# Analyze The Effect Of Selected Ayurvedic-Herbal Medicines On Cardio-Respiratory Endurance Performance Of Athletes Using Biochemical Variables

**Toijam Brojendro Meitei[1], Salam Joymala Devi[2]**

[1*]Head Coach, Lamphel (IDTA), email: brojenlawntennis.sai@gmail.com
[2]Lecturer, Phy Edn Deptt. BMC

[*]**Corresponding Author:** Toijam Brojendro Meitei
[*]Head Coach, Lamphel (IDTA), email: brojenlawntennis.sai@gmail.com

**ABSTRACT**

**Aims and Objectives:** To analyze the effect of selected Ayurvedic-Herbal medicines on Cardio- respiratory Endurance performance of athletes using biochemical variables

**Material and Methods:** The data from all three groups was statistically assessed to see if there were any significant differences using the analysis of co-variance. After pre-test means were eliminated, the adjusted post-test means of the three groups were checked for significance, and if there was a significant difference, the Scheffe's Post-hoc test was used to determine the significant difference between paired means.

**Results:** The result on Cardio-Respiratory Endurance do indicates that, no significant differences existed among three groups. It means that Lassifer Lacca and Mymosa Pudicca may not have any influence on the Cardio Respiratory-Endurance of the subjects thereby accepting the hypothesis thus formulated.

**Conclusion:** In Ayurveda, athletic performance is coming under *Balya* or *Bala* which means *Vyayam Sakthi*. The selected medicine *Lakshadi Choornam* with ingredients Lassifer Lacca and Mymosa Pudicca is a type of medicine which can be given to increase the *Vyayam Shakthi* or athletic performance. Even though the biochemical variables chosen, such as haemoglobin, total cholesterol, and blood glucose, have a direct association with endurance performance, supplementation had no effect on them.

**Keywords:** Ayurvedic-Herbal medicines, biochemical variables, haemoglobin, total cholesterol, and blood glucose,

## INTRODUCTION

Health comprises a person's physical, mental, social, and emotional well-being and is an important part of enjoying a successful life, or, to put it another way, living a happy life. One of them is physical health, which is based on the efficient functioning of numerous systems in the human body. Athletes' genetic endowment with physical, psychological, physiological, and metabolic abilities related to performance attributes required in their sport is critical to their sporting success. To develop physical strength, mental toughness, and mechanical edge, such genetically gifted athletes require specialised training. The purpose of human competition, whether in conflict or athletics, is to obtain an edge over the other person. They frequently use drugs and other performance-enhancing medications to gain the upper hand. Athletes, on the other hand, frequently try to supplement their training with substances and procedures. Many systems are linked to the food that is consumed, and numerous systems of medicine are used to protect one's health from various ailments and to enhance or promote good health, with the Ayurvedic system of medicine being the most widely used in India. Ayurveda, as well as the ancient Egyptians, Romans, and Chinese, recognised many herbal remedies as advantageous to physical performance. Herbal plants and spices are used heavily in Ayurvedic remedies, as they have magical properties that not only cure diseases but also promote excellent health and physical fitness. Ayurvedic-herbal medicines Mimosa Pudicca and Laccifer Lacca are important for maintaining good health. Since ancient times, the aforementioned remedies have been utilised in various ways for curing diseases as well as boosting strength and endurance.

The goal of this study was to see how the use of "Lakshadi Choornam" (powder) containing the components Lassifer Lacca and Mimosa Pudicca affected the patients' cardio-respiratory endurance. In order to achieve the study's purpose, the research scientist chose 45 college male students who were enrolled in a professional course in Physical Education as subjects. They were separated into three equal groups after being picked at random. The experimental group was split into three sections: the control group, the placebo group, and the experimental group. The control group received no treatment, while the placebo group received only regular wheat powder. The experimental group was given one gramme of the prepared herbal medicines three times a day, after breakfast, lunch, and supper, for forty-five days. There were no changes in the subjects' regular routines during the experimentation period in any of the three groups. Pre-tests were conducted 24 hours before the commencement of the experiment, and post-tests were conducted 24 hours after the trial was completed for all three groups. Aside from cardio-vascular endurance, biochemical markers like haemoglobin, total cholesterol, and blood sugar were examined.

Using the analysis of co-variance, the data from all three groups was analysed to see if there were any significant differences. The adjusted post-test means of the three groups were tested for significance after the pre-test means were deleted, and if there was a significant difference, the Scheffe's Post-hoc test was employed to determine the significant difference between paired means.

## REVIEW OF LITERATURE

Kochhar and Nagi (2005) investigated the effect of traditional medicinal plant supplements on blood glucose in non-insulin-dependent diabetics. The effect of supplementing with a powdered mixture of three traditional medicinal plants—bittergourd, jamun seeds, and fenugreek seed (raw and cooked form)—on blood glucose was studied in 60 non-insulin-dependent male diabetics. The patients were divided into two 30-person groups, with group I receiving the raw powdered combination in capsule form and group II receiving the raw powdered mixture in salty biscuit form. After taking 1 g of this supercharged mixture daily for 1.5 months and then increasing to 2 g for another 1.5 months, the diabetic patients' fasting and postprandial glucose levels were dramatically reduced. There was a significant decrease in oral hypoglycemic medicine use and a drop in the percentage of participants who were on hypoglycemic drugs after the 3-month feeding study. In diabetics, 2 g of a powdered blend of traditional medicinal plants, either raw or cooked, was proven to effectively lower blood glucose levels.

Liang et al. (2005) studied the effects of supplementing with Panax ginseng extract (6g/day) over an eight-week period on treadmill running time, based on blood levels of antioxidant enzymes, and concluded that it reduced oxidative stress. However, there was no placebo in this one-group trial, which included a control pre-test followed by a post-test following the eight-week supplementation period.

A study on the effects of Tribulus terrestris on athletes was undertaken by Neychev and Mitev (2005). Serum testosterone and androstenedione levels were shown to be unaffected by a daily dose of 20 mg/kg body weight for four weeks. Tribulus terrestris supplementation had no effect on body weight, body composition, maximal strength, or muscular endurance in resistance-trained males during training in a double-blind, placebo-controlled research.

Kuriyan and Rajendran (2005) investigated the effects of Coccinia Cordifolia extract supplementation on newly diagnosed diabetes patients. The herb Coccinia indica (synonym Coccinia cordifolia), which grows abundantly in India, has long been used in the treatment of diabetes. However, there aren't any well-controlled trials on its effectiveness.

On a cycle ergometer, Bock et al. (2004) discovered that an acute dose of Rhodiola rosea (200 milligrammes) reduced time to fatigue by 3%. On the other hand, no discernible effect was observed after four weeks of therapy with 200 mg daily. There was no change in maximal strength, response time, or movement time other from that. Furthermore, it has been proven that mixing these herbals has no ergogenic effect.

According to Herbold et al. (2004), 17% of female collegiate athletes utilise herbal/botanical supplements. Physically active people use herbal dietary supplements for a variety of reasons, including enhanced energy, weight loss, muscular growth, and other physiological or metabolic reactions that may help them perform better during exercise. Some sports drinks and sports bars contain herbals as well. Research supports the medicinal effects of numerous plants for certain health concerns, as documented in Herbal Medicine: Expanded Commission E Monographs (Blumenthal et al. (2000) and WHO Monographs on selected Therapeutic Plants (WHO 1999). With a few exceptions, research on the ergogenic effects of herbal supplements is limited.

Pittler and Ernst (2004) evaluated the studies on a variety of dietary supplements advertised for weight loss, including several herbals, and concluded that none of them (with the probable exception of ephedra) have provided proof beyond a reasonable doubt that they are helpful for weight loss.

Willoughby (2004) found that supplementing with 1200 mg/d of Cystoseira canariensis for 12 weeks while doing resistance exercise had no effect on serum myostatin levels, muscle mass, muscle strength, or body fat.

Curtis Prior (1999) did research on the Ginkgo biloba leaf extract from the Chinese Ginkgo tree, the world's most ancient extract, which dates back two hundred million years. Ginkgo biloba's mode of action is thought to be when its active constituents, flavonoids and terpenoids, work together. The stimulation of endothelium-derived relaxing factor, which may improve muscle tissue blood flow through better microcirculation, is one of the tissue-level effects.

## METHODOLOGY

### Selection of Subjects

The study included 45 athletes from the University of Calicut who were engaged in a professional programme in Physical Education. Only students who agreed to participate in the study were chosen, and the participants' ages ranged from 18 to 25. The subjects were informed about the study's purpose before being enrolled as participants, and their written agreement was acquired. The patients were then randomly assigned to one of three groups: supplements, placebo, or control, under double blind conditions.

All of the subjects were living in the university hostel, leading normal lives and engaging in the same type of physical activity five days a week. Table 1 shows their average physical attributes.

**Table 1: The anthropometric data of the subjects selected for the study**

| Parameters | Total (N=45) (Mean) | Supplementation Group (Mean) N=15 | Placebo Group (Mean) N=15 | Control Group (Mean) N=15 |
|---|---|---|---|---|
| Age (years) | 22.25 | 22.48 | 22.83 | 22.42 |
| Weight (Kg) | 62.42 | 63.41 | 62.20 | 61.49 |
| Height (Cm) | 172.0 | 171.27 | 170.21 | 172.45 |
| BMI ($Kg/m^2$) | 18.62 | 17.23 | 17.69 | 17.84 |

The investigation was carried out after the head of the University of Calicut's Department of Physical Education gave his assent. Subjects were also told that if they felt uncomfortable during the study, they could withdraw their consent at any point.

**Selection of Variables**

The researcher did a thorough analysis of the relevant literature and met with a number of Ayurvedic experts before deciding on this problem. The viability of the problem was thoroughly reviewed before it was finalised, including the availability of treatments, processes, and probable outcomes. After analysing the multiple components connected with the problem, the following variables were chosen for this study.

| | |
|---|---|
| **Physical Fitness** | Cardio-respiratory Endurance |
| **Biochemical** | Hemoglobin |
| | Blood Sugar |
| | Total Cholesterol |

Hemoglobin, Blood Sugar, and Blood Cholesterol are significant biochemical variables that are not only intimately related to human health and physical performance, but also heavily influenced by food consumption.

**Selection of the Tests**

The numerous factors in this investigation were measured using standard tests. Table 2 lists the variables that were chosen, as well as the tests and instruments that were employed.

**Table 2: The list of selected variables and their respectiveTest and instrument used**

| Sl. No. | Variable | Test and Instrument used |
|---|---|---|
| **Physical Fitness Variable** | | |
| 1 | Cardio- RespiratoryEndurance | 12 minute Run /walk test (Cooper Test) |
| **Bio chemical Variable** | | |
| 2 | Hemoglobin | Tested at a standard Medical Lab |
| 3 | Blood Sugar | Tested at a standard Medical Lab |
| 4 | Total Cholesterol | Tested at a standard Medical Lab |

**Statistical Techniques**

The data collected from the three groups before and after therapy were statistically analysed for significant differences in means using analysis of covariance (ANCOVA). The Scheffe's post-hoc test was then performed to examine if there were any meaningful differences between the adjusted post-hoc means if the F- ratio was significant. The 0.05 significance level was chosen. The data was examined using SPSS statistical software for social sciences, with the level of significance set at 0.05.

**RESULTS**

**Analysis of the Data**

This study presents the results of the data analysis for the study. The goal of the study was to see how the Ayurvedic-Herbal Medicine "Lakshadi Choornam" (powder) with the components "Lassifer lacca" and "Mymosapudica" affected cardio-respiratory endurance. Hemoglobin, blood sugar, total cholesterol, and cardio-respiratory endurance were among the biochemical variables studied statistically.

Analysis of covariance was used to assess the mean differences between the three groups. The Scheffe's post-hoc test was then performed to examine if there were any meaningful differences between the adjusted post-hoc means if the F-ratio was significant. The 0.05 significance level was chosen.

**Findings**

**Table 3: Analysis of Co-variance done among the different groups on Hemoglobin**

| | **Control** | **Placebo** | **Exp- erimental** | ***Source of Variance*** | ***Sum ofSquares*** | ***df*** | ***Mean Squares*** | **'F' Ratio** |
|---|---|---|---|---|---|---|---|---|
| **Pre-test Mean** | 14.2667 | 14.2200 | 14.2467 | Between | 0.0164 | 2 | 0.0082 | 0.008 |
| **SD** | 0.72572 | 1.29240 | 0.90069 | Within | 42.115 | 42 | 1.003 | |
| **Post-test Mean** | 14.1333 | 14.7467 | 14.9600 | Between | 1.125 | 2 | 0.563 | 2.424 |
| **SD** | 0.89655 | 0.91952 | 1.33031 | Within | 47.867 | 42 | 1.140 | |
| **Adjusted Post-test Mean** | 14.125 | 14.756 | 14.959 | Between | 1.024 | 2 | 0.512 | 2.783 |
| | | | | Within | 41.810 | 41 | 1.020 | |

The table 3 value required for significance at 0.05 level of confidence with df $_{(2,41)}$ is 3.230 and df $_{(2,42)}$ is 3.220. The F-ratis in the pre-test were 0.08 and in the post-test were 2.424, which were significantly smaller than the tabulated F(2, 42) of 3.220, according to the above table about the analysis of co-variance done among the different groups on haemoglobin. The adjusted F-ratio found in the post-test was only 2.783, which was significantly lower than the tabulated F (2, 41) of 3.230. The post-hoc test was not performed since the F- ratio for the modified post-test was judged to be negligible.

**Table 4: Analysis of Co-variance done among the different groups on Blood Sugar**

| | **Control** | **Placebo** | **Exp- erimental** | ***Source of Variance*** | ***Sum of Squares*** | ***df*** | ***Mean Squar es*** | **'F' Ratio** |
|---|---|---|---|---|---|---|---|---|
| **Pretest Mean** | 73.07 | 74.33 | 74.13 | Between | 13.911 | 2 | 6.956 | 0.070 |
| **SD** | 11.24 | 8.9176 | 9.613 | Within | 4176.00 | 42 | 99.429 | |
| **Posttest Mean** | 71.67 | 74.73 | 73.67 | Between | 72.711 | 2 | 36.356 | 0.493 |
| **SD** | 7.79 | 10.19 | 7.508 | Within | 3095.60 | 42 | 73.705 | |
| **Adjusted Posttest Mean** | 71.67 | 74.73 | 73.665 | Between | 72.04 | 2 | 36.022 | 0.477 |
| | | | | Within | 3095.39 | 41 | 75.497 | |

The table 4 value required for significance at 0.05 level of confidence with df $_{(2,41)}$ is 3.230 and df $_{(2,42)}$ is 3.220. The F-ratio in the pre-test was 0.070 and in the post-test was 0.493, which were significantly less than the tabulated F(2, 42) of 3.220, as shown in the above table connected to the analysis of co-variance done among the different groups on Blood Sugar. While it was only 0.477 in the modified post-test, it was still much less than the calculated F(2,41) of 3.230. The post-hoc test was not performed since the F-ratio for the adjusted post-test was judged to be negligible.

**Table 5: Analysis of Co-variance done among the different groups on Total Cholesterol**

| | **Control** | **Placebo** | **Exp- erimental** | ***Source of Variance*** | ***Sum of Squares*** | ***df*** | ***Mean Squares*** | **'F' Ratio** |
|---|---|---|---|---|---|---|---|---|
| **Pretest Mean** | 214.26 | 184.53 | 220.5333 | Between | 11096.71 | 2 | 5548.3 | 4.095 * |
| **SD** | 31.653 | 24.115 | 49.8166 | Within | 56912.400 | 42 | 1355.0 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Posttest Mean** | 169.40 | 162.00 | 166.6667 | Between | 420.044 | 2 | 210.02 | 0.297 |
| **SD** | 30.965 | 23.862 | 24.2919 | Within | 29656.933 | 42 | 706.11 | |
| **Adjusted Posttest Mean** | 165.51 | 172.88 | 159.668 | Between | 1119.306 | 2 | 559.65 | 1.470 |
| | | | | Within | 15611.377 | 41 | 380.76 | |

* Significant at 0.05 level.

The table 5 value required for significance at 0.05 level of confidence with df $_{(2,41)}$ is 3.230 and df $_{(2,42)}$ is 3.220. The F-ratio in the pre-test was 4.095 and in the post-test was 0.297, according to the following table about the analysis of co-variance done among the different groups on Total Cholesterol. The F-ratio in the pre-test mean is significant, however the F-ratio in the post-test mean is substantially lower than the tabulated F(2, 42) of 3.220. And it was only 1.470 for the adjusted post-test, which was substantially lower than the calculated F (2, 41) of 3.230. The post hoc test was not performed since the F- ratio for the modified post- test was judged to be negligible.

**Table 6: Scheffe's Post-hoc Test done on the three groups for differences between adjusted Post-test paired means on Respiratory Rate**

| **Adjusted Post -test Mean** | | | **Mean Differences** | **Critical Difference** |
|---|---|---|---|---|
| **ControlGroup** | **PlaceboGroup** | **Supplementation Group** | | |
| 17.327 | | 16.144 | 1.183* | 1.167 |
| 17.327 | 16.595 | | 0.732 | 1.167 |
| | 16.595 | 16.144 | 0.451 | 1.167 |

*Significant at .05 level.

The mean difference of 1.183 was substantially greater than the critical difference of 1.167, indicating that there is a significant mean difference between the supplementation and control groups. However, no significant mean differences were discovered between the placebo and supplementation groups, or between the control and placebo groups, because the mean differences were only 0.451 and 0.732, respectively, far less than the critical difference of 1.167.

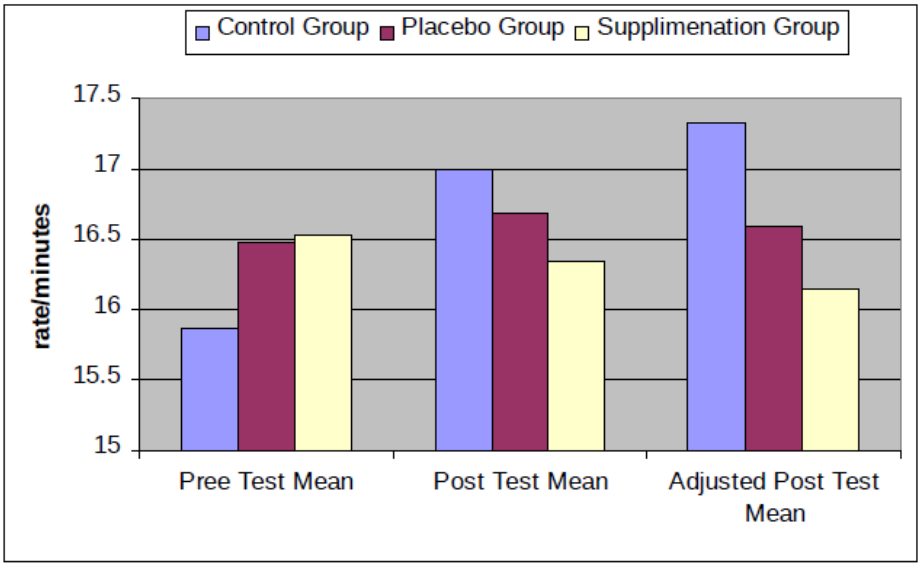


**Figure 1: Graphical representation of the Pre -test, Post-test andadjusted Post-test means on Respiratory Rate of the three different groups**

**Table 7: Analysis of Co-variance done among the different groups on Cardio-Respiratory Endurance**

| | **A** | **B** | **C** | ***Source of Variance*** | ***Sum ofSquares*** | ***df*** | ***Mean Squares*** | **'F' Rati o** |
|---|---|---|---|---|---|---|---|---|
| **Pretest Mean** | 2678.33 | 2664.67 | 2591.33 | Between | 65667.778 | 2 | 32833.889 | .811 |
| **SD** | 187.9748 | 211.5881 | 203.2633 | Within | 1699880.000 | 42 | 40473.333 | |
| | 2739.00 | 2794.33 | 2745.00 | Between | 27657.778 | 2 | 13828.88 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Posttest Mean** | | | | | | | 9 | |
| **SD** | 257.6695 | 372.3999 | 173.7917 | Within | 3293903.333 | 42 | 78426.270 | .176 |
| **Adjusted Posttest Mean** | 2713.70 | 2779.34 | 2785.29 | Between | 46534.843 | 2 | 23267.421 | .410 |
| | | | | Within | 2327702.227 | 41 | 56773.225 | |

The table 7 value required for significance at 0.05 level of confidence with df $_{(2,41)}$ is 3.23 and df $_{(2,42)}$ is 3.22. The F-ratis in the pre-test were 0.811 and in the post-test were 0.176, which were significantly less than the tabulated F(2, 42) of 3.220, as shown in the above table connected to the study of co-variance done among the different groups on Cardio respiratory do. In the corrected post test, it was only 0.410, which was significantly lower than the F(2, 41) tabulated value of 3.230. The post-hoc test was not performed since the F-ratio for the adjusted post-test was judged to be negligible.

**DISCUSSION**

The goal of the study was to see how certain Ayurvedic herbal medicines affected cardio-respiratory endurance performance. The researcher used ayurvedic herbal medicines known as 'Lakshadi Choornam' (powder) containing the ingredients 'Laccifer Lacca' and 'Mymosa Pudicca' for this aim.

According to the results of the haemoglobin study, there is no significant difference between the three groups. This demonstrates that Lassifer Lacca and Mymosa Pudicca have no effect on haemoglobin, implying that the hypothesis proposed is correct. This could be because the Lakshadi Choornam, which contains Lassifer Lacca and Mimosa Pudicca, has a link to blood purification, coagulation, and other blood-related issues, but there are no specific references to an increase in erythrocytes in the blood. Furthermore, only Lassifer lacca has these qualities in Laksahdi Choornam, and Mimosa Pudicca does not.

According to the results of the blood sugar study, there is no significant difference between the three groups. This demonstrates that Lassifer Lacca and Mymosa Pudicca have no effect on blood sugar, implying that the hypothesis proposed is correct. This could be because Blood Sugar is known as Prameha in Ayurveda, and it is a condition caused by the vitiation of Thridosa, which primarily affects Kapha and affects blood and medas. Ayurvedic remedies having bitter, astringent, or other qualities are commonly used to treat Blood Sugar patients. This could be because, while herbal medications like Lassifer Lacca and Mimosa Pudicca can help diabetics lower their blood sugar, some drugs, even if they have the same qualities, may not work the same way on everyone. Another reason could be that some drugs, even if they have the same qualities, are not interchangeable.

There is no significant difference between the three groups, according to the findings of the Total Cholesterol study. This shows that Lassifer Lacca and Mymosa Pudicca have no effect on total cholesterol, proving the hypothesis. This could be because, like Blood Sugar, Lassifer Lacca and Mimosa Pudicca are herbal medicines that can be given to patients with high cholesterol levels in their blood. However, administration of these herbal medicines has not shown a significant difference in Total Cholesterol, as age and physical characteristics of the subjects should be considered when administering such herbal medicines.

The study's ultimate goal was to see if Lakshadi Choornam (powder) had any effect on the individuals' Cardio-Respiratory Endurance. The results of the Cardio-Respiratory Endurance test show that there were no significant differences between the three groups. It follows that Lassifer Lacca and Mymosa Pudicca have no effect on the subjects' Cardio Respiratory Endurance, implying that the hypothesis is correct.

According to Ayurvedic literature, Lakshadi Choornam (powder) is a type of medicine that falls under the category of 'Balya' or 'Bala,' which means performance improving. Balancing is known in Ayurveda as 'Vyayam Shakthi,' and athletic performance falls under this category. Thus, herbal treatments for Vyam shakthi may not have a direct effect on biochemical variables such as haemoglobin, blood sugar, or total cholesterol.

**CONCLUSION**

The study's findings show that there was no significant difference in haemoglobin levels between the control group and the other two experimental groups because the consumption of Lakshadi Choornam with ingredients Lassiffer Lacca and Mymosa Pudicca had no effect on the subjects' haemoglobin levels.

On Total Cholesterol, there was no significant difference between the three groups. This means that Lakshadi Choornam, which contains the components Lassiffer Lacca and Mymosa Pudicca, has no effect on total cholesterol levels.

On Blood Sugar, there was no discernible difference between the three groups. This means that Lakshadi Chooornam, which contains the components Lassiffer Lacca and Mymosa Pudicca, has no influence on blood sugar levels, either rising or falling.

There was no significant difference in Cardio-Respiratory Endurance between the control group and the other two experimental groups, as the ingestion of Lakshadi Choornam with components Lassiffer Lacca and Mymosa Pudicca had no effect on the individuals' Cardio-Respiratory Endurance.

Athletic performance is classified in Ayurveda as Balya or Bala, which signifies Vyayam Sakthi. The selected medicine Lakshadi Choornam, which contains the ingredients Lassifer Lacca and Mymosa Pudicca, is a type of medicine that can be used to improve athletic performance or Vyayam Shakthi. Supplementation had no influence on the biochemical variables chosen, such as haemoglobin, total cholesterol, and blood glucose, despite the fact that they have a direct relationship with endurance performance.

**REFERENCES**

1. Kochhar, Anitha and Nagi, Malkit, (2005). Effect of Supplementation of Traditional Medicinal Plants on Blood Glucose in Non–Insulin Dependent Diabetics, *Journal of Medicinal Food*. Winter, P.545-549.
2. Liang,C.; Podolka, T. and Chuang, W., (2005) Panax Notoginseng Supplementation Enhances Physical Performances During Endurance Exercise. *Journal of Strength and Conditioning Research.* P.108.
3. Neychev, V. and Mitev, V., (2005). The Aphrodisiac Herb Tribulus Terestris does not influence the Androgen Production in young Men. *Journal of Ethanopharmacology*. P.319.
4. Bock, De, K. and Eijnde, B., (2004). Acute Rhodiola Rosea intake can improve endurance exercise performance. *International Journal of Sport Nutrition and Exercise Metabolism*, P. 298-307.
5. Herbold, N.; Visconti, B.; Frates, S. and Bandini, L., (2004). Traditional and Non traditional Supplement Used by Collegiate Female Varsity Athletes. *International Journal of Sports Nutrition and Exercise Metabolism.* P. 586.
6. Pittler, M., and Ernst, E., (2004). Dietary Supplements for Body Weight Reduction. *American Journal of Clinical Nutrition.* P. 529.
7. Willoughby, D., (2004) Effects of an alleged myostatin-binding supplement and heavy resistance training on serum myostatin, muscle strength, mass and body composition. *International Journal of Sport Nutrition and Exercise Metabolism*, P. 461- 472.
8. Prior, Curtis. P., (1999). Therapeutic value of Ginkgo Biloba in reducing symptoms of decline in mental function. *Journal of Pharmacy and Pharmacology.* P. 535.