

**TERMINALIA ARJUNA; A POTENT CARDIOPROTECTIVE ERGOGENIC AID****<sup>1</sup>\*Kankanamalage Nimali Achini Dharmasena, <sup>2</sup>Aku Ramamurthy, <sup>3</sup>Krutika Joshi and <sup>4</sup>Gaurav Sharma**<sup>1</sup>MD Scholar, Postgraduate Department of Dravyaguna, National Institute of Ayurveda, Amer road, Jaipur (302002), Rajasthan.<sup>2</sup>Professor, Postgraduate Department of Dravyaguna, National Institute of Ayurveda, Amer road, Jaipur (302002), Rajasthan.<sup>3</sup>Lecturer, Postgraduate Department of Dravyaguna, National Institute of Ayurveda, Amer road, Jaipur (302002), Rajasthan, National Institute of Ayurveda, Madhav vilas Palace, Amer road, Jaipur (302002), Rajasthan.<sup>4</sup>Pharmacologist, Postgraduate Department of Dravyaguna, National Institute of Ayurveda, Amer road, Jaipur (302002), Rajasthan.**\*Corresponding Author: Dr. Kankanamalage Nimali Achini Dharmasena**

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**ABSTRACT**

*Terminalia arjuna* is an important medicinal plant used in heart related diseases since *vedic* period. It had shown cardiac protective effects through recent scientific validations as well. Cardiopulmonary endurance is a key element in the success of athletes. This study has focused to compile and evaluate the scientific evidence along with Ayurveda concepts to find out the capabilities of *Arjuna* as a cardioprotective ergogenic aid. Data was collected from online journals, grey literature and authentic Ayurveda books. *Arjuna* bark possesses a positive inotropic effect on the heart muscle, hypotensive effect, Brady-cardiac effect, and cardioprotective effect against oxidative stress caused by hypoxia. According to Ayurveda concepts, there are sub-parts of the key biogenic humours of the body; *sadhaka pitta*, *avalambaka kapha*, *vyana vata* are situated in the heart. Properties of *Arjuna* bark can make the balance of these components to maintain its functional and structural wellbeing. This significant property helps to protect the heart from extreme conditions and with rapid recovery. It is a marvelous benefit for athletes who are on regular strenuous workouts. Hence, *Arjuna* can be developed as a potent cardioprotective ergogenic aid for athletes.

**KEYWORDS:** *Terminalia arjuna*, Cardio protective ergogenic aid, endurance.**INTRODUCTION**

Sports medicine is a branch of medicine deals with physical fitness and the prevention of sports injuries, which is separated recently from the main stream of medicine facilitating the needs and growing demands. It made the path to initiate expertise medical professionals for sports.

Ayurveda is entitled *Ashtangaayurveda*, since, it had eight branches. Later, it has been divided into some other branches like *swasthavrita*, *dravyaguna*, *stree roga*, *prasuti tantra*.etc permitting the requirements of the time. Since Ayurveda is a *shasvata* philosophy; the concepts and observations can be applied at all times. However, Ayurveda does not permutated for sports medicine. Even though, Ayurveda receives superfluous attention from athletes from all over the world.

Ayurveda deliberates physical, mental and even spiritual enhancement. Hence, it is named the science of life. It promotes *hita ayu* and *sukha ayu* through *trisuutra*; *hetu* (cause), *Linga*(Features), *aushadha* (drugs). This utmost

principle of Ayurveda can be applied even in sports medicine on a logical basis as well. Apart from the management procedures, the herbal drugs used in Ayurveda are being researched over the various requirements of athletes. Among them, *Terminalia arjuna* has received a high concern from sports professionals due to its' cardio-protective action. This study has been designed to analyze its utility in sports medicine.

*Terminalia arjuna* (Roxb.) W. & A. (*Combretaceae* family) is a therapeutically important plant since *vedic* period. It is commonly known as 'Arjun tree' in both English and Hindi languages. Due to the Whitish appearance of the bark it is called 'Arjuna'. Over 6000 years of documented history of Indian scriptures have evidenced the utility of this plant. *Rig veda*, *Atharva veda*, *aranyaka grantha*, *brahmana grantha* and even the sacred text *Ramayana* mentioned about Arjuna tree. *Rig veda* described *Arjuna* as *ayushya*(beneficial for life), *shosha nashaka* (alleviate emaciation), and *rakshogna*

*dravya* (anti-microbial property).<sup>[1]</sup> However, extensive uses of *T.arjuna* can be found in the *samhita* period.

**Latin name – Terminalia arjuna** (Roxb.) W. & A.

**Family** – Combretaceae family.

**Classical name** – *Arjuna*.

**Sanskrit synonyms** – *Indradru, Dhawala, Dhawalavruksha, Nadisarja, Kukubha, Dewasala, Madhuragandhi prasunaka, Veeravriksha, Shwasaneshwara, Shwetavaha, Sarpana, Hridrogavairi.*

**Habit** -A large evergreen tree of 60-70 m in height.

**Habitat** – Commonly found along rivers, streams, and dry water bodies. Though it grows all types of soils, it prefers humid, fertile and red lateritic soil.

**Parts used in medicinal purposes** – Mainly bark

The botanical source of *Arjuna* is *Terminalia arjuna* (Roxb.) W. & A. Though, another two botanical species namely; *Terminalia tomentosa* and *Sterculia urens* also considered as *Arjuna* in different parts of India.

*Terminalia arjuna* and *Terminalia tomentosa* belong to the Combretaceae family, while *Sterculia urens* belongs to the Sterculiaceae family. The three species are large trees and have striated, fissured or flaky appearance on the bark. The inner bark is soft and red in colour. This characteristic bark of *Arjuna* tree had been used for heart diseases by ancient Ayurveda texts as it has a special potency on the heart. Scientific evidence also supports its' tremendous action on heart muscle especially over ischemic heart diseases.

34% of Calcium carbonate were found among the ashes of bark. It has rich content of tannins, flavonoids, glycosides and phytosterols. It possesses Arjunic acid and Arjungenin as the main triterpenoids. There also present a considerable amount of two Arjunoglycosides. Arjunolon, Flavones, Quercetin, Kaempferol and Pelargonidin are the flavonoids presented in the Arjuna bark. Due to this vast chemical constitution, Arjun bark holds multi therapeutic access.<sup>[2]</sup>

Table -1 Shows different drug groups in which *Arjuna* is classified by ancient Ayurveda *acharyas* considering the therapeutic range.

**Table 1: Ayurveda classification of Arjuna.**

	<i>Caraka samhita</i>	<i>Sushruta samhita</i>	<i>Ashtanga hrida samhita</i>
<b>Drug groups</b>	<ul style="list-style-type: none"> <li>• <i>Udarda prashamaniya</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Salasaradi</i></li> <li>• <i>Nyogrodhadi</i></li> <li>• <i>Veerataradi</i></li> <li>• <i>Vatashamaneeya gana</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Nyogrodadhi</i></li> <li>• <i>Asanadi</i></li> </ul>

Performances of athletes are depending on strength, speed, endurance, and recovery apart from his born skills. However, only training schedules do not work without a proper nutrition. Nutrition is the backbone of athletes. It helps athletes to sustain themselves throughout the competition. Athletes use high nutrition formulas to reduce fatigue, release their energy, and protect their cardio-pulmonary circulation in extreme conditions. Fatigue depends upon the utilization of oxygen. Two phases can be identified in athletes' workouts; the aerobic exercise phase and the anaerobic exercise phase. Both of the phases can be enhanced in trained athletes in order to reach maximum energy with proper cardio-pulmonary nutrition.<sup>[3]</sup>

*Arjun* bark has been validated scientifically for cardio protective and cardio-tonic actions. Hence, this study has focused to find the scope where *Arjuna* can apply in order to enhance the cardio-pulmonary endurance of athletes.

#### AIMS AND OBJECTIVES

1. To compile the scientific data and Ayurveda properties of *Arjuna* interrelated to sports medicine.
2. To analyze the evidence to find the capabilities of using *Arjuna* for enhancing performances of athletes.

#### METHODOLOGY

Scientific data was collected via Mendeley library. The keywords used for browsing were '*Terminalia arjuna*', '*Arjuna*', 'cardio-pulmonary endurance, and 'endurance'. All the review articles, *in-vivo*, *in-vitro* and randomized clinical trials were studied. In addition, some review articles were searched directly through online databases using the same keywords. Relevant articles to the topic were extracted after careful review. Conceptual references of Ayurveda were collected from the Ayurveda authentic texts. Extracted data were analyzed to find the applicability of *Arjuna* as a cardiac protective ergogenic aid in sports medicine.

#### RESULTS AND ANALYSIS

'Ergogenic aid' defines as a mechanical, nutritional, pharmacological, physiological or psychological tool used to provide support for enhancing performances and recovery of athletes.<sup>[4]</sup> When the provision is intended to be used in cardiopulmonary endurance; it is called cardioprotective ergogenic aid.<sup>[5]</sup>

Performances in endurance sports may decline due to poor cardiac output. It is a resultant of altered intra-thoracic pressure followed by strenuous workouts (Amann, 2012).<sup>[6]</sup> Hence, it is essential to keep the cardio-pulmonary system in good condition to achieve the best in tournaments. Proper maintenance of cardio-

pulmonary circulation throughout the competition without being deterioration is explained as 'cardio-pulmonary endurance' in sports science. Many herbs are being studied to abstract cardiac endurance endurance in sports science. Few pieces of researches among these studies have proved cardio-pulmonary endurance of *Terminalia arjuna*.<sup>[7]</sup> This study focused to find the impact of *Terminalia arjuna* over the different aspects of sports medicine with a deep insight into Ayurveda concepts.

**Inotropic effect and hypotensive effect** - Inotropes are the agents that have ability to modify the energy level of muscular contractions.<sup>[8]</sup> There are two types of inotropes namely positive and negative. Positive inotropes increase the contractile strength of the muscle. When there is a high contractile power in the heart muscle it can increase the cardiac output. Cardiac output directly enhances the tissue perfusion. It helps an athlete to work out without being fatigued.<sup>[6]</sup> Water extracts of *T.arjuna* bark show a positive inotropic action on rat atria.<sup>[9]</sup> Further, water extract of *Arjuna* bark increased the force of contraction of cardiac muscle in frog's heart *in situ*, hypo dynamic heart *in situ*, and isolated perfused rabbit's heart.<sup>[10]</sup> It also proved that the inotropic property of *Arjuna* bark is caused by its high concentration of  $Ca^{++}$ .<sup>[11]</sup>

**Brady-cardiac effect** - 'Athlete's heart' is a state defined as a non-pathological condition that develops in athletes who are doing aerobic exercises more than 5 hours per week.<sup>[12]</sup> It is mainly due to physiological remodeling due to repetitive cardiac loading and it is very common in endurance athletes. It results in a low resting heart rate in athletes. However, their heart rate may increase up to 200 bpm during exercises. Aqueous bark extracts of 70% alcohol can produce dose dependent brady- cardiac effect in dogs.<sup>[13]</sup> It was capable to increase coronary blood flow as well.<sup>[14]</sup> Brady cardiac effect allows longer diastolic period and high perfusion of myocardium during the elevated workload.<sup>[15]</sup> Hence, it prevents the heart from ischemia and palpitation.

**Cardio – protective effect** - Decline of cardiac contractibility index, cardiac output, and high end diastolic pressure are alarming features of heart failure. Hearts of the pre-treated rats from dried pulverized bark of *T.arjuna* (500/kg in 2% carboxyl methyl cellulose - 6 days per week for 12 weeks) have been tested against oxidative stress associated with ischemic-reperfusion injury. This *in-vitro* study proved a significant protection capacity of *T.arjuna* bark against oxidative stress.<sup>[16]</sup> Administration of 6.75/kg alcohol extract of *T.arjuna* also augments endogenous antioxidant compounds of the rat heart.<sup>[17]</sup>

**Hypotensive effect** - Hypotensive effect is a normal condition found in athletes apart from the pathological reasons of hypotension. This situation is present in healthy and regular strenuous exercising athletes at rest

time. It indicates a strong heart with a well-developed circulatory system. Studies showed dose dependent The hypotensive effect after giving *Arjuna* bark aqueous and alcohol extracts.<sup>[18]</sup> 70% alcoholic extract of *T.arjuna* produced hypotension of peripheral origin. Further, the study observed a direct action of *Arjuna* plant extract on the heart muscle.<sup>[19]</sup> Hypotensive effect lowers the risk of heart diseases and strokes. It may also contribute to the cardiac protective property.

**Anti-hypertrophic effect** - TA bark extract has ability to restore the marker mRNAa, signaling kinases, transcription factors and total protein in hypertrophied rat heart. It restores cardiac function partially or completely. This significant reveal describes the prevention capacity of cardiac hypotrophy.<sup>[20]</sup> Physiological cardiac hypotrophy specifically left ventricular hypotrophy is a common condition (athletes' heart) in athletes. Meanwhile pathological cardiac hypertrophied myopathy is the commonest cause for non-traumatic exercise related sudden cardiac death in young athletes.<sup>[21]</sup> In these both conditions TA barks extract can play a significant role in the prevention of hazardous effects of hypertension.

**Prevention of oxidative stress** - Strenuous exercise may increase free radicals and Reactive Oxygen species (ROS). These reactions cause oxidative stress and tissue damages. Yet, it differs according to the nature of the sport.<sup>[22]</sup> Antioxidants play an important role in prevention of oxidative stress reaction in the tissues. The active components of *Arjuna* bark; Arjunic acid and its' bark extract can exhibit antioxidant property, anti-apoptotic defense against  $CoCl_2$ - induced hypoxic injury.<sup>[23]</sup> Another *In-vitro* study has revealed a protective effect from oxidative stress when subjected to ischemic-reperfusion injury. Further, it revealed that *T.arjuna* can augment augments endogenous antioxidant compounds of the heart followed by superseding the oxidative stress.<sup>[16]</sup> This remarkable benefit of *Arjuna* helps to prevent injuries especially in the cardio-pulmonary circulation.

**Cardio – conditioning effect** -Overall positive cardiac health is the key point in success of athletes. Cardiac health can be determined by the Left Ventricular Ejection Fraction and Right Ventricular Myocardial Performance Index. The findings regarding TA extract over these aspects were proved by Girandola *et.al* in 2017 and established cardiac conditioning effect TA extract.<sup>[5]</sup> It also evidenced the cardiovascular efficiency and a greater decrease in fatigue level.

#### Analysis through Ayurveda aspect

*Acarya Charaka*, has mentioned that the therapeutic actions of certain drugs can be manifested by virtue of its' *rasa (taste)*, some drugs by virtue of their *virya(potency)* or by *guna (qualities)*, some drugs by *vipaka(after digestive effect)* and others due to its *prabhava (special action)*.<sup>[24]</sup> Thus, the action of a drug

is based on the *rasa panchaka* (pharmacodynamics properties of Ayurveda; *rasa, guna, veerya, vipaka, prabhava*) of the drug. *Rasa panchaka* of a drug is a resultant of the specific permutation of *panca mahabhuta* (five basic elements).

The table - 2 is given Ayurveda pharmacodynamics properties of *Arjuna* bark.

**Table 2: Ayurveda properties of *T. arjuna* bark.**

<b>Rasa (taste)</b>	<b>Guna (properties)</b>	<b>Veerya (potency)</b>	<b>Vipaka (after digestive effect)</b>	<b>Prabhava (special potency)</b>	<b>Dosha karma(actions on three biogenic humours of the body)</b>
<i>Kashaya</i> (Astringent)	<i>Laghu</i> (Light) <i>ruksha</i> (rough)	<i>Sheeta</i> (cold)	<i>Katu</i> (Pungent)	<i>Hridya</i> (beneficial for the heart) <sup>[25]</sup> <i>Vishagna</i> (Anti poisonous) <sup>[26]</sup>	<i>Kapha pitta shamaka</i> (pacify <i>kapha, pitta</i> )

*Arjuna* bark possesses *kashaya rasa, laghu guna, sheeta veerya* and *katu vipaka*. According to the basic principles of Ayurveda the predominance permutation of *panca mahabhutas* can be identified as *vayu maha bhuta* (basic element- air), *priti maha bhuta* (basic element- earth) and *agni maha bhuta* (basic element – fire) accordingly

(table -30). This predominance *panca bhautika* composition with other basic elements gives pharmacodynamics qualities to *Arjuna* as mentioned in table 2. While table 3 elaborates the qualities receive from the *vayu, priti* and *agni* elements.

**Table 3: Qualities of *Arjuna* bark receive from *panca bhautika* (basic elements) composition.<sup>[27]</sup>**

<b>Basic element</b>	<b>Qualities</b>	<b>Functions</b>
<i>Pritvi</i> (earth)	<i>guru</i> (heaviness), <i>kathina</i> (hard), <i>vishada</i> (clear). <i>Manda</i> (slow), <i>Sandra</i> (dense), <i>sthula</i> (fat/stout/thick), <i>sthira</i> (stable), <i>gandha guna bahula</i> ( predominance of smell sensation)	<i>upacaya</i> (nourishment of tissues), <i>gaurava</i> (provides heaviness), <i>sanghata</i> (provides hardness and compactness), <i>sthairya</i> (provides stability)
<i>Vayu</i> (air)	<i>Ruksha</i> (dry), <i>sukshma</i> (minute/deep penetrating), <i>laghu</i> (light), <i>vishada</i> (clear), <i>vikasi</i> (quick spreading), <i>sheeta</i> (cold), <i>sparsha gun abhula</i> ( predominance of touch sensation)	<i>Rookshata</i> (provides hardness), <i>laghuta</i> (lightness), <i>vishadata</i> ( provides clarity), <i>glani</i> (tiredness), <i>vichara</i> (promotes and monitors different activities)
<i>Agni</i> (Fire)	<i>Teekshna</i> (intense), <i>ushna</i> (hot), <i>ruksha</i> (rough), <i>sukshma</i> (minute), <i>laghu</i> (light), <i>vishada</i> (clear), <i>Rupa guna bahula</i> (predominance of sight sensation)	<i>Daha</i> (burning sensation), <i>Paka</i> (suppuration), <i>prakasha</i> (provides glow and glitter), <i>prabhava</i> (provides complexion), <i>varnya</i> (provides good colour)

The term '*hridaya*' refers to both anatomical heart and brain. '*Hridya*' property defines as wholesomeness towards the heart or maybe towards the brain.. It is considered as *moola* (*origin*) of the *rasavaha srotus* (channel of transporting *rasa dhatu*/ essence of food after digestion) and *pranavha strortus* (can be correlated with the path of external air inside the body or respiratory system)<sup>[28]</sup> Hence, *hridaya* is one of the main three vital points (*marma*) of the body.

*Prana* is the element that keeps the body alive, while *rasa dhatu* provides nourishment to the body. *Prana vayu* circulates all over the body along with *rasa* and *rakta dhatu* (Blood) within their channels. While, the main force of the circulation, ejection capacity and the governing process of cardiac output depend upon the *vyana vayu* (a type of *vata dosha*; one of the biogenic humours of the body). Further the *avalambaka kapha* (a type of *kapha dosha*) seated in the heart helps to maintain the proper function of the heart. The third basic component of the heart is '*sadhaka pitta*' (a type of *pitta dosha*). *Sadhaka pitta* is *agneya* in nature. It is contrary to the qualities of *avalambhaka kapha*. Hence, it can

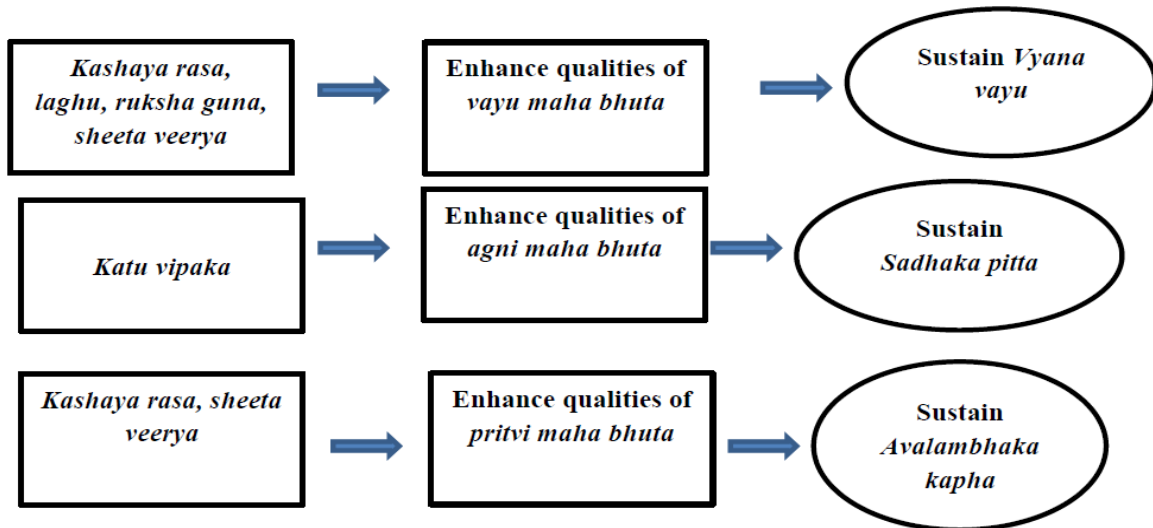
create the balance of *avalambaka kapha*. Increased *kapha dosha* of the heart causes *tamo guna* (it is the quality of inactivity/lethargy/ dullness).<sup>[29]</sup> While having the *agneya* property of *katu vipaka*, *Arjuna* bark drives the proper function of *sadhaka pitta* thereby the functional equilibrium of the heart. These three aspects are necessary to sustain the vitality of *hridaya*, and body.

The physiology of the *hridaya* can be summarized as follows,

- *Vyana vayu* facilitates circulatory compartment
- *Avalambaka kapha* facilitates in situ function of the organ
- *Sadhaka pitta* stimulates and regulates the balance of functional components

## DISCUSSION

Correlation between Ayurveda physiology and Ayurveda pharmacology related to *Arjuna* bark can be demonstrated as follows.



**Figure 1: Schematic relationship between the functional components of heart with Ayurveda pharmacological properties of Arjuna bark.**

When functional components (*prana vayu*, *avalambaka kapha* and *sadhaka pitta*) get vitiated interconnected structural components; *rasa* and *rakta dhatus* also get vitiated. Hence, *rasa dhatu kshaya* (depletion of *rasa*

*dhatu*) gives *hrit peeda*, (pain in the heart), *hrda ghattana* (pain in the heart with a feeling of someone holding) and *hrid kampa* etc. as mentioned in table 4.

**Table 4: Heart related symptoms of *rasa dhatu kshaya* mentioned by *brihatrayii*.**

<i>Caraka samhita</i> <sup>[30]</sup>	<i>Sushruta samhita</i> <sup>[31]</sup>	<i>Ashtangahrda samhita</i> <sup>[32]</sup>
<i>Hrida ghattana</i> (pain in the heart with a feeling of someone holding and shaking)	<i>Hrit peeda</i> (pain in the heart)	<i>Shrama</i> (tiredness)
<i>Hrid drava</i> (palpitation)	<i>Hrut kampa</i> (tachycardia)	<i>Glani</i> (feable)
<i>Hrid shula</i> (cardiac pain)		
<i>Shrama</i> (Tiredness)		
<i>Klama</i> (tiredness even after small exercise)		
<i>Alpa cheshta</i> (inability to perform act)		

*Rasa kshaya* follows the vitiation of *vata dosha*. It influences the cardiac output and the whole blood circulation as it governs by a *vayu* component; *vyana vayu*. Depletion of *kapha dosha* also befalls due to its' interrelation with *rasa dhatu*.<sup>[33]</sup> Hence, *Avalambhaka kapha* seated in the heart is also affected and the heart starts to function improperly. While describing the aetiopatholgy of heart diseases *acarya Charaka* had elaborated *ati vyayama* (Excessive excercises), *ati cinta* (mental stress) and *abhighata* (injuries) under causative factors as these factors cause *vata* vitiation.<sup>[34]</sup> These stages can be overcome by the judicial use of *Arjuna*. It is well evidenced by the drug classification of *acarya Sushruta* by categorizing *Arjuna* under *vata samshamaniya gana* (the drug group which pacifies *vata dosha*. (table 1)

*Arjuna* bark act on *kapha dosha* (Due to *kasahya rasa*, *laghu guna*, *ruksha guna*, *katu vipaka*) and may be directly towards the *rasa dhatu* as well. Hence, *acarya Charaka*<sup>[35]</sup> and *acarya Vagbhata*<sup>[36]</sup> prescribed *Arjuna* under the treatment of *kaphaja Hrida roga*. Later texts like *Chakradatta*<sup>[37]</sup> and *Bhaisajya ratanvali*<sup>[38]</sup> prescribed *Arjuna* decoction with milk as an adjuvant (as *Arjuna ksheera kashaya*). Thereby it receives the capability of pacifying *tridosha* (the ability to pacify all the *doshas*) - *vata*, *pitta* and *kapha*. The most important quality of TA is *hridya*. It is well established by the recent scientific evidence by claiming its' direct action on the heart muscle.

**Table 5: Correlation between Modern Pharmacotherapeutics and Ayurveda pharmacodynamics.**

<b>Inotropic action</b>	Through <i>agneya</i> property ( <i>laghu</i> , <i>teekshna</i> , <i>vishada</i> )
<b>Anti- hypertension effect</b>	Through the characters of <i>pritvi</i> ( <i>manda</i> , <i>sthira</i> , <i>sheeta</i> )
<b>Cardio-protective effect</b>	Through the characters of <i>pritvi</i> ( <i>sthira</i> , <i>vishada</i> , <i>sheeta</i> )
<b>Brady-cardiac effect</b>	Through the characters of <i>pritvi</i> ( <i>manda</i> , <i>Sandra</i> , <i>sthira</i> , <i>sheeta</i> )
<b>Prevent oxidative stress</b>	Through the characters of <i>vayu</i> ( <i>sukshma</i> . <i>Laghu</i> , <i>teekshna</i> , <i>vikasi</i> , <i>vyavayi</i> )

**CONCLUSION**

*Terminalia arjuna* is a time tested medicinal plant with a great significance of heart protective action. It is been used in many diseases including *visha* (toxicity), *udarda* (urticaria), *Pradara* (menorrhagia), *prameha* (diabetes mellitus), and *hrid roga* (heart diseases). *Arjuna* had been targeted by many researchers due to its special potency towards the heart.

Heart and its circulatory system is the determinant of cardiac pulmonary endurance of athletes. Ayurveda has given an immense significance for the heart anatomically as well as physiologically. Many studies that have been conducted to evidence the different effects of *Terminalia arjuna* over cardio-pulmonary system. These aspects of this valuable herb can be applied to improve the cardiac endurance of athletes. The present study was focused to demonstrate the evidence-based effect of *Arjuna* through the validated scientific confirmations in order to exhibit the capabilities to act as a cardioprotective ergogenic aid.

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