

ABSTRACT

BACKGROUND

The variations in *Tridoṣas* are the basis for disease diagnosis and treatment in *Āyurveda*. Traditionally *doṣas* were assessed by sensing the radial pulse manually with fingers which depends on skill of the physician. There is a need to measure *doṣas* using instruments and study them objectively as evidence based research is gaining importance in accepting any medicine or system of medicine.

AIM

Arterial stiffness is a pulse parameter and has a significant research and clinical interest in modern medicine. The aim of the research was to measure the arterial stiffness from *Tridoṣa* locations of radial artery and investigate the significance of arterial stiffness in *Tridoṣa* analysis. The following studies were conducted to investigate the significance of arterial stiffness.

- **TRIDOSA STUDY:** significant variations of arterial stiffness across *Tridoṣa* locations.
- **DIABETES STUDY:** association of arterial stiffness with Type 2 Diabetes.
- **OBESITY STUDY:** effect of one week Integrated Approach of Yoga Therapy (IAYT) on arterial stiffness across young and older adults with obesity.

OBJECTIVES

- To acquire radial pulse from *Tridoṣa* locations and study the pulse wave in an objective manner in the context of *Āyurveda*.

- To measure the arterial stiffness from radial artery and study the variations of arterial stiffness across *Tridoṣa* locations with a view to explore the association of arterial stiffness with traditional pulse parameter *kāṭhinya*.

METHODS

Subjects were recruited from participants of yoga camps conducted by S-VYASA and also from participants who joined *Aryogyadhama* to undergo one week integrated yoga therapy program. Data collection was done at the beginning of the yoga camp from the participants of the camp and the data was collected at the beginning and end of the one week integrated yoga therapy program from the participants of *Arogyadhama*. The arterial stiffness parameters namely stiffness index (SI) and reflection index (RI) were considered for the study.

TRIDOSA STUDY

The participants were recruited from yoga camps conducted by S-VYASA and a total of 90 participants who were not having any disease at the time of camp were included in the study. The pulse data was collected using *Nāḍī Tarāṅgiṇi* and the variations of arterial stiffness across *Tridoṣa* locations were studied. The data was analyzed using one-way ANOVA followed by Tamhane's T2 test. The changes in SI and RI between males and females were assessed using independent samples t test.

DIABETES STUDY

Participants were recruited from yoga camps conducted by S-VYASA. A total of 192 participants (non diabetes – 104, diabetes – 88) were included in the study. The participants were

divided into diabetes and non-diabetes groups based on fasting plasma glucose (FPG) levels. The SI and RI were measured for *Tridoṣas* and studied across diabetes and non-diabetes groups. The changes in SI and RI between diabetes and non diabetes groups were assessed using independent samples t test.

OBESITY STUDY

Subjects were recruited from *Arogyadhama*, a residential centre of S-VYASA and the participants with and without obesity were considered for the study. A total of 18 participants (4 males and 14 females) were included in the study. The participants were divided into three groups based on their age and body mass index (BMI). The participants were given one week IAYT program as intervention. The data was collected before and after IAYT program. The pre and post IAYT data was analyzed using paired samples t test.

RESULTS

The results of all the three studies are summarized below.

TRIDOSA STUDY

SI at *pitta* (8.910 ± 3.509) was significantly high compared to *vāta* (5.669 ± 1.165) and *kapha* (8.021 ± 2.814), RI at *vāta* (0.846 ± 0.071) was significantly low compared to *pitta* (0.945 ± 0.043) and *kapha* (0.952 ± 0.033). SI at *kapha* was significantly high in males compared to females.

DIABETES STUDY

SI at *vāta* was negatively correlated with FPG ($p < 0.05$) for non-diabetes group whereas for diabetes group there was no significant correlation. However, RI was not significantly correlating with FPG. There was a significant positive correlation between SI and RI ($p < 0.01$). SI at *vāta* was significantly high in diabetes group (5.898 ± 0.786) compared to non-diabetes group (5.414 ± 1.179), SI at *pitta* was significantly low in diabetes group (7.308 ± 1.929) compared to non-diabetes group (8.726 ± 3.474) and SI at *kapha* was significantly low in diabetes group (6.529 ± 1.389) compared to non-diabetes group (6.529 ± 1.389).

OBESITY STUDY

There was a significant reduction in SI ($P < 0.05$) after IAYT (Integrated Approach of Yoga Therapy) in young adults with obesity. There was a significant reduction in BMI after IAYT in older adults but SI was significantly low only in young adults. There were no significant changes in RI after IAYT.

DISCUSSION

TRIDOSA STUDY

SI and RI measured at *vāta*, *pitta* and *kapha* locations were significantly different. SI at *pitta* was high compared to *vāta* and *kapha* which can be attributed to age. The average age of the subjects in the study was 50-60 years, a *pitta* dominant age which could be the reason for SI to be high at *pitta* compared to *vāta* and *kapha*. As per *Āyurveda Nāḍī* will be soft in childhood

which is *kapha* dominant age, elastic in middle age which is *pitta* dominant age and will become hard in old age which is *vāta* dominant age. As per modern medicine arterial stiffness increases with age and hence arterial stiffness can be closely associated to *kāṭhinya*.

DIABETES SYUDY

SI at *vāta* of non-diabetes group was negatively correlated with fasting plasma glucose and the association of SI with fasting plasma glucose was observed only in non-diabetes group and there was no such association in diabetes group. There were no such correlations for SI at *pitta* and *kapha* locations for both the groups. SI at *vāta* of diabetes group was high compared to non-diabetes which matches with previous studies confirming the increase in arterial stiffness with diabetes. The diabetes group has shown significantly lower SI at *pitta* and *kapha* locations when compared to non-diabetes group.

OBESITY STUDY

There was a significant reduction in arterial stiffness (SI) in young adults with obesity but the changes in older adults with or without obesity were not significant after giving intervention of IAYT for one week. The results of the study have shown that one week IAYT program has reduced BMI of obese participants across young and older adults but reduction in SI was observed only in young adults and not in older adults. Arterial stiffness would have increased naturally with age in older adults and hence one week duration may not be sufficient for older adults to see significant changes in SI.

CONCLUSIONS

A method was developed for measuring pulse parameters SI and RI using *Nāḍī Tarāṅgiṇi* across *Tridoṣa* locations and analyzing the arterial stiffness across *Tridoṣa* locations in objective manner. SI and RI acquired using *Nāḍī Tarāṅgiṇi* have shown significant variations across *Tridoṣa* locations. The results confirmed that the arterial stiffness measured from *Tridoṣas* is significantly varying across diabetes and non diabetes groups. The arterial stiffness measured from radial artery using *Nāḍī Tarāṅgiṇi* has decreased significantly after one week IAYT in young adults with obesity compared to older adults.