

## A REVIEW ARTICLE ON PHYSIOLOGICAL CHANGES IN HUMAN BODY DUE TO EXERCISE WITH SPECIAL REFERENCE TO VYAYAMA

Dr. Payal D. Gaikwad\*<sup>1</sup>, Dr. Sampada S. Sant<sup>2</sup> and Dr. Kishor Ugale<sup>3</sup>

<sup>1</sup>PG Scholar, Department of Kriya Sharir, Government Ayurveda College, Nanded.

<sup>2</sup>HOD of Kriya Sharir Department, Government Ayurveda College, Nanded.

<sup>3</sup>Assistant Professor, Department of Kriya Sharir, Government Ayurveda College, Nanded.

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**\*Corresponding Author**

**Dr. Payal D. Gaikwad**

PG Scholar, Department of  
Kriya Sharir, Government  
Ayurveda College, Nanded.

### ABSTRACT

*Ayurveda* is ancient science of life. In *Ayurveda*, *Acharyas* have explained the importance of exercise in their *samhitas*. *Acharya Charak* has explained importance of exercise. He has mentioned the benefits that lightness in body, ability to work hard, regular exercise can give your body stability, increases your endurance power, increases appetite, decreases *doshas*.<sup>[1]</sup> He also explained the quantity of exercise that one should perform exercise half of its whole strength.<sup>[2]</sup> He also explained that one should perform heavy exercise in Winter season and autumn season. Now a days people are becoming

very health conscious. Globalization induces sedentary lifestyle. There is evidence of the effectiveness of regular physical activity in the primary and secondary prevention of several chronic diseases e.g. cardiovascular diseases, diabetes, cancer, obesity, hypertension, bone and joint diseases. Physical activity / exercise can improve your health. Physical activity and exercise can have immediate and long term health benefits. Daily 30 minutes of exercise can allow you to enjoy health benefits. The primary purpose of this review was to evaluate the current Ayurvedic and Modern literature and provide further insight into the role physical inactivity plays in the development of chronic diseases and premature death So this is my small effort to create the awareness in people about the exercise and to review the physiological effects of exercise in human body.

**KEYWORDS:** Samhitas, Acharyas.

## INTRODUCTION

In Ayurveda, Acharyas have included Vyayam means exercise in Dinacharya.<sup>[3]</sup>

Dinacharya means the activities one should perform on daily basis. Thousand years ago, Acharyas have known the importance of exercise. So they have included Vyayam that is exercise in Dinacharya. *Acharya Charak* has described in detail about exercise in first section of Sutrasthana and in the chapter on 'Non suppression of natural urges'. He was first who gave the idea of the maintenance of positive health where it includes proper diet, sleep, rest, active habit, regular exercise etc. He described body, mind, soul, these three are like tripod; the human is sustained by their combination. He clearly suggested Vyayama (physical exercise) for the body and Yoga for mind and soul.

Vyayama is referred to any karma which will bring Ayasa. (Exhaustion). Vyayama of Ayurveda is comparable to the physical exercise. Various aspects of Vyayama such as features of adequate exercise, indication, contraindication etc have been described in detail in Ayurveda.

Exercise defined as such a physical action, which is desirable and is capable of bringing about bodily stability and strength is known as physical exercise. **Exercise physiology** is the physiology of physical exercise. It is the study of the acute responses and chronic adaptations to a wide range of exercise conditions. Exercise physiologists study the effect of exercise on pathology, and the mechanisms by which exercise can reduce or reverse disease progression. Frequent and regular physical exercise is an important component in the prevention of some of the diseases such as cancer, heart disease, cardiovascular disease. **PHYSIOLOGY** • Coined from these two words "physis" meaning nature or origin "logos" meaning speech or talking about something. **PHYSIOLOGY** is the study of the mechanical, physical and biochemical functions of the body as a whole and of the structures found there in. According to Ayurveda and modern science, lack of exercise causes diseases. So one should perform daily exercise to prevent these diseases and for leading a healthy lifestyle. Recent evidences have been found about the positive association between increasing physical activity and desirable health effects.

Concept of Exercise according to Ayurveda.

**Defination of Vyayama**

Vyayama is referred to any karma which will bring Ayasa. (Exhaustion). Sushruta defines Vyayama as follows - Any act that causes fatigue to the body is called Vyayama.

**Benefits of exercise**

1. Lightness in body, ability to work hard, regular exercise can give your body stability, increases your endurance power, increases appetite, decreases *doshas*.
2. Enemies will be not able to defeat the person
3. Vardhakya (Old age) doesn't attract him quickly.
4. Lack of physical exercise causes many diseases such as Sthaulya (Obesity), Prameha (Diabetes), etc. To prevent these diseases one should exercise daily.

**Matra of Vyayama**

Vyayama should be performed by persons as per their bala in all the seasons. The quantity of exercise that one should perform exercise half of its whole strength. One should perform heavy exercise in Winter season and autumn season.

**Balardha Lakshanas are as follows**

1. There is profuse sweat appears at axilla, forehead, nose, arms, shoulders.
2. Shortness of breath
3. Dryness of mouth.

**Types of Vyayama**

Sushruta had mentioned 4 types of Vyayama they are as following -

1. Swinging heavy weights called **Santolas** (Each weighing 10/20 pounds.)
2. **Gunakarsha** (Pulling bow strings)
3. **Dhanurakarsha** (bending bows and bending body in various directions)
4. **Charya** (the practice of exercise involving the use of swords and arrows while riding on elephants, horses, and **Chariots** (In making quick marches on foot)

**Ativyayam Sevan Janya Vyadhi**

Excessive exercise give rise to Shrama (tiredness), Klama (exhaustion), Kshaya (depletion of body tissues), Trishna (excessive thirst), Raktapitta (bleeding from different parts of body), Pratamaka (darkness in front of eyes), Kasa (Cough), Jwara (fever), Chardi (Vomiting), Urakshata (wound in the chest), death.

**Vyayama Varjya (Contra- indications of Exercise)**

1. Persons suffering from diseases of Vata and Pitta dosha, Raktapitta (bleeding from different parts of body), Rajayakshma (Tuberculosis), Shwasa (Dyspnoea), Kasa(Cough), Ajeerna(Indigestion), Navajwara(fever), Udakodara, Mutrakruccha, Vatarakta Vyadhi, Karna Roga, Asthibhagna, bhagandar, Jalodar (ascites), emotional distress, dukha(grief), bhaya (fear).
2. Vyayama is contra- indicated in Varsha and Vasant Ritu.
3. Person who have become very thin and whose routine work involves enough physical activity. Persons who are in grip of anger, below age 10 years, those older than 70 years, pregnant women, after taking food.
4. Person having Vatika Constitution and who speaks too much and who suffer from hunger and thirst.

**Vyayama as Treatment**

Vyayama is prescribed as treatment in many diseases, such as Sthaulya (Obesity), Tandra (Stupor), and diseases related to Kapha Vruddhi, diseases caused by suppression of urge of vomiting.

Concept of Exercise according to Modern science.

**Definition of Exercise Physiology<sup>[6]</sup>**

Study of acute responses and chronic adaptations to wide range of exercise conditions.

**EXERCISE TYPES****According to muscular contraction**

1. Dynamic exercise
2. Static exercise

**According to metabolism**

1. Aerobic exercise
2. Anaerobic exercise

**Types according to muscular contraction****1. Dynamic exercise**

In this type of exercise there is isotonic muscle contraction where joint angle and muscle length changes during contraction Example- swimming, bicycling, walking.

## 2. Static exercise

It includes isometric muscle contraction where joint angle and muscle length doesn't change example- pushing heavy objects.

### Types according to metabolism

#### 1. Aerobic exercise

Energy production with the help of oxygen

Example -Jogging, fast walking, running, bicycling

#### 2. Anaerobic Exercise

Energy production without air

Example-pull ups, push ups, weight lifting

Metabolism in aerobic process & anaerobic process

During heavy exercise, Muscle burn glycogen and Lactic acid produced.

This is anaerobic process of metabolism it takes 3-5 min and still continued exercise then aerobic process of metabolism starts. Continuation of exercise burn glycogen in liver to produce energy in the presence of oxygen so this is aerobic process of metabolism. and it takes place for 20 minutes.

Still continued to exercise then body starts to utilize fats for production of energy.

### Severity of Exercise

**Mild Exercise-** Slow walking

**Moderate Exercise-** Can be performed for longer period. No strenuous muscular activity.

Example- Fast walking, slow running.

**Severe Exercise-** Strenuous muscular activity. Performed for short duration. Example-Fast running.

### Effect of exercise on cardiovascular system

**Cardiac Output-Moderate exercise** - 20 lit/min, Severe exercise-35 lit / min

**Heart Rate Moderate exercise** - 180/ min, Severe exercise - 240-260 / min

**Blood Pressure** -Systolic BP increases. Diastolic BP not altered.

**Blood flow to skeletal muscles**

**Normal** - 3 to 4 ml / min

**Moderate** - 60 to 80 ml /min

**Severe** -90 to 120 ml / min

**On Blood**

It causes mild hypoxia. So juxtaglomerular apparatus activates erythropoietin. So bone marrow stimulates RBC production.

**On blood volume**

It activates thermoregulatory system. It increases sweat production.

Increased sweat production causes fluid loss, hemoconcentration, reduced blood volume.

**Effect of exercise on respiratory system****Pulmonary ventilation**

Pulmonary ventilation - tidal volume  $\times$  RR

Normal - 6 liters, Moderate - 60 liters, Severe- 100 liters

**Consumption of oxygen**

Consumption of oxygen increased by skeletal muscles

**Respiratory Quotient**

Molar ratio of CO<sub>2</sub> production : O<sub>2</sub> consumption - 1

During exercise -1.5 to 2

**Effect of exercise on nervous system**

It contributes to brand new brain cells. Involuntary process in body - heart rate, blood pressure controlled by autonomic nervous system. Exercise increases activity of parasympathetic nervous system so it decreases BP and heart rate, increases blood flow to kidney and intestines. It helps to recover from stress. Regular exercise decreases activity of sympathetic nervous system.

**Effects of exercise on digestive system**

Light exercise- It produces more efficient bowel movements. Example- Yoga

Extreme exercise

Negative effects on digestion.

Example- extreme running can cause gastritis and gastro oesophageal reflux.

### **Effect of exercise on urinary system**

Exercise increases the activity of sympathetic nervous system so blood flow to skeletal muscles increases simultaneously blood flow to kidney decreases. so amount of fluid filtered by kidney decreases.

Because of exercise there is loss of fluid and sodium through sweat. Body tries to conserve water with the help of ADH and restoration of normal electrolyte levels is done with the help of aldosterone and angiotensin II

As a result urine production decreased.

Exercise increases lactic acid production which is excreted via kidneys making urine more acidic

### **Effects of Exercise on Respiratory System**

Exercise increases the breaths/minute. Exercise increases the amount of air in each breath (tidal volume)

#### **During light exercise**

Ventilation increases linearly with oxygen uptake and carbon dioxide production. This increase in ventilation is accomplished more by increased tidal volume (breathing deeper in and out).

#### **During higher exercise levels**

Ventilation is increased more by increased breathing frequency

This will keep the blood saturated with oxygen because the blood is in the alveoli capillaries long enough for complete diffusion of gases

#### **Steady rate (moderate) exercise**

Sufficient oxygen is supplied to muscles due to increased oxygen uptake, there is little, or no, build up of lactic acid in the muscles. some lactate will be produced and removed by the blood stream. Lactic acid is neutralized in the blood (this reaction produces carbon dioxide as a by-product) increased carbon dioxide in the blood will stimulate increased ventilation. Increased ventilation is accomplished by both increased tidal volume and frequency.

## CONCLUSION

We finally conclude that the knowledge of physical exercise (Vyayama) available in Ayurvedic text with highly evolved manner is more informative and helpful than the current literature. Ayurveda have mentioned that one should always perform Vyayama considering age- One should perform more exercise in Tarunyavastha (Youth). Persons below 10 years and older than 70 years are included in Vyayama Varjya. Physique- Persons having Kapha Prakruti should perform more exercise than Vata Prakruti, Habitat- People living in Anup Pradesh should perform more exercise than Jangal Pradesh, Season One should perform heavy exercise in Winter season and autumn season.

**Strength-** Vyayama should be performed by persons as per their bala in all the seasons. Balardha Lakshanas are as follows-1. There is profuse sweat appears at axilla, forehead, nose, arms, shoulders. 2. Shortness of breath. 3. Dryness of mouth. The quantity of exercise that one should perform exercise half of its whole strength. Otherwise the person gets affected by various diseases. Excessive exercise should not be done in any condition. In Modern literature they haven't mentioned about such things. So people are suffering from sudden heart attacks in gym due to over exercise. So one should follow guidelines regarding exercise mentioned in Ayurveda to live a long and healthy life.

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