



parameters were not affected (17). As a result the effect of different musical tempo remains unclear.

Further not much has been studied about the effect of music and different musical tempo on the post exercise recovery time. In the Intervention study reported here, the effect of different musical tempo on post exercise recovery of physiological and psychological parameters following a bout of physical exercise in healthy volunteers were tested. We hypothesized that music hastens post exercise recovery and that slow music shall have greater effect than fast or no music.

The physical and psychological differences between males and females are generally a reflection of hormonal differences between the sexes. As a result men and women respond differently a given physical or mental task (22). Our study also tested the gender differences in the effect of different musical tempo on post exercise recovery time.

The effect of individual music preferences on post exercise recovery time was also analyzed.

#### MATERIALS AND METHODS

Thirty healthy volunteers (15 males, 15 females) from the first year medicine course aged between 17 to 21 years signed the standard informed consent forms to participate in the intervention study following consent from the College Ethics Committee. Students suffering from diagnosed cardiovascular diseases, respiratory diseases, anxiety disorders, hypertensive, smokers, obese, physically handicapped, trained athletes were excluded from the study.

The subjects were explained about the procedure of the exercise, a prior trial was given for them to get acquainted with the treadmill exercise. Pulse rate, blood pressure were recorded after 30 minutes rest in the laboratory, prior to exercise. After two accommodation periods the participants were subjected to sub maximal exercise on

treadmill walking (stage 5 of Bruce Protocol) for 5 min and allowed to rest. During the post exercise relaxation time pulse rate and blood pressure were measured immediately and after every 2 min until the parameters returned to resting values. The subjects graded their sense of exertion on Rating of perceived exertion scale (22) immediately after exercise and then every 4 minutes until the person reported of complete recovery from exertion. Blood pressure was measured by the same experienced observer using a standard mercury sphygmomanometer, taking the first and the fifth phases of Korotkoff sounds as systolic and diastolic values, respectively. Pulse rate is taken by counting radial pulse for one minute. Rating of perceived exertion scale (RPE; BORG, 1982). The RPE ratio scale allows participants to give a subjective exertion rating for the physical task at any time during and after the activity. The scale ranges from 0 to 10. The higher the RPE score, the higher the rating of perceived exertion. The RPE scale is a reliable indicator of physical discomfort, has sound psychometric properties, and is strongly correlated with several other physiological measures of exertion.

Background music was played using Ipod through headphones during the two experimental treatments with the other test being a no music control. Two types of music were (a) Type A, slow tempo, melody songs (less than 100db), (b) Type B, fast tempo, dance beats (more than 200db) (16). After each experimental treatment pulse rate, blood pressure and RPE were measured as explained earlier.

#### Statistical analysis

Differences among the treatment were determined by Repeated measures ANOVA test (4). The 0.05 level of significance was set prior to the study.

#### RESULTS

Thirty healthy volunteers (15 males, 15 females) from the first year medicine course

were recruited for the study. Of the study subjects 17 (56.6%) preferred slow music, while 13 (43.4%) preferred fast music. Table I gives the general characteristics namely age, body weight, BMI and pulse rate of the study volunteers. Table II shows the pre exercise basal values of blood pressure and pulse rate.

TABLE I : General characteristics and cardiovascular parameters of the study subjects.

	<i>Males</i>	<i>Females</i>
Age	20.2 ± 1.0	20.6 ± 1.3
Body weight	58.0 ± 7.1	55.0 ± 3.3
BMI	19.5 ± 2.2	23.4 ± 1.4
Pulse rate	75.6 ± 6.8	76.1 ± 4.1
Systolic blood pressure	115.6 ± 8.8	105.6 ± 4.4
Diastolic blood pressure	69.2 ± 7.0	62.6 ± 4.1

Data presented are mean ± SD.

TABLE II : Pre-exercise basal values of systolic blood pressure (SBP), diastolic blood pressure (DBP) and pulse rate (PR).

	<i>Males</i>			<i>Females</i>		
	<i>No music</i>	<i>Slow music</i>	<i>Fast music</i>	<i>No music</i>	<i>Slow music</i>	<i>Fast music</i>
SBP(mmHg) at rest	115.6 ± 8.8	115.0 ± 7.5	112.8 ± 7.8	105.6 ± 4.4	102.0 ± 2.9	103.8 ± 4.5
DBP(mmHg) at rest	69.2 ± 7.0	68.9 ± 7.2	68.4 ± 7.7	62.6 ± 4.1	62.6 ± 4.1	62.8 ± 4.3
PR(beats/min) at rest	75.8 ± 7.2	75.0 ± 7.5	75.6 ± 7.9	76.1 ± 4.1	78.2 ± 3.8	78.1 ± 4.2

Data presented are mean±SD.

Table III depicts the effects of slow and fast music therapy on recovery time (RT) (min) of systolic blood pressure (SBP) (7.9±2.5), diastolic blood pressure (DBP) (5.5±3.4)

The individual music preferences found by questionnaire showed that the individual preference of the tempo of music has no effect on the relaxation time in both males and females.

TABLE III : Effects of slow and fast music therapy on recovery time (RT) (min) of systolic blood pressure (SBP), diastolic blood pressure (DBP), pulse rate (PR) and rating of perceived exertion (RPE) following practice of isotonic exercise.

<i>Parameters</i>	<i>No music</i>	<i>Slow music</i>	<i>Fast music</i>
SBP (mmHg) RT	11.6 ± 2.8 <sup>#</sup>	7.9 ± 2.5* <sup>#</sup>	9.4 ± 2.4*
DBP (mm Hg) RT	7.2 ± 3.5 <sup>#</sup>	5.5 ± 3.4* <sup>#</sup>	6.5 ± 3.4*
PR beats/min) RT	12.1 ± 2.9 <sup>#</sup>	8.0 ± 2.3* <sup>#</sup>	9.6 ± 2.5*
RPE RT	11.6 ± 2.8 <sup>#</sup>	7.7 ± 2.5* <sup>#</sup>	9.3 ± 2.1*

Data presented are Mean ± SD.

\*Depicts comparison with no-music group and <sup>#</sup> depicts comparison with fast-music group. \*P < 0.05; <sup>#</sup>P < 0.05

pulse rate recovery (PR) (8.0±2.3) and recovery from exertion (RPE) (7.7±2.5) were significantly faster when compared to recovery time of fast music therapy and control groups (P< 0.05).

There was no significant difference among the two genders in recovery time of systolic and diastolic pressures, pulse rate and recovery from exertion with the two types of music and control.

## DISCUSSION

The present study supported the hypothesis that relaxation with music after a bout of physical exercise caused faster recovery of physiological parameters namely pulse rate and blood pressure in comparison with relaxation in silence. It is consistent with other study which proved that music has the potential to reduce physiological indicators of anxiety including pulse rate and blood pressure (20,21). Music

reduced muscular and mental tension and thereby decreased sympathetic stimulation (21) as observed in some studies. In addition to this, the plasma catecholamine is also lowered when relaxation is accompanied by music (6). Probably these factors together caused recovery of the pulse rate and blood pressure to baseline earlier than relaxation in the absence of music.

The effect of different musical tempo on post exercise recovery time showed interesting results. The heart rate and blood pressure returned to base line faster while listening to slow music when compared to fast music probably music of slow tempo reduced the arousal, leaving the subject in a state of relaxation (22).

The subjective feeling of exertion perceived by each individual at the end of exercise was rated on the Rating of perceived exertion (RPE) scale. The peak levels of perceived exertion were found to be the same at the end of the exercise tasks with the two tests and control for each subject. During the post exercise relaxation period, the subjects felt faster recovery from exertion in presence of music than relaxing in silence. Further relaxation was fastest with slow music when compared to fast music. This effect may be due to distraction from fatigue and is dependent on the attention capturing strength of the distracting stimulus (20). Music acts as a good tool of distraction that reduces physiological awareness and lowers the perceived exertion ratings (12, 23, 24). It also inhibits and stops ruminative and worrisome thinking about bodily sensations. Music is composed of auditory tones and rhythms that do not direct the mind but distract it, focus attention, facilitate breathing and stimulate the relaxation response (25), thereby causing significant faster recovery from perceived exertion.

It is an established fact that physical, intellectual, emotional or behavioral response of men and women to a given task or situation is different. This is due to the hormonal

differences which in turn are due to the sex specific genotype expressions (22). However, we found that there is no gender difference in the recovery duration with respect to both types of music. It proves that both males and females have the same psychological and physiological responses to music listening.

We also found that individual music preferences had no effect on the recovery time with music. Thus the relaxation effect of music is independent of the likes and dislikes of the individual.

Thus music of slow tempo is one of the best relaxation tools as it causes rapid recovery of both physical and psychological parameters following a bout of physical exertion. Playing slow music during short breaks in between work time would hasten mental and physical relaxation and would improve the work efficiency of the employees at the work place. The present study is limited to a small bout of exercise and is conducted on healthy volunteers. Further studies have to be conducted on these lines to investigate gender differences with larger sample size; on patients during the hospital stay; prior, during and following surgical procedures with more specific parameters included to confirm the mechanism of relaxation brought about by slow music. The present study should also be extended on patients under various types of stress as in spite of having several studies in these lines there is a need for more structured study due to several controversial results found till date.

The present study concluded that music of slow tempo is a good tool for relaxation following a bout of physical exercise. Slow music hastened the recovery of physical parameters like pulse rate and blood pressure. It also had an affective component in that it caused a subjective feeling of faster recovery from exertion when compared to no or fast music. The individual music preferences and gender difference had no significant influence on the effect of music on the relaxation time.

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