EFFECT OF YOGASANA PRACTICE ON SYSTOLIC TIME INTERVALS

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ABSTRACT: Therapeutic values of yoga practices are well documented in the ancient Indian literature. In this study an attempt has been made to see the effect of Yogasana practice on cardiac functions by measuring systolic time intervals (STI). The asanas studied are Sirsasana, Sarvangasana, Halasana, Paschimottanasana and Bhujangasana. Five healthy Yogasana practitioners who where practicing regularly for more than a year were the subjects. The result of the study was statistically analyzed and presented systematically here.

INTRODUCTION

The systolic time intervals have been used by many workers to study the cardiac function in health and in cardio circulatory disorders (Ahmed et al 1972, Chokinos et al 1976 Pigott et al 1971, Wissler and et al, 1976). Also the influence of posture and exercise on cardiac-circulatory performance and systolic time intervals have been reported (Lecerof 1971, Pigott et al, 1971, Spodick et al 1971, Spodick and Quarry-point, 1973). Currently, the practice of yogasanas or yogic exercises is being used throughout the world as preventive and curative measures for many psychosomatic disorders (Benson 1983, Datey et al 1969, patel 1975, Udupa 1976). The present study was undertaken to provide information on the measurement of systolic time intervals during the practice of yogasanas as there are presently no studies available in literature regarding cardiac response to asana practice.

MATERIAL AND METHODS

The present study was carried out on five male healthy volunteers, who were free from any cardiovascular diseases. They were in age range of 22-25 years and all non-smokers. The subjects were practicing Yogasanas regularly for more than 3 year and used to stay in an asana up to 3 minutes with out discomfort.

The tracings of electrocardiogram (ECG), Phonocardiogram (PCG), and ear-densitogram (EDG) were obtained with the help of four channel recorder at a paper speed of 100 mm/sec before, during and after two minutes stay in particular asana. See figure 1 for sample tracing. The recordings were carried out in supine posture before and after the asanas. The recordings were taken for 5 separate asanas on every subject on different day; subjects were also recorded before, during and after a 50-wattpedallining by bicycle ergometer for two minutes. These parameters are sufficient to measure the systolic time intervals as per earlier reports (Chirefe & Spodick, 1972, Korbell et al 1974, Quarry-Pigott et al 1973). Limp lead II for ECG left second inter costal space for PCG with suitable microphone and upper most portion of the left ear (pinna) for EDG transducer were the sites used to pick up the
potsentials. The yogasanas studies were Sirsasana (head stand posture) sarvangasana (shoulder stand posture) Bhujangasana (cobra posture), Halasana (plough posture) and Paschimottanasana. The procedures to practice of these asanas were as per the instructions of Kuvalayananda (1966). Fig 2 shows a subject in sarvangasana, with the electrodes connected for measurements on a 4-channel polygraph.

Using the above tracings recorded during the Yogasanas and exercise, the follow during time intervals were calculated. Electromechanical systole (QS2) was obtained by measuring the time interval between one of QRS complex (Q point) and the closure of aortic value of or the of seconded heart sound (S2 point) in the phonocardiogram. See Figure 1 for details. Left ventricular ejection time (LVET) was measured from the interval between the beginning of the upstroke and nadir of the dichrotic notch of the ear densitogram. Pre-ejection period (PEP) was calculated by Deducting LVET intervals from QS2 values, which includes the isovolumetric contraction time. The RR interval was expressed in milliseconds to indicate the cycle length. The corrected left-ventricular ejection time (LVETc) was calculated by using the formula LVET/RR interval (Spodick and Quarry Pigott 1973).

Apart from the time intervals the cardiac stroke volume was calculated using Grayboys et al (1974) formula. These values were further converted to cardiac output put by multiplying the stroke volume with the heart rate.

All the measurements were analyzed statistically for obtaining significances related to the above parameters.
**RESULTS**

The extra mechanical systole, pre-ejection period and left ventricular ejection time changes are tabulated in Table 1 for the above Yogasanas.

The extra mechanical systole (QS2) is described significantly in Sarvangasana and Paschimottanasana after 1 min stay, the same value is maintained even after 2 min stay. During Halasana, the QS2 decrease is observed only after 1 min stay, while in Bhujangasana, the decrease in QS2 is seen only after two min stay. However, during Sirsasana no significant change observed. Pre-ejection period (PEP) changes are significantly decreased in sirsasana both after 1 min and 2 min stay in Bhujangasana, the significant decrease in only after 1 mi stay. In remaining asanas, the PEP changes are insignificant. Left ventricular ejection time (LVET) changes are insignificant during Bhujangasana and Halasana. However, it is decreased significantly in Paschimottanasana during both after one and two min stay, while in Sarvangasana it is decreased significantly only after 2 min stay. The significant increases are observed in Sirsasana both after 1 and 2 min stay.

In Table II, the heart rate corrected LVET and RR intervals are tabulated. Corrected LVET changes are not significant during the stay in any of the asanas for both after 1 and 2 min stay. The RR interval is decreased significantly after one min. stay in Sirsasana and Sarvagasana and after 2 min Stay; the decrease is maintained only in Sirsasana. In the remaining asanas the changes are insignificant.

The systolic time interval changes during exercise are shown in Table III only LVET and RR interval durations are found to be decreased significantly after one min exercise, while remaining
TABLE I
Systolic time intervals during yogasanas (Mean ± SD in msec)

| ASANAS       | EXTRA MECHANICAL SYSTOLE (QS2) | PRE-EJECTION PERIOD (PEP) | LEFT VENTRICULAR EJECTION TIME (LVET) |
|--------------|--------------------------------|---------------------------|--------------------------------------|
|              | PRE ASANA 1' STAY 2' STAY POST ASANA | PRE ASANA 1' STAY POST ASANA | PRE ASANA 1' STAY POST ASANA |
| Sirasasana   | 393.20±1 385.80±1 389.80±1 | 103.30± 93.48±** 94.40±** | 99.66±99.66±99.66±99.66± |
| Sarvangasana | 402.30±1 371.28±1 377.40±1 | 105.44± 88.94±15 107.38±107.38± | 99.62±99.62±99.62± |
| Bhujanga     | 420.14±1 393.26±1 396.62±1 | 103.82± 98.34±17 107.96±107.96± | 98.34±98.34±98.34± |
| Paschimotanasa | 389.46±1 353.96±1 351.06±1 | 106.24±106.24±106.24±106.24± | 865.90±865.90±865.90± |
| Halasana     | 396.10±1 371.60±1 379.76±1 | 107.56±107.56±107.56±107.56± | 978.60±978.60±978.60± |

*p<0.05, **<0.01

TABLE II
Corrected LVET and RR intervals during Yogasanas (Mean ± SD in msec)

| ASANAS       | CORRECTED LVET | R-R INTERVAL DURATION |
|--------------|----------------|------------------------|
|              | PRE ASANA 1' STAY 2' STAY POST ASANA | PRE ASANA 1' STAY POST ASANA |
| Sirasasana   | 311.30±8.88 334.48±7.99 336.14±8.01 | 865.86±171.89 763.76±106.42 |
| Sarvangasana | 330.20±29.26 355.14±19.35 353.92±30.59 | 830.98±242.30 632.60±64.71 |
| Bhujanga     | 349.90±35.93 394.70±32.35 357.10±25.47 | 865.96±102.89 643.10±64.70 |
| Paschimotanasa | 317.56±6.51 356.34±15.00 328.22±17.59 | 778.86±108.44 551.00±138.00 |
| Halasana     | 333.84±16.70 316.82±7.69 316.16±10.41 | 769.16±131.51 695.60±46.29 |

*p<0.05, **<0.01
time intervals as well as LVET changes are non significant during 50 watt load bicycle peddling in comparison with pre-exercise values in these subjects. The same subjects who did the asanas underwent exercise testing also.

Cardiac out put changes are not significant both after 1 min and 2 min stay in Sirsasana, Sarvangasana, Bhujangasana and Halasana. However, it was increased significantly after one min stay only in paschimottanasana and after one min peddling with bicycle ergo meter as shown in Table IV.

Discussion

Left ventricular ejection time (LVET) changes are mainly determined by heart rate and stroke volume. The heart rate corrected (LVET) (Spodick and Quarry-Pigott 1973) changes revealed no significant changes during the practice of any of these asanas. This indicates that the LVET changes are related to heart and confirms the earlier reports (Leighton et al 1971, Sapru wet al 1978, Spodick& Kumar 1968). This finding also reveals that stroke volume changes are non-significant. This was confirmed using Grayboys formula, as there were no significant changes in cardiac out put seen during the practice of these asanas, excepting paschimottanasana.

TABLE III
Systolic time intervals during exercise (Mean ± SD in msec)

| TIME INTERVALS | PRE Ex.     | AFTER 1' | AFTER 2' | POST Ex  |
|----------------|-------------|----------|----------|----------|
| QS             | 394.32±47.77| 343.40±24.25| 332.02±27.02| 392.00±44.16 |
| LVET           | 307.44±29.11| 281.50±19.47*| 277.90±19.44| 305.90±28.84 |
| PEP            | 84.88±15.07 | 61.80±8.38 | 54.12±11.68 | 86.12±16.86 |
| LVETc          | 353.40±28.72| 393.80±20.11| 402.80±33.22| 350.64±23.69 |
| RR-Interval    | 760.00±97.21| 512.80**±55.88| 488.36±108.17| 770.40±55.27 |

*P<0.05  
**P<0.01  
Ex.=Exercise
TABLE IV
Cardiac output changes during yogasanas and exercise (mean ±SD in L/min)

| ASANAS       | PREASANA | AFTER1STAY | AFTER2STAY | POST ASANA |
|--------------|----------|------------|------------|------------|
| Sirsasana    | 6.15±0.66| 7.22±0.50  | 7.07±0.31  | 6.29±0.66  |
| Sarvangasana | 6.83±1.30| 8.23±0.62  | 8.08±1.24  | 7.15±0.76  |
| Bhujangasana | 6.96±1.29| 8.56±1.35  | 8.24±0.88  | 6.44±0.73  |
| Paschimottanasana | 6.42±0.24 | 8.94*±1.64 | 7.40±0.78  | 6.48±1.14  |
| Halasana     | 7.01±0.72| 6.58±0.27  | 6.52±0.44  | 6.47±0.76  |
| Exercise     | 7.72±1.11| 10.43*±0.95| 11.36±2.83 | 7.59±1.03  |

*P<0.05

The reduction in PEP was mainly due to a fall in isovolumetric contraction time. This is related to the increased rate of shortening of contractile elements (Ahmed et al 1972, Tally et al 1971). PEP was independent of heart rate changes (Chokinos et al 1976, Spodick and Kumar 1968). The significant reduction in PEP during Sirsasana practice indicates increased myocardial contractility and for a confirmation of this, further study was recommended.

The present study shows that there are no significant changes noted in systolic time intervals and therefore suggests that the practice of these Yogasanas produce changes in cardiac function, which are well within the normal functioning limits of the heart.

The question has been asked often, if yogasana practice could be done by cardiac patients and further, if these patients could be taught yogasanas to improve their cardiac functioning. Often, the sustained muscle contraction could cause in carrying out an asana is a contraindication in patients with cardiac problems. In other words, the isometric contraction could cause excess load on the heart, leading, in an occasional case, to a perception of an anginal or related abnormal functioning of heart.

The experiment carried out and reported here shows clearly, that the load on the cardiac system-at least in healthy volunteers—is not significantly. If similar results were established in cardiac patients, it would imply that the asanas could be taught to these patients without any adverse effects. The systolic time interval studies carried out here are thus important in establishing the cardiac functioning in asana practice.
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