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Antioxidant and Antimicrobial Activity of Fruit Juices

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Abstract

This research was conducted to highlight the benefits of fruits and their juices in terms of their role in preventing harmful substances which cause different types of diseases within human body. The key properties that are investigated in this research are antioxidant and antimicrobial properties of fruit juices that are important in healthcare and food science. This study explores the effect of fresh juices and determine how it prevents the human body cells to get damage. It also investigates the capacity of fruit juices to kill microorganisms in human body. Three fruit juices (apple, grapes and pomegranate) were selected to analyze their anti-microbial activity. The results proved that the fruits with high acidity are considered more antimicrobial and antioxidant in nature, hence, more helpful to react against diseases and to make strengthen the immunity of human's body. Apple has high anti-microbial activity as compared to grapes and pomegranates which is very nice supplement for human body to react against bacteria and other harmful antibodies. Most of diseases will be cured with fruits in future instead of intaking high potency antibiotics.

Keywords: Traditional medicine, fruit juices, antibacterial properties, antioxidant and antimicrobial activity.

Introduction

Historically, plants were used for healing and curing human illnesses since the dawn of civilization. The history of plants can be traced back to stone-age where plants were considered a main source of food by humans, neglecting their physical properties [1]. However, humans

started to investigate the botanical properties of plants with passage of time. They established modern laboratories and tried to understand the actual properties in these plants to differentiate various fruits separately [2]. Some researchers investigated peals and juices and their effect on human body. It was observed that the fruits could improve one's health by strengthening human's immunity system [3]. Fruits and their juices do have anti-bacterial properties. These properties help one to develop resistance against diseases and also to boost the defense mechanism of human body [4].

People of ancient times used fruits to keep their bodies and muscles strong against various diseases [5]. Fruit juices were used to treat many diseases like heart problems, drug addiction and muscle aches etc. In this study we analyzed antioxidant and antimicrobial activity of three fruit juices apple, grapes and pomegranate [6].

Apple has large number of phenolic compounds, fibers, and is used to balance free radical cells in human body [7]. Different varieties of apples have different number of phenolic compounds that generates new antimicrobials against diseases.

Grapes are important source of vitamins and nutrients. Grapes are widely cultivated in Nigeria, that play an important role in economic growth of Nigeria. Grapes contain powerful antioxidants known as polyphenols. These are thought to have anti-inflammatory and antioxidant properties. One of these is resveratrol [8]. It is found in the skins of red grapes. Laboratory studies have suggested that resveratrol may be able to slow or prevent the growth of tumors in lymph, liver, stomach, breast, colon, skin cancer, and leukemia [9].

Pomegranate is used extensively due to its medicinal properties that removes toxins from human body and make it less vulnerable to illnesses [10]. Pomegranate contain a variety of nutrients, minerals, saccharides and polyphenol.

The process of building and rebuilding of different type of cells within human body is always on the way, however, the antioxidant properties of fruit juices could slow down the cell damaging process in humans [11].

Antioxidation is a chemical process which cause to stop oxidation of cells within human body. Antioxidant agents are either available in fresh fruit juices or in man-made items [10]. However, the antimicrobial properties of fruits have ability to kill microorganisms which are present in human body. The antioxidant and antimicrobial properties of fruits make them important by nutritional point of view [12].

The plants have healing properties in them which cause them to be used for various purposes. Strawberries have potential to cure the body of microorganisms. Different types of strawberries were studied to investigate their certain qualities. Strawberry help in boosting the immune system of human body. In many experiments, berries proved more effective for curing various diseases. Certain studies have proved that cranberry and black currant juices showed strong antimicrobial activity against bacteria and fungus [10].

Fruit juices are considered a best source of vitamins without any side effect and are considered to have more energy and health benefits in terms of cardiovascular health. It is assumed that antioxidants are more helping to prevent Reactive Oxygen Species (ROS).

It is experienced that all antioxidants have different levels of bioavailability; this term of bioavailability is easier to understand as a certain percentage of nutrients that are consumed for metabolism.

Seed oils have been found very efficient against diseases [13]. These are full of vitamins and Vitamin C is the most important antioxidant present in fruits to repair the damaged cells of human body and for their proper growth [Bernini, R. et al 2015]. The juices which are available in market with artificial flavors are not considered to be quite effective. Microorganisms exist in natural juices used for curing the oral teeth cavity in the form of commensal. Dental issues are very common especially in kids so antimicrobial activity of fruit juices can keep them safe from such diseases [14]. Pomegranate is a plant from "Lythraceae" family and polyphenols are present to make compounds for offering anti-infective effects. Pomegranate comprise of tannins, polyphenols, elegiac acid, Delphinidins and Cyanidins [15]. These contents can prevent the creation of tartar in tooth by blocking the movement of microorganism. Such juices are plentifully available in the market with the property of covering up the minerals [16].

This research was conducted to highlight the antioxidant and antimicrobial activities of fruit juices by healthcare point of view. It also aims at analyzing the medicinal properties of fruits and plants. An attempt is made to create an awareness among masses about efficiency of fruit juices to kill microorganisms.

Materials and methods.

We purchased three fruits (Apple, Grapes and pomegranates) from local market and prepared their juices in laboratory.

1- **Test via Micro- organisms:** S.mutans and Enterococcus fecalis were brought from Microbial Institute and confirmed their biochemical characteristics. In order to test antimicrobial activity of fruit juices, sterile distilled water was used to adjust bacterial strains according to 0.5 McFarland Standards.

1- **Assessment:** All stained bacteria were incubated at 37 oC and then 100ul volume of inoculums was poured into sterile Muller Hinton plate. Sterile borer was used to made wells having size 8mm in plates. These wells have bacterial inoculums. A100ul volume of selected fruit juices was poured in these plates and left these plates to get cool at room temperature. Fruit juices indicated the presence of antibacterial activity.

Results and discussion.

Figure 1 is showing variations in pH of juices used in this research. It describes that the apple has higher pH than other two fruits therefore, apple is more helpful in antimicrobial and antioxidant activities than other two fruits.

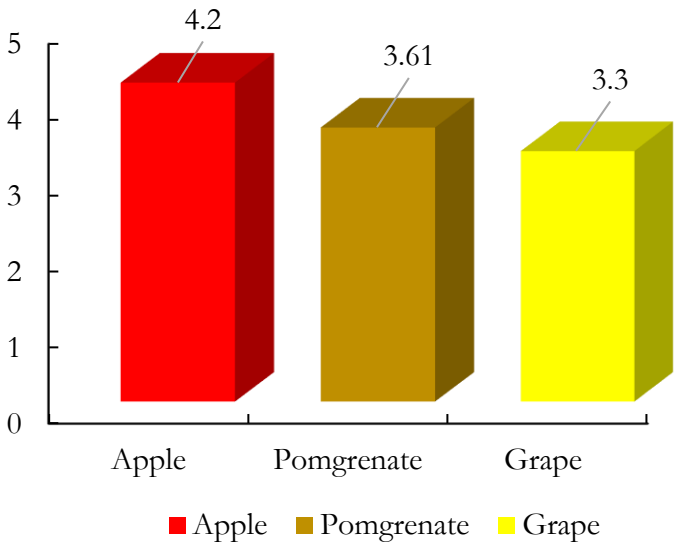

Figure 1. pH of juices.

Agar-well diffusion method was adopted to determine antimicrobial activity of fruit juices (pomegranate, apple and grapes). The effects of these juices was analyzed on S.mutans and Enterococcus fecalis. Results show that the effect of apple juice on Enterococcus fecalis was high as compared to other fruit juices as its mean diameter of inhibition zone was 9.4mm. Grapes and pomegranates had significantly low antimicrobial activity as their mean values are low.

Different parts of pomegranate fruit were analyzed e.g., the pomegranate appetizing portion contained significant number of saccharides, minerals and polyphenols (as phenolic-rings bearing several hydroxyl assemblages). Moreover, its polyphenol part was comprised of flavonoids (e.g. anthocyanins), hydrolysable tannins (e.g. gall tannins) and condensed tannins (proanthocyanins).

We obtained 10 samples of each juice and computed the mean and standard error and found that apple has high standard error as compared to other two juices resulting high antimicrobial activity and vice versa.

Table 1: Mean diameters values.

Selected Microorganisms	**Fruit Groups**	**Samples count**	**Mean± S.D**	**Standard Error**
Enterococcus Fecalis	Grapes	10	0.4±0.516	0.163
	Pomegranate	10	0.7±0.675	0.213
	Apple	10	9.4±0.69	0.221
	Total	**30**	**3.5±4.289**	**0.783**
S-.mutans	Grapes	10	0.4±0.516	0.163
	Pomegranate	10	0.7±0.483	0.153

Apple	10	12±0.816	0.258
Total	**30**	**4.37±5.524**	**1.009**

In order to compare these three different fruit juices regarding their efficient performance, a value of P≤0.5 was selected against selected microorganisms.

Table 2: Comparative analysis.

Selected Microorganisms	Fruit Groups	Mean± S.D	Mean Difference	Standard Error	Value of P
Enterococcus Fecalis	Apple	9.40±0.69	8.7	0.28	0.5
	Pomegranate	0.7±0.675			
	Apple	9.40±0.69	9	0.28	0
	Grapes	0.40±0.51			
	Pomegranate	12±0.81	0.3	0.28	0.54
	Grape	0.70±0.48			
S.mutans	Apple	12±0.81	11.3	0.27	0
	Pomegranate	0.7±0.483			
	Apple	12±0.816	11.6	0.27	0
	Grape	0.40±0.51			
	Pomegranate	0.7±0.483	0.3	0.27	0.53
	Grapes	0.40±0.51			

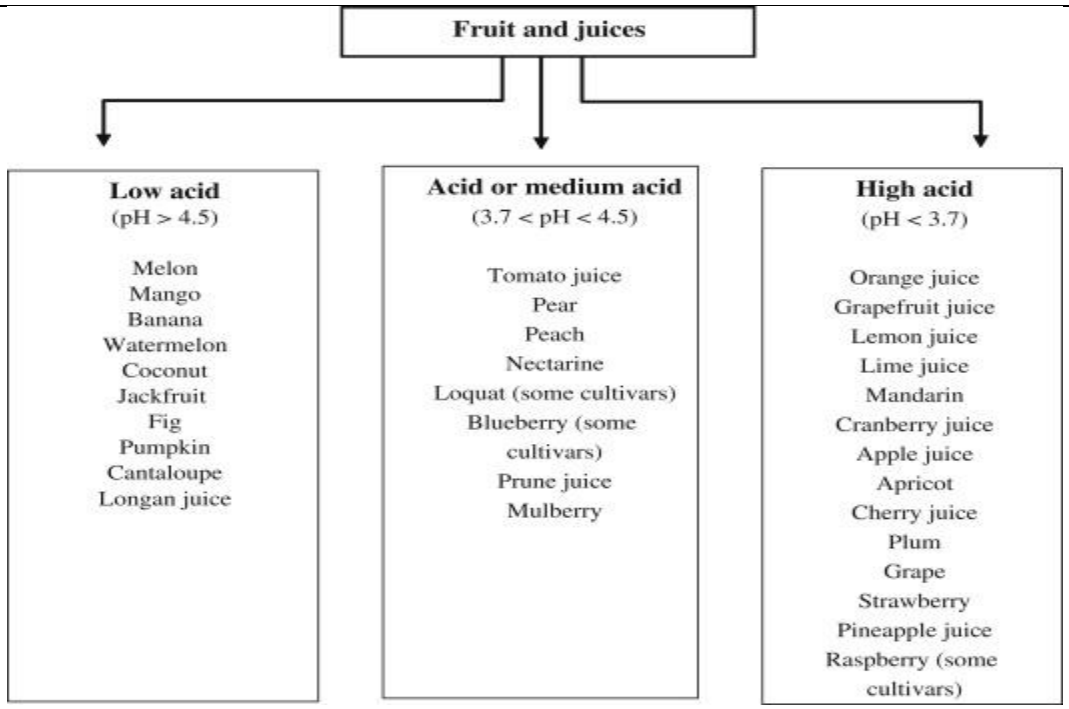

Figure 2. Fruits and juices having different pH levels.

Figure 2 is showing that the fruits with high acidity are considered more antimicrobial and antioxidant in nature, hence, more helpful to react against diseases and to make strengthen the immunity of human's body.

The above-mentioned results show antioxidant and antimicrobial properties of fruits. These fruits are mostly citrus in nature or consist of ascorbic acid. Such fruits are mostly rich in vitamin C and are used for the cure of skin diseases. These are also used to boost up the internal human immunity. It can be inferred from the present study that the use of fruit juices should be increased and it must be recommended by the healthcare professionals. Antioxidants are simple compounds to prevent oxidation that produces free radicals. From the health perspective, the consumption of antioxidants may lower the heart diseases and cancer risks. The straight way to increase the oxidants is simply to drink fruit juices in surplus. But the variances in the antioxidant activities amongst the fruit juices possibly be predictable with differences in their compositions and phenolic contents. Moreover, the existence of non-phenolic antioxidants matters a lot in this regard.

Natural foods like fruits are considered fundamental sources of treatment with the help of antioxidant plus antimicrobial activity and can serve as immune system's response mediators. The fruits are one of the primogenital means of food and assist to cure of several infections and diseases e.g. arthritis, muscle aches and heart diseases. Fruits are endowed with divine attributes, e.g., mellow Apple comes with numerous health benefits due to penalty of phenolic compounds especially chlorogenic acid, quercetin, and Phloridzin contents. All such compounds are proficient enough to compensate free radical that might become the reason of cell injuries. An antimicrobial agent can kill the microorganisms e.g. a bacterium, fungus or virus. Prevention of radicals helps to fight against cardiovascular diseases. Citrus fruits have ability to fight against skin diseases. These fruits include lemons, grapes, pomegranate.

Results show that apple, grapes and pomegranate are primarily against the bacteria and different kinds of fungal infections, though the phytochemical composition significantly varies in these fruits. Phenolic compounds inside such citrus fruit's juices comes with liquid chromatography along with photodiode range coupled with electrospray-ionization-triple. Therefore, these are antimicrobials, antiradicals, anti-carcinogenic and anti-mutagenic.

Though human body possessed an antioxidant resistance system, but this built in system may not be adequate to counterbalance the various kinds of attacks that may weaken a man's body gradually. Therefore, human body need antioxidants to make strengthen the human immunity system. On the other hand, antioxidant activity of a ready-made commercial orange juice/nectar can be observed by keeping in view Total Antioxidant Activity (TAA) of ready-made orange juice /nectar that is from 57.88 - 349.32 (micromole) TEAC/100 milliliter. But the Total Phenolic Compound (TPC) is extended from 18.7 - 54.2 milligrams (gallic-acid / 100 milliliter). Correlation of total phenolic compound with total antioxidant activity is also exposed that if there is a higher level of TPC then TAA level will reach at peak.

Usually, materials working on the responsive oxygen species can be utilized in the food supplements. As the artificial antioxidants can be toxic and maybe having cancer-causing effects, so the fruit extracts and fruit juices with antioxidant properties can be the best

alternates. A major part of the antioxidant capacity by fruits is offered in form of vitamin C, vitamin E, Carotenoids, and various Polyphenols.

The maintenance of these stuffs should be a part of the human life as the Polyphenols can guard the human's body cells against the possible oxidative destruction and harm. Otherwise, different degenerative elements viruses linked with the oxidative tension may be produced by the free radicals. Besides this, phenolic composites are flavonoids therefore they can be accredited with an extensive array of therapeutic effects e.g. antimicrobial, anti-inflammatory, cardiotonic and antineoplastic.

Antimicrobial Properties in Fruits and Plants

Plants have extensive antimicrobial properties which are for killing of microorganisms within the body. The antioxidant and antimicrobial activities of fresh fruit juices are important features to investigate for human 's wellbeing. The foods commonly consumed should not only fresh and natural but it must be safe and healthy. Synthetic additives, chemicals and many other microorganisms are giving a huge challenge to food science sector. A lot of people suffer food borne diseases every year. As a result of which the use of antibiotic products and its further lead to the problem of drug resistance by pathological microorganisms. Scientists are focusing to create an awareness among masses for the use of natural products for curing diseases. Because the natural elements of plants and fruits contain healthy amount of antioxidant and antimicrobial contents for treatment of bacterial diseases.

Removal of Bacteria through Fruit Juices

There is a large number of bacteria in the human body that is of two types: 1) healthy bacteria 2) harmful bacteria. The healthy bacteria treat as helpful for the body tissues and perform various functions which are actually good for health. However, the harmful bacteria need to be removed from the body because it puts human body in trouble [13]. It has been found in the studies that the harmful bacteria may cause big problems inside the human body and this bacterium effected body need extensive therapy either by natural or by chemical ways. It is necessary to restrict the use of antibiotics by fruit juices which are helpful in fighting against harmful bacteria.

Treatment of Oral Cancer via Fruit Juices

The importance of fruit juices cannot be underestimated while treating oral cancers. This type of cancer is highly dangerous and is produced by intensive smoking. The use of tobacco is quite dangerous for mouth that cause oral cancer and its treatment is usually called chemotherapy [17]. This treatment is painful and the patients lose their hair during the complete procedure of quiring. However, fresh fruit juices are the most suitable and fundamental source to cure oral cancer.

Treatment of Skin Diseases via Citrus Fruits

The citrus fruits have the quality of curing various types of skin diseases. These fruits include lemons, grapes, pomegranate and some other sour fruits. These fruits are rich in ascorbic acid having penalty of vitamin C. These are highly recommended for patients who have weak immunity. Hence, citrus fruit juices like tangerine, lime and grapes etc have more antioxidants properties than others as their pH level are higher, therefore, they also work well

for bacterial and fungal problems. On the other hand, grape juices have more scavenging capacities. Talking about antimicrobial activities in fruit juices, berries are on the top of list, black currant, blue berries, raspberries have more antimicrobial activities.

Conclusions.

This study describes the magical properties of fruit juices. They must be utilized for their special properties and healing nature. It can be inferred from the present study that the use of fruit juices will be a common practice in future to fight against various diseases instead of using high potency antibiotics. These days, oral diseases have also become an alarming thing for the whole world.

1-References

1. Sairam K, Dorababu M, Goel RK, Bhattacharya SK. (2002). Antidepressant activity of standardized extract of Bacopa monniera in experimental models of depression in rats. Phytomedicine. 9:207
2. Alu'datt, M.H.; Rababah, T.; Alhamad, M.N.; Gammoh, S.; Al-Mahasneh, M.A.; Tranchant, C.C.; Rawshdeh, M. Chapter 15—Pharmaceutical Nutraceutical and Therapeutic properties of selected wild medicinal plants: Thyme, spearmint and Rosemary. In Therapeutic, Probiotic and Unventional Food; Grumezescu, A.M., Holban, A.M., Eds.; Academic Press: Cambridge, MA, USA, 2018; pp. 275–290.
3. Andrade, M.A.; Ribeiro-Santos, R.; Costa-Bonito, M.C.; Saraiva, M.; Sanches-Silva, A. Characterization of rosemary and thyme extracts for incorporation into a whey protein based film. LWT-Food Sci. Technol. 2018, 92, 497–508.
4. Kartni T. (2011). Herbs, Spices and Medicinal Plants. In: Cracker LE, Simon JE, editors. Vol. 3. Arizona, USA: Oryx Press. pp. 145–73.
5. Karimi, M.; Sadegui, R.; Kokini, J. Pomegranate as a promising opportunity in medicine and nanotechnology. Trends Food Sci. Technol. 2017, 69, 59–73.
6. Khwairakpam, A.D.; Bordoloi, D.; Thakur, K.K.; Monisha, J.; Arfuso, F.; Sethi, G.; Mishra, S.; Kumar, A.P.; Kunnumakkara, A.B. Possible use of Punica gratum (Pomegranate) in cáncer therapy. Pharmacol. Res.2018, 133, 53–64.
7. Derakhshan, Z.; Ferrante, M.; Tadi, M.; Ansari, F.; Heydari, A.; Hosseini, M.S.; Conti, G.O.; Sabradad, E.K. Antioxidant activity and total phenolic content of

ethanolic extract of pomegranate peels, juice and seeds. Food Chem. Toxicol. 2018, 114, 108–111.
8. Kharchoufi, S.; Licciardello, F.; Siracusa, L.; Muratore, G.; Hamdi, M.; Restuccia, C. Antimicrobial and antioxidant features of 'Gabsi' pomegranate peel extracts. Ind. Crops Prod. 2018, 111, 345–352.
9. Martínez, L.; Ros, G.; Nieto, G. Hydroxytyrosol: Health benefits and use as functional ingredient in meat. Medicines 2018, 5, 13.
10. Chen Y, Han T, Qin L, Rui Y, Zheng H. (2003). Effect of total triterpenes from Centella asiatica on the depression behavior and concentration of amino acid in forced swimming mice. Zhong Yao Cai. ;26:870–3.
11. Rice-Evans CA, Miller NJ, Paganga G. (2007). Structure antioxidant activity relationships of flavonoids and phenolic acids. Free Radic Biol Med. 20:933–56.
12. Maxwell SR. (2005). Prospect for the use of antioxidant therapies. Drugs. 49:45–361.
13. Halliwell B, Gutteridge JM.(2018). Oxygen toxicity, oxygen radicals, transition metals and diseases. Biochem J. 219:1–4.
14. Bernini, R.; Gilardini-Montani, M.S.; Merendino, N.; Romani, A.; Velotti, F. Hydroxytyrosol-derived compounds: A basis for the creation of new pharmacological agents for cancer prevention and therapy. J. Med. Chem. 2015, 58, 9089–9107.
15. Peiretti, P.G.; Gai, F.; Ortoffi, M.; Aigotti, R.; Medana, C. Effects of rosemary oil (Rosmarinus officinalis) on the shelf-life of minced rainbow trout (Oncorhynchus mykiss) during refrigerated storage. Foods 2012, 1, 28–39.
16. Pazos, M.; Alonso, A.; Sánchez, I.; Medina, I. Hydroxytyrosol prevents oxidative deterioration in foodstuffs rich in fish lipids. J. Agric. Food Chem. 2008, 56, 3334–3340.
17. Jyoti A, Sharma D. (2006). Neuroprotective role of Bacopa monniera extract against aluminium-induced oxidative stress in the hippocampus of rat brain. Neurotoxicol. 27:451–7.