Section XI

General summary
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Surya Namaskar (SN), a group of Yogic exercise consists of a set of twelve postures that is practiced by some of the Yoga practitioners. In this study various physiological parameters were taken on different groups of subjects when they were actually practicing SN. When a group of Yoga instructors were allowed to perform SN according to their own time duration they could be classified into two groups, slow and fast practitioners. Slow practitioners performed SN within 130.8±11.44 sec. (1st round); 97.0±3.65 sec. (2nd round) and fast practitioners performed SN within 75.5±14.10 sec. (1st round); 87.8±18.9 sec. (2nd round). The VO₂ and O₂ pulse increased with the duration of the SN practice as it is observed in case of Yoga instructors. Exercise intensity as expressed in terms of METS showed significantly higher value (P<0.05) in the slow practitioners than the fast practitioners in the 1st round. It showed non-significant difference between the slow and the fast practitioners in the 2nd round. The overall energy cost in SN practice increased with the duration of its practice. But when the overall energy cost was expressed relatively to time and/ or body mass units the values of energy cost decreased with the duration of the exercise.

In case of Yoga trainees (Section 6.0) data showed that SN was an aerobic yogic practice with the oxygen consumption from 0.350 to 1.220 lit./min. that corresponds to 12% to 41% of the VO₂ max. or from 1.4 to 4.6 MET. Average energy expenditure during the performance of SN was 3.83 ± 0.250 kcal./min. and total energy expenditure while performing SN was 14.03 ± 1.89 kcal. The heart rate was between 65.0 ± 2.821 to 102.0 ± 2.94 beats per minute.

Considering subsection 5.2 of section 5, it appeared that the practice of SN can be utilized in many ways. It is ideal form of aerobic exercise in which isometric stretching and dynamic muscular components of exercise are present. One can perform SN for short duration (2-3 rounds) as a means of warming up exercise prior to any physical cultural programme or games. On the other hand, one can perform SN for prolonged duration (10-15 rounds) to get the benefits of aerobic exercise. As the cardiorespiratory demand of SN practice ranged between 15-24% of the VO₂ max and 60-68% heart rate reserve, the prolonged SN practice for 10-15 rounds by the slow practitioners and 8-13 rounds by the
fast practitioners keep the VO₂ in the range between 50-85% of the VO₂ max level which is safer range for performing aerobic activity as prescribed by the American College of Sports Medicine (1). Literatures on Yogic practices (155,277) also suggest to perform SN for 10-20 minutes which is sufficient for practicing approximate 10-15 rounds of SN. This is in agreement with our finding. If the slow and fast practitioners perform SN for 10-15 rounds and 8-13 rounds respectively the time duration of practice will be similar to those suggested by the literatures.

The present study has been carried out for the age group in the range of 20-25 years. But for the higher age group special precaution is to be taken for prescribing the number of rounds of SN to be practiced as VO₂ max decreases with age.

From the comparative studies (as in Section 7.0) (comparison between SN and other dynamic exercise (bicycle ergometric exercise) it was found out that at light and moderate intensities of exercise, heart rate was greater in SN than in other dynamic exercise. But at higher exercise intensity cardiac stress is comparatively greater in dynamic exercise as compared to SN. Respiratory stress during SN was lesser as compared to dynamic exercise. At all levels of exercise intensities (as mentioned earlier) the respiratory parameters like ventilation, breathing frequency, ventilatory equivalent for oxygen and ventilatory equivalent for carbon dioxide showed comparatively higher values in dynamic exercise than in SN. Tidal volume also showed the similar trend at lower and higher exercise intensities but at moderate exercise intensity it showed comparatively higher value in SN.

Cardiorespiratory data for the Yoga trainees and Yoga Proficient were taken when they were actually performing SN. Trainees' data were compared amongst the three different phases of the yogic training and also the trainees' data were compared with those of the Proficient' and Semi-proficient' data.

During the Yogic practice for one year the effect of training on SN was observed. There was gradual decrease in oxygen consumption, heart rate, ventilation, breathing frequency and blood pressure as it was observed during any conventional physical training programme. While comparing the data of Yoga trainees at different stages of the training with respect to Yoga Proficient (practicing SN for more than 4 years) and Semi-proficient (practicing SN for 2-4 years with interruption) it was observed that the trainees showed
conditioning of their cardiorespiratory parameters after three months of training when their values were compared with those of the Yoga Proficient and Semi-proficient.

As a whole SN, a special set of Yogic Asanas having both static stretching and dynamic muscular exercise components involving majority of joints, muscles and possibly different internal organs systems of the body is an all round Yogic practice. It seems to be an ideal form of aerobic exercise.

If the total rounds / duration of SN is increased according to the necessity one can achieve the physical activity level as per the ACSM guidelines. In addition to this one can take its additional advantage of its stretching and isometric component of the exercise.