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Effects of Synchronous Music on Gymnastics' Motor Skills Performance among Undergraduate Female Students in Physical Education College

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Abstract**—**The present study aimed to investigate the effect of synchronous music in Gymnastics' motor skill performance among undergraduate female students in physical education college at Basra University. The researcher used experimental design. 20 female students of physical education divided equally into two groups, (10) experimental group with music, (10) control group without music. All participants complete 6 weeks in testing. Data analysis based on T-test shows significant difference at ($\alpha = 0.05$) in all skills level between experimental and control groups in favor of experimental group. Results of this study contribute to developing the role of synchronous music in improving gymnastic skills performance.

Keywords**—**Performance, motor skill, music, synchronous.

I. Introduction

SUCCESS in sports is the result of many years of extensive planning and preparation by coaches, clubs and other supporting partners. The most successful long term development programs are the result of full system integration and alignment, with all partners working together in the best interest of the participant. Music is a new concept in athletics and sports. It is one of the most effective instruments in training process, improving motor skills and abilities [1]-[4]. Music took an important role in providing a way for participants to have more fun and enjoyment while exercising. Many exercise programs today using motivation music to enhance the physical and psychological responses of the participants. Music has the potential to affects people in a variety ways. It can increase muscular energy, alter metabolism, influence heat rate, help to release emotions, relieve fatigue, reduced perceived exertion, enhanced work output, improved skill acquisition, speed recovery and healing after training and stimulate thinking, sensitivity, and creativity [5]. Over the past decades, growing body of research has proved that music enhances the development of physical skills and creative skill. Ayers [6] found music to reduce time taken to complete cycling laps during a 6- day race. In [7] it was found that music significantly influenced the distance walked. Simpson and Karageorghis [8] found that 400 m runners increased their speed when running in time to Music. Music reduced choice reaction time among tennis players in Bishop; and produced more positive psychological responses over no music [9]. Psychological benefits have been found to include improved feelings of pleasure or displeasure, enhanced mood and thought processes, and improved pre-task affect and mood [10]. Music has been associated with improved performance in short-duration physical activities, such as 60-yard sprinting [11], 400-metre running [8], grip strength [12], and the Wingate anaerobic test [13]. Performance improvements in long duration activities have also been shown in activities such as cycling [14]-[16], rowing ergometer [17], treadmill running [18], and treadmill Walking [9].

Some of the key features of research efforts to date include the benefits of using synchronous music in improving performance. It refers to the use of the rhythmic and temporal aspects of music to regulate movements. The synchronous use of music entails the conscious performance repetitive movements in time with its rhythmical elements such as the beat or tempo [9]. Researchers have consistently shown that synchronous music yields significant ergogenic effects in non–highly trained participants. Such effects have been demonstrated in bench stepping [19], cycle ergometer [20], callisthenic-type exercises [21], 400-m running [8], and in a multi activity circuit task [22]. Until very recently, however, research has been done on the effects of music aerobic and anaerobic exercise performance, but not much research has been done to see if music improves gymnastic performance. There is a growing interest in the effects of music upon gymnastic motor skills performance and, more specifically, synchronous music's effect upon gymnastic motor skills performance thus, this study try to addressed this gap in the literature by testing the effects of synchronous music on gymnastic skills performance.

A. Conceptual Framework

Terry and Karageorghis [23] developed a theoretical framework to predict the benefits of music specifically for sport and exercise applications, which is the model underpinning the current program of research (Fig. 1). The four key factors contributing to the motivational qualities of music were retained, according to their salience: rhythm, musicality, cultural impact, and associations. The first factor, rhythm response refers to the natural tendency to respond to rhythmical aspect of music, especially tempo as measured in beats per minute (bpm). The second factor, musicality, relates primarily to the harmony and melody of a musical track. The first two qualities mentioned are regarded as internal motivators because the preference for these comes from within an individual. The third factor, cultural impact, takes into

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account the popularity of a track or musical genre enjoyed by a specific culture or part of society and, fourthly, associations attributed to a musical piece from prior exposure and associated experiences is also thought to influence the listener's experience of the music. According to this model, the benefits to be yielded by careful selection of music are improved mood, arousal control, dissociation, reduced RPE, greater work output, improved skill acquisition, flow states and general performance enhancement.

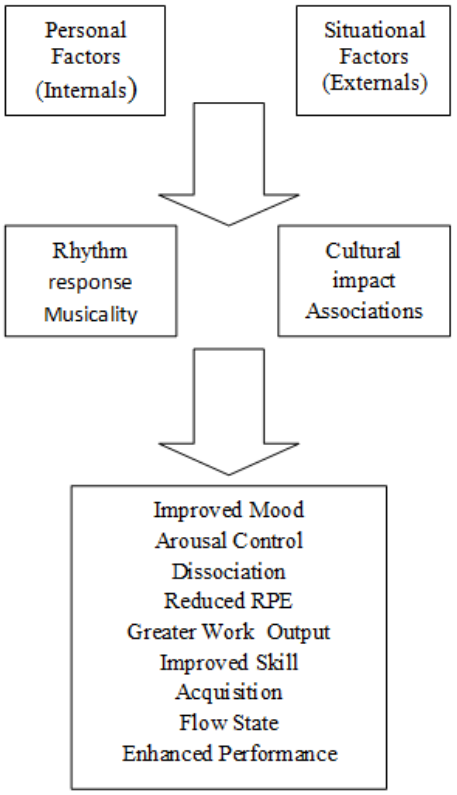

Fig. 1 Conceptual framework for benefits of music in sport and exercise settings

II. Materials and Methods

A. Participants

The subjects were 20 undergraduate female students, deliberate assigned from the school of physical education, University of Basra, in academic year 2013-2014, from second and third year. They were divided two groups equally experiment group and control group. The mean and stander deviation of age, height, weight and body mass index for experimental group are: 18.80 ± 1.13years, 159.0 ± 4.97cm, 57.0 ± 7.21kg and 22.5 ± 1.6 kg.m2 respectively. For control group are: 18.80 ± 0.78 years, 160.0 ± 4.42cm, 57.60 ± 4.35 kg and 22.5 ± 1.5 kg.m2 respectively.

B. Procedures

The ethical approval to conduct this study was taken from the ethics committee of Basra University. Experimental group attended course of training program in gymnastic motor skills with synchronous music, and control group took the same course of training program in gymnastic motor skills without music (silent). Subjects were informed about the risks and benefits of this project; agree to volunteer as subjects for this study. At the onset of the study, the participants were not informed about the purpose of the study; they were only told that the results would help trainers to develop better strategies for improving performance and methods of training. Each participant was required to exercise three days per week and the program extend for 6 weeks composed of 18 meeting.

C. Experimental Protocol

The researcher supervised an educational program depending on many references [24]-[26]. The educational program were devised in conjunction with specialist professors in Physical Education College, the researcher obtained their approval and recommendations to the principals and components of the program. The Protocol for Experiment:

1. First Week: The first and second meeting: general preparation with a focus in basic gymnastic movements. The third meeting: special preparation for gymnastic motor skills.
2. Second Week: The 4th and 5th meeting teaching front horizontal balance and forward somersault. The 6th meeting: teaching double forward roll with synchronous music.
3. Third week: The 7th and 8th meeting: review all the skills as a kinetics series joint with connection moves. The 9th meeting: teaching handstand to double forward roll with synchronous music.
4. Fourth week: The 10th and 11th meeting: teaching cartwheel. The 12th meeting: teaching double cartwheel with synchronous music.
5. Fifth week: The 13, 14 and 15th meeting: teaching all the motor skills as a kinetics series with synchronous music.
6. Sixth week: The 16 and 17th meeting: review all the motor skills as a kinetics series with synchronous music. The 18th meeting: test the experimental group in kinetics series with synchronous music.

All the subjects in control group had been given the same number of meetings and motor skills but without music.

III. Result

It was hypothesized that would be significant differences in all gymnastic motor skills performance with synchronous music and no music conditions. Independent T-test was used to determine the differences between the experimental group (training with synchronous music) and control group (training without music) in posttests. Table I shows the results of mean and stander division for the two conditions.

The results as shown in Table I indicated that participants in the experimental group report statistically significant differences in comparison with control group (tabulated T value at the level of (α= 0.05) = 1.96). Results proved that experiment group (training with synchronous music) record significant differences in front horizontal balance and forward somersault, double forward roll, handstand to double forward

roll, and double cartwheel (M=8.82±0.31, M=8.64±0.17, M=8.76±0.27, M=8.67±0.27) in comparison with control group (training without music) (M=7.71±0.36, M=7.58±0.22, M=7.23±0.62, M=7.40± 0.60) respectively.

TABLE I
MEAN AND STANDER DIVISION OF GYMNASTIC MOTOR SKILLS FOR EXPERIMENT AND CONTROL GROUP

Motor Skills	Experimental Group		Control Group		T	Sig
	Mean	SD	Mean	SD		
Front Horizontal Balance and Forward somersault	8.82	0.31	7.71	0.36	7.29	0.0001*
Double Forward Roll	8.64	0.17	7.58	0.22	11.8	0.0001*
Handstand to Double Forward Roll	8.76	0.27	7.23	0.62	7.03	0.0001*
Double Cartwheel	8.67	0.27	7.40	0.60	6.02	0.0001*

**p < .05. **p < .01

IV. DISCUSSION

The purpose of this study was to determine the effects of synchronous music in gymnastic skills performance. The results indicated that current research approved that synchronous music have significant effect in gymnastic motor skills performance. Therefore, finding of this study highlighted the importance of synchronous music in enhancing gymnastic skills performance; a notion that is entirely consistent with previews studies which consistently demonstrated the ergogenic effects of synchronous music in activities such as 400 m running [8], and treadmill walking to exhaustion [9]. This finding corroborates the theory of [27], which suggested that that the main benefits athletes might derive from synchronous music would be (a) extended work output through synchronization of music with movement; (b) enhanced acquisition of motor skills when rhythm or association is matched with required movement patterns; (c) dissociation from unpleasant feelings such as pain and fatigue; (d) reduced ratings of perceived exertion (RPE) especially during aerobic training; (e) increased positive moods and reduced negative moods; (f) pre-event activation or relaxation; (g) increased likelihood of athletes achieving flow states; and (h) enhanced performance via the above mechanisms. Music is more likely to utilize an ergogenic effect when there is the possibility for it to influence voluntary performance as in a gymnasium-type "workout" rather than a strictly-controlled exhaustive effort [28].

Strong evidence was found when researchers reported that auditory rhythmic stimulation maybe beneficial to enhance individual motor performance [29]. Synchronous music occurs to improve athletes' ability to extend their potential distance, enhance the acquisition of motor skills [23].Many research has shown the efficacy of synchronous music as an ergogenic aid in aerobic activities such as cycle ergometer [30]. Fitness experts and coaches encourage synchronization of movement with music tempo to increase enjoyment, reduce perceptions of fatigue, and encourage more effort from exercisers [3], [10]. Sport organizers agree that music create an atmosphere of excitement, and motivation emotions [31], [32]. There is a neuropsychological explanation for the proposed benefits of synchronous music during exercise and physical activity. The supplementary motor area of the brain plays an important role in both the perception of musical rhythm and the rhythmic ordering of motor tasks [33]. Music release endorphins in the blood which gives the strength, confidence, happiness, wellbeing, reduce depression and anxiety, and reduce the pain by stopping the signals and the athlete is able to work for more time even after his threshold limit is over [34], [35].

The demonstrated improvements in physical performance associated with music would most likely accrue as a result of the combined effects of beneficial psychological responses, reduced perceived exertion and improved physiological efficiency. When comparing exercise to music with the same work output completed without music, physiological benefits have included lower HR [36], lower systolic blood pressure and blood lactate production [37], and reduced oxygen consumption [38], all of which should logically contribute to improved physical performance. Compared to silence, it has been shown that relaxing music facilitates recovery from psychologically stressful activities by reducing the production of cortisol, the stress hormone. Khalfa et al. [39] indicate that music may be an effective component of stress management programs. Another mechanism by which music provides beneficial outcomes to athletes and exercisers is via the process of synchronization of music and movement. Producing movement that is in perfect synchrony with the regular, distinctive beat of a piece of music appears to create sensations that extend beyond prosaic feelings to border on a spiritual experience. Exercisers report intense pleasure that comes from working in harmony with musical rhythm, Synchronization of music and movement provides a powerful motivator to continue [40]-[42].

The extent of potential performance enhancements has been exemplified recently by the findings of [9] which showed that time-to-exhaustion when exercising synchronously to motivational music was 15% longer than without music and 6% longer than with neutral music, and those of Terry et al. [43] who showed that elite athletes increased their time-to-exhaustion during treadmill running by 18.1% and 19.7% respectively when running to synchronous motivational and neutral music compared to no music. It seems plausible that music produces what might be termed movement contagion where listeners "catch" the rhythms inherent in a tune and reproduce them in their own movement. In the context of physical activity, this might result in a listener replicating rhythms that are fast, powerful, persistent, or driving; all qualities associated with superior physical performance [3], [44].

V. CONCLUSION

The purpose of the current research was to investigate the effects of synchronous music on gymnastic motor skills performance among undergraduate female students in Physical Education College. The hypothetical outcome was that gymnastic motor skills performance would be superior when performance in time to music than without music. The result from this study may have potentially yielded evidence that

synchronous music has significant positive effects in skills performance.

This study could be taken in few further directions. The first is being a larger more diverse sample size. It could be interesting also to look at different stages in school (primary, intermediate, and high school). This leads to the question of the potential effects of music in developing the curriculum of physical education as training and teaching method.

The possibility of detection elite character among students could be existed because music has been found to successfully distract an individual away from their perceived exertion during exercise. This could serve to push the exerciser post their individual limits, improving adherence, and efficiency. This would be another interesting further area of research. However, there is limited research and specific theory underling use of synchronous music rendering this fruitful area for further investigation.

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