,2,3-cd]pyrene, 2-amino-3-methylimidazo[4,5-f]quinoline (IQ) (13), isoprene, 2-amino-3-methyl-9H-pyrido[2,3-b]indole (MeAαC) (14), 5-methylchrysene, 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone, naphthalene, nickel, nitrobenzene, nitromethane, 2-nitropropane, N-nitrosodiethanolamine (NDELA) (15), N-nitrosodiethylamine, N-nitrosodimethylamine, N-nitrosomethylethylamine, N-nitrosomorpholine, N-nitrosonornicotine, N-nitrosopiperidine, N-nitrosopyrrolidine, N-nitrososarcosine, quinoline, 2-amino-1-methyl-6-phenylimidazo[4,5-b]pyridine (PhIP) (16), polonium-210, styrene, o-toluidine, 3-amino-1,4-dimethyl-5h-pyrido[4,3-b]indole and 1-methyl-3-amino-5h-pyrido[4,3-b]indole.

**Toxic metals:** Although most of the metals are useful for health when in trace amount but in access these become toxic. The toxic metals present in tobacco are including cadmium and arsenic which are usually come from pesticides or rat poisons used for agriculture purposes.

**Radioactive substances:** These are more harmful chemicals as compare to non-radioactive. Various metals like Lead-210, uranium-235, uranium-238 and polonium-210 are radioactive and dangerous to human health.

**Addictive:** The substances causing or tending to cause addiction, such as anabasine (17), nicotine (18) and nornicotine.

**Other poisonous substances:** These chemicals can cause severe physical distress or even death of a healthy subject. Around 250 poisons have been investigated from cigarette smoke. These are including ammonia, carbon monoxide, hydrogen cyanide, acrolein (19), acrylamide, coumarin (20), lead, mercury, methyl ethyl ketone, phenol, propionaldehyde, propylene oxide, selenium, toluene, vinyl acetate. Various harmful chemicals found in tobacco products are given in Fig. 3.

## HOW DOES TOBACCO AFFECT?

Various dangerous chemicals of tobacco smoke can damage DNA of a healthy individual. A research by Denissenko *et al*. (1996) corroborated that benzo(a)pyrene present in tobacco damages p53 gene that protects our cells from cancer whereas a research by Zaga *et al*. (2011) states that polonium-210 becomes concentrated in hotspots in smokers' airways, subjecting them to very high doses of high-energy alpha-radiation that damages the DNA of nearby cells. These chemicals in combined form (cocktail) are even more dangerous than alone. Toxic metals of tobacco smoke such as cadmium, arsenic and lead stop our cells from repairing DNA damage. This worsens the effects of chemicals like benzo(a)pyrene that damage DNA and makes it even more likely that damaged cells will eventually turn cancerous. Various *in vitro*, *in vivo* and case studies have suggested that heavy metals present in cigarettes of Indian origin may induces intracellular ROS accumulation and increased expression of PI3K, AKT, NFκB, c-Myc which ultimately lead to unusual cell division or cancer (Mohapatra *et al*., 2014).

## ROLE OF AYURVEDA IN REDUCING THE RISK OF TOBACCO

Ayurveda is an ancient Hindu traditional medicinal system native to the Indian subcontinent which is a discipline of the upaveda (auxiliary knowledge) in Vedic tradition (Garg, 1992). The basic concepts of Ayurveda (Widgery, 1930) are Gunas, Dravyas and Doshas in which Gunas means qualities, Dravya means five elements (ether, air, fire, water and earth) and Dosha means movement (Kapha, Pitta and Vata). Gunas are also known as primary forces of creation i.e., Sattva or pure (goodness, constructive, harmonious); Rajas or excitable (passion, active, confusion) and Tamas or indifferent (darkness, destructive, chaotic). According to Ayurveda, the human body is a vehicle for spiritual experience and its form as well as function is created according to prakriti (desire) of an individual. Each human body is made up of Panchamahabhutas, the five elements of creation i.e., ether (space), air (movement), fire (transformation), water (fluidity) and earth (crystallization) which are principle sources of atomic energy, electrical energy, radiant energy, chemical energy and mechanical energy, respectively for the body (Sharma, 2014a, b).

Ayurveda is known to be a complete medical system that comprised of physical, psychological, philosophical, ethical and spiritual health. It is also called as a science of self-healing, an oldest healing system in the world because each individual and each cell is considered to be inherently an essential expression of pure intelligence (Lad, 1987). Apart from self-healing concept, the use of medicinal herbs,

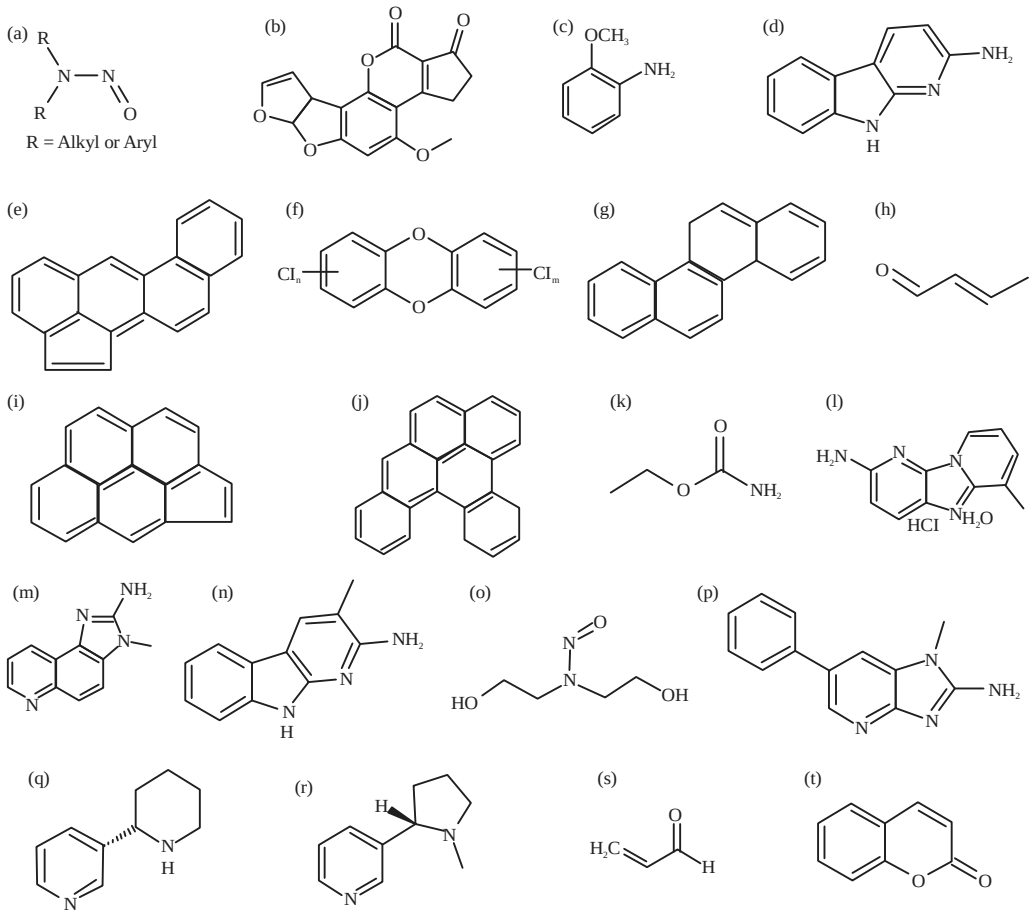


Fig. 3(a-t): Various harmful chemicals found in tobacco products, (a) N-nitrosamines, (b) Aflatoxin B1, (c) o-Anisidine, (d) A-alpha-C, (e) Benz(j)aceanthrylene, (f) Chlorinated dioxins, (g) Chrysene, (h) Crotonaldehyde, (i) Cyclopenta[c,d]pyrene, (j) Dibenzo[a,l]pyrene, (k) Urethane, (l) Glu-P-1, (m) IQ, (n) MeAαC, (o) NDELA, (p) PhIP, (q) Anabasine, (r) Nicotine, (s) Acrolein and (t) Coumarin

minerals, surgical techniques and massages are also the parts of Ayurvedic practice (Ameeuw, 2013). Various Ayurvedic approaches are certainly helpful in reducing the adverse effects of tobacco (Kerala Traditional Ayurveda Medicine, 2008). These approaches are given in following heads.

**Intake of Adequate Water:** Drink plenty of water (stored in a copper container which can help in removing toxic deposits) helps in reducing weight by increasing metabolism and boosting the ability to burn fat (Boschmann *et al*., 2003). Tobacco consumption affects the heart in various ways, however, intake of adequate water every day is helpful in protecting the heart from various problems. An adequate amount of water thins the blood and reduces the risk of blood clots that can lead to heart attacks (Chan *et al*., 2002). Intake of plenty of water (about 1.5 L daily in addition to the usual intake) also reduces stress and boosts brain power and prevents migraine by regulating body temperature and supplying adequate oxygen to brain (Wober and Wober-Bingol, 2010).

**Yoga and other exercises:** Yoga is a form of relaxation and exercise that incorporates stretching, meditation and the knowledge of the body's full potential (Mishra, 2004). It helps in relieving tension and stress and helps to increase the strength and vitality without using any form of tobacco. Moreover, meditation twice a day for a regular smoker can bring remarkable results to refresh the mind and consciousness.

Neti-Kriya (nasal cleaning), a cleansing practice of sinus passages, has been practiced for centuries for physical, psychological and spiritual benefits. Performing Neti-Kriya (Fig. 4a) at morning and night with normal saline solution at room temperature helps in sinus infection and allergy problems mainly caused by smoking. Moreover, practice of Bhastrika Pranayama (bellows breath), the breathing pattern resembles the blowing of bellows (Fig. 4b) at morning and night is helpful in expelling tobacco contaminants in the upper and lower airways.

**Use of ayurvedic herbs:** Regular use of tobacco caused a deposition of nicotine, tar and other toxic compounds in

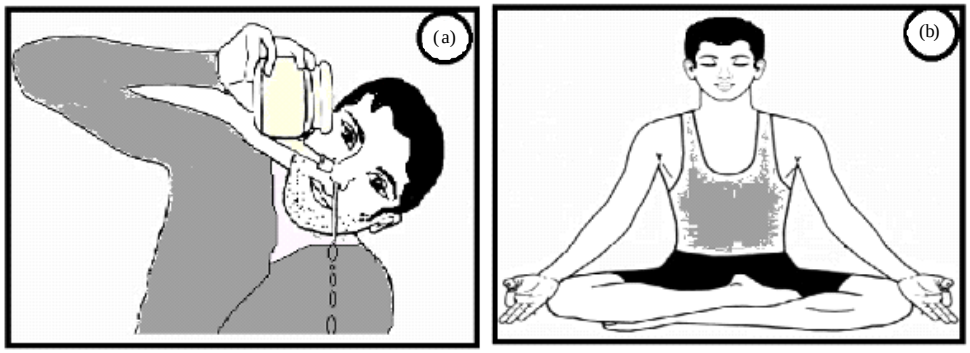


Fig. 4(a-b): Men performing yoga, (a) Neti-Kriya with normal saline solution and (b) Bhastrika pranayama

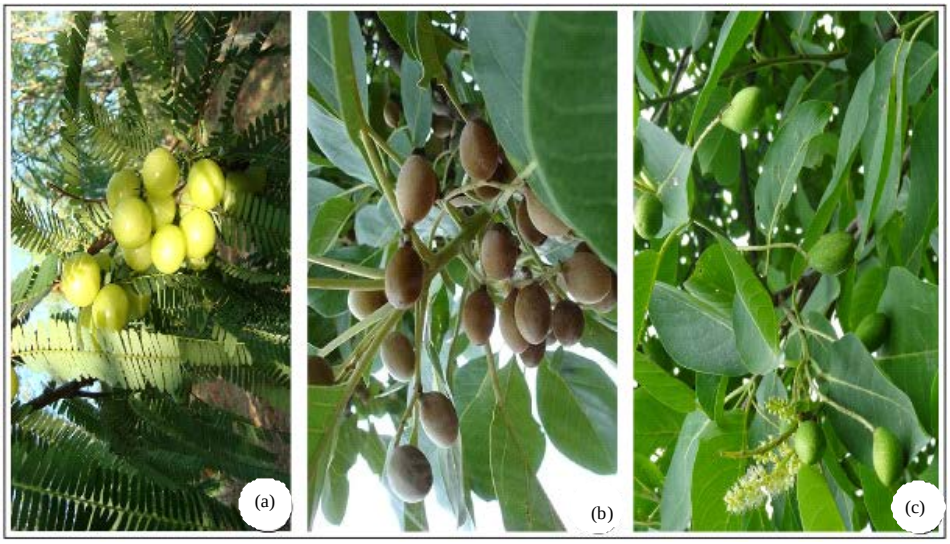


Fig. 5(a-c): Fruits used for the preparation of Triphala, (a) *Emblica officinalis*, (b) *Terminalia bellirica* and (c) *Terminalia chebula*

tissues. To expel such toxic substances, one tablespoon of Triphala powder (A mixture of equal parts of Amalaki (*Emblica officinalis*), Bibhitaki (*Terminalia bellirica*) and Haritaki (*Terminalia chebula*) without seeds) every night, before bedtime is helpful because it has potency to cleanse the colon and flush out the body toxins.

Triphala, a well-known Ayurvedic herbal formulation effectively regulates the functions of digestive system and enhances the strength of immune system, lungs, urinary tract and the muscles. Triphala is scientifically proven for various activities such as anti-mutagenic activity (Kaur *et al*., 2002), cytochrome P450 inhibitory activity (Ponnusankar *et al*., 2011) and protective activity against radiation oxidative damage (Sandhya *et al*., 2006). All three plants used in Triphala powder are given in Fig. 5.

Similar to Triphla, a powder of the combination of Ashwagandha (*Withania somnifera*), Shatavari (*Asparagus racemosus*) and Bala root (*Sida cordifolia*) taken every morning is helpful in detoxification. This powder is also found helpful for the brain, nervous system, chronic pain and sexual health. Moreover, Chyavanaprash, a combination of various useful herbs, is considered to be a strong supplement for immunity boosting that helps to fight against various diseases (Panda, 2013). The main herbs used in the preparation of Chyavanaprash are *Adhatoda vasica* (Vasa), *Aegle marmelos* (Bael), *Aquilaria agallocha* (Agarwood), *Asparagus racemosus* (Shatavari), *Bignonia suaveolens* (Patala), *Boerhaavia diffusa* (Punarnava), *Cyperus rotundus* (Musta), *Desmodium gangeticum* (Shalaparni), *Elettaria cardamomum* (Ela), *Emblica officinalis* (Amla), *Gmelina arborea* (White teak), *Habenaria intermedia* (Ruddhi), *Hedychium spicatum* (Spiked Ginger Lily,), *Inula racemosa* (Pushkara), *Ipomea digitata* (Vidari), *Leptodenia reticulate* (Jeevanti), *Lilium poilyphyleum* (Kakoli), *Martynia diandra* (Kakanasika), *Microstylis muscifera* (Jeevaka), *Microstylis wallichi* (Vrishabhaka), *Nymphaea caerulea* (blue water lily), *Nymphaea stellate* (Utpala), *Oroxylum indicum* (Indian trumpet flower), *Phyllanthus fraturnus* (Taamalaki), *Piper longum* (Long pepper), *Pistacia integerrima* (Karkatashrungi), *Polygonatum cirrhifolium* (Meda), *Premna corymbosa* (Agnimantha), *Santalum album* (Sandalwood), *Sesamum indicum* (Sesame or Til), *Sida cordifolia* (Bala),

*Solanum indicum* (Indian Nightshade), *Solanum xanthocarpum* (Yellow-fruit nightshade), *Teramnus labialis* (Horse vine), *Terminalia chebula* (Chebulic Myrobalan), *Tribulus terrestris* (Gokshura), *Uraria picta* (Prishnaparni), *Vigna trilobata* (Wild gram), *Vitis vinifera* (Raisins), *Withania somnifera* (Ashwagandha). In addition to help in purifying blood, stimulating liver and eliminating toxins, this polyherbal formulation improves respiratory and digestive problems.

## CONCLUSION

Studies show no matter how you consume tobacco, it is dangerous to our health and affects our entire body. Governments of most of the countries do not want to stop the use of tobacco and related products because it is one of the top economy generating industries in the world. The total burden caused by tobacco products more than outweighs any economic benefit from their manufacture and sale. Although it will be a big challenge to stop the use of tobacco completely but it is not an impossible task. A proper awareness, education, counseling and herbal treatment can stop or reduce the use of tobacco. In this serious issue, Ayurveda, an ancient medical science can be played an important role. The addiction of tobacco can be stopped with the help of Yoga or other physical practices including meditation. Moreover, Ayurvedic herbal formulations in the form of dietary supplement or medicine can reduce the side-effects caused by tobacco consumption.

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