

Warning: Exercise May Damage Your Hearing

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Abstract Little research exists on hearing health of individuals using cardiovascular entertainment (CE) systems while exercising. The authors have previously researched and discovered patrons of a fitness center voluntarily prefer volume settings above the recommended safe hearing levels. The purpose of this study was to investigate preferences for volume settings of CE systems within the environment of a university fitness center when hearing health warning signs are posted. Participants (N=104) completed a cardiovascular workout while listening to music and/or television on a CE system with earphones. All participants exceeded the manufacturer's suggested volume setting levels while hearing health warning signs were posted, thus endangering hearing health.

Keywords Exercise, Hearing Loss, Cardiovascular, Fitness, Health Clubs

1. Introduction

Exposure to excessive sound intensity levels has been directly related to an increased risk for hearing loss[1]. Approximately 26 million adult Americans have "high frequency hearing loss due to exposure to loud sounds or noise at work or in leisure activities"[2]. Noise can be measured by frequency, measured in Hertz (Hz), and intensity pressure, measured in decibels (dB). Normal conversational speech is generally measured to be 60 to 70 decibels[3]. If the auditory system is exposed to excessive sound intensity levels, the normal ear may experience hearing loss. Loud noise in excess of 85 dB can cause permanent hearing loss[4].

Young people are progressively showing increasing symptoms of hearing damage such as distortion, tinnitus, hypersensitivity to sound, or loss of hearing (commonly referred to as noise-induced hearing loss or NIHL)[5]. Tinnitus, ringing in the ears, may be a symptom of permanent hearing damage[6]. Unlike many tissues in the body, hair cells and nerve fibers of the ear do not regenerate when damaged[7]. Tinnitus is a common hearing condition, especially in those exposed to excessive and constant sound[4].

Concern is expressed in[8] for musicians and others working in the entertainment and sports industry by

referring to the negative effect of sound intensity on hearing as a 'music-induced hearing loss' (MIHL). Music has long been an important component of the fitness culture. Mechelle Meadows[9], a Certified NASM Performance Enhancement Specialist, stated "when it comes to exercising, sometimes the music selections are just as important as the physical activity." Music can positively influence exercise motivation[10]. In fact, as found in[11], up-tempo, loud music may positively affect exercise performance.

Even though exercise performance may be enhanced, loud music may affect hearing health. According to[12], NIHL may occur when the sound intensity level is above 85 dB. Yet, as found in[13], "portable music players are capable of producing sound levels ranging...from 60 to 120 decibels (dB). With the volume approximately one-quarter of the way up, you hear about 85dB...with the volume all the way up, you could hear about 120 dB" (p. 1). One-hundred and twenty dB is consistent with the sounds of a chain saw or ambulance siren[2].

With 48% of U.S. adults believing that they have suffered some hearing loss[14], appropriate sound intensity levels of music has become a current health issue for those in the fitness industry. Music is a vital part of American culture; but if it is played too loud, music can have lasting negative effects on hearing. Employees of nightclubs may also be at a higher risk of NIHL due to their repeated exposure to music and noise above the suggested limit of 85 dB[8].

Gymnasiums, fitness centers and health clubs are increasingly becoming environments of hazardous noise exposure. In 2006, the American-Speech-Language Hearing

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Association listed health clubs as environments that commonly exceed the desired decibel level of 85 dB. Audiology experts have recommended that the maximum amount of time a person should spend listening to music through earphones is 15 min at 115 dB, which is roughly equivalent to the sound intensity levels at a fitness center or health club[13].

The sound intensity of music when set at 90 dB and maintained throughout an aerobics class supported the idea that prolonged exposure could cause permanent hearing damage[15]. Yaremchuk and Kaczor measured noise levels in 125 aerobic classes. Readings were collected every five minutes using a portable sound level-meter. Noise levels ranged from 78 dB to 106 dB. Seventy-nine percent of the readings measured between 90 and 98 dB with six readings above 100 dB. The study concluded that a majority of the aerobic classes tested were significantly above the recommended 85 dB level. Interestingly, in the classes that exceeded 100 dB the instructor used a microphone to amplify voice commands[16]. Another study conducted by[17] reiterated previous studies that a typical group exercise class can repeatedly exceed the recommended decibel level.

The effects of earphone volume levels of 104 participants utilizing a cardiovascular entertainment system while exercising were studied. The study found participants voluntarily set the volume level control higher than the manufacture recommended level, thus participants may be at risk for hearing loss. Thus, personal use of CE Systems may also be a significant risk factor for NIHL[18].

[18] confirms the paucity of research in hearing health education in fitness facility administrators and their patrons. Thus, this research study investigated the effects of hearing health warning signs on volume levels voluntarily set by participants utilizing CE systems. Another purpose of the study was to compare gender differences.

2. Methodology

The participants in this study were individuals utilizing a fitness center on the campus of a rural, midwestern university in the United States. A convenience sample of 104 volunteers (52 females and 52 males) was selected at random. Participants completed a cardiovascular workout using a treadmill or cross trainer, while listening to a CE system (Cardio Theater®) with earphones.

The CE system was utilized for a post-test assessment of individuals' preference to volume levels while exercising on cardiovascular equipment. According[19], Cardio Theater's creators state that "Cardio Theater's full line Exercise Entertainment™ systems enable health club members to listen to individually selected audio-visual entertainment choices while exercising on cardiovascular equipment". CE systems acquire sound from multiple televisions or individual units mounted on fitness equipment and then transfer that sound to cardiovascular machines that may be

accessed with the use of personal earphones. The volume controls were located on each cardiovascular machine and were fully controlled by the individual exercising on that particular machine. Each volume control relayed sound from a corresponding LG® Infinia plasma television to the participant's earphones. Warning signs were posted on each television. Apple® MA662G/B earbuds were chosen as the earphones for each participant because of compatibility with the CE system and consistency of sound quality relaying from the high definition output to each participant. The Apple® earbuds were directly inserted into the volume setting controls.

The default volume control on each cardio fitness machine was set at a volume level of two (66 dB) as determined by the CE system manufacturer. The CE system manufacturer suggested that the volume setting should not be set beyond a volume setting of six (85.26) to ensure hearing health. Each cardio fitness machine contained the same volume control setting. The maximum volume setting on each machine was level sixteen (111.91 dB).

Each participant was exposed to a hearing health warning label that was placed on every television choice urging participants to not exceed the recommended volume setting to ensure hearing health.

Participants were randomly tested over a duration of three weeks. Maximal volume levels were recorded at the end of each exercise session, and means were recorded for the whole group and by gender while being compared to a previous study that did not expose participants to hearing health warning labels.

3. Results

The group volume setting mean of 9.82 greatly exceeded the volume setting level suggested by the CE system manufacturer (level 6). Mean, median, and mode of voluntary volume setting levels by group and gender are recorded in Table 1.

Table 1. shows the average (mean) volume setting, middle volume setting and most common (mode) volume setting by gender and a total group

Mean, Median, and Mode of CE System Voluntary Volume Setting Levels by Gender			
	Female (n=52)	Male (n=52)	Group (N=104)
Mean	9.73	9.92	9.82
Median	10	10	10
Mode	10	12	12

When compared to the previous hearing health volume setting study by[20] without exposure to hearing health warning labels, volume setting means were less when warning labels were present although volume settings were still above the recommended safe hearing health volume levels as illustrated in Figure 1.

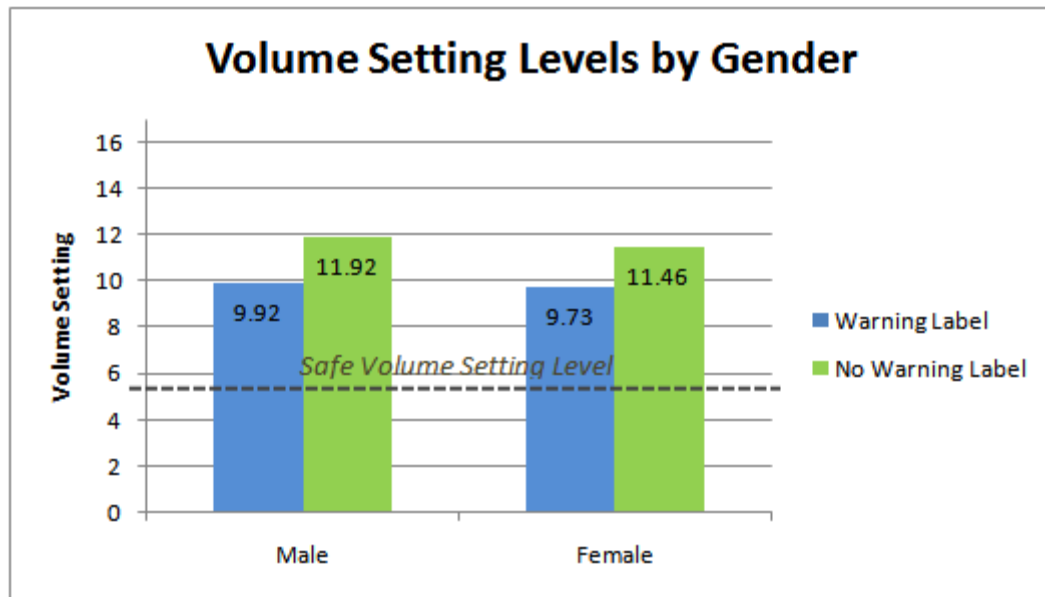


Figure 1. illustrates the volume setting levels of participants by gender that were exposed to a hearing health warning label and participants that were not exposed to a hearing health warning label. The highest safe hearing health volume level (6) is also noted by the dotted line

3.1. Discussion

The results of this study revealed that participants who utilized a CE system while exercising and being exposed to hearing health warning labels still exceeded the manufacturer's suggested volume setting levels, thus endangering hearing health. Even though volume setting levels were lower when hearing health warning labels were present, a danger still exists. According to [1], "Long or repeated exposure to sounds at or above 85 decibels can cause hearing loss" (p. 1). Popular CE systems are viewed as 'must haves' for providing a positive fitness experience for patrons [21]. Although wellness center and health club staff should not be expected to monitor the patrons' use of personal listening devices such as iPods, MP3 players, smartphones, or radio devices, the use of earphones with the CE systems should be identified as a possible hearing health risk. Listening to music, through earphones, while engaging in exercise is considered 'basic gym gear' for most fitness patrons, and the trend will most likely continue [22]. Music can positively influence exercise motivation with louder music corresponding with higher exercise performance [11,10]. Exercise has been linked to improved health [23]; yet, using a high volume level on earphones may somewhat counter this improvement by contributing to negatively altered hearing. Exercise has also been recommended to reduce a person's risk of hypertension and depression [23], but exposure to loud noise can contribute to hypertension and other health problems [24].

The ACSM has recommended engaging in aerobic activity for at least 30 minutes a day on most days of the week plus resistance and flexibility training for two to three days per week [23]. This recommendation may inadvertently encourage exercisers to listen to loud music for long periods of time which may affect their hearing. Fitness center and

health club patrons should be informed of appropriate sound levels related to music and volume controls [25] as we did have a decrease when warning labels were present.

3.2. Conclusions

As suggested in [17], administrators should closely monitor the volume level on music within the facility in order to assure sound level for its patrons. Professionals within health and wellness along with fitness directors should take a more active role and collaborate with audiologists to educate fitness administrators and fitness center patrons concerning the increased risk for hearing loss when CE systems are played above the suggested volume setting levels [17]. Further education needs to be presented to patrons that also use their own personal hearing devices concerning hearing health. CE system manufacturers should consider noting a hearing health warning on their products as suggested by [18]. Furthermore, hearing health warning labels easily viewed by patrons should be strongly considered by fitness and health club administrators. Although volume setting levels still exceeded the recommended levels, the volume setting levels did decrease when warning labels were present.

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