



PHYSIOLOGICAL RESPONSES OF ZUMBA: AN OVERVIEW UNDERSTANDING THE POPULAR FITNESS TREND

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ABSTRACT

Physical inactivity is a commonly observed cause of increasing incidence of lifestyle diseases. As dancing is a physical activity that can be tailored to fit a target population's age and culture therefore, zumba is becoming a global dance fitness activity to reduce lifestyle disease epidemic. It has a mixture of popular entertaining music, different dance styles and aerobic exercises which improves the health of all age groups. Thus, physiological effects of zumba can be used as adjuncts to conventional medicine for prevention of various lifestyle diseases e.g. diabetics and obesity. Several neurological benefits of zumba have been identified which ranges from memory improvement to strengthened neuronal connections. Zumba is able to enhance cardio vascular endurance and cardio respiratory functions. It incorporates movement of large muscle groups for aerobic endurance, strength training and flexibility thereby contributing to improved health in all ages, especially in the geriatric population. It also maintains bone density and prevents osteoporosis in postmenopausal women. Various researchers have recorded the positive effect of Zumba on weight, BMI, body fat mass, hormonal profile and reproductive function. Psychosocial aspect of health also shows encouraging results in Zumba intervention. To summarize, these findings reflect that Zumba intervention can be explored further as a therapeutic tool in Complementary and alternative medicine for improving health and preventing lifestyle diseases.

Keywords: Zumba, Musculoskeletal, Psychosocial, Geriatric, cardio vascular endurance

1. INTRODUCTION

Zumba is a global dance fitness program focused on whole-body rhythmic movements which fuses fitness and entertainment. It was designed by Alberto "Beto" Perez during the 1990s (Lloyd, 2011) and involved Latin dance, Aerobic exercises, Hispanic music, Latino music and a mixture of pop music. It has gained much popularity in the last two decades. Zumba is chosen as review domain as it is gaining rapid popularity especially in youngsters. Its motto is "Ditch the workout. (Join the Party. Parcher A., Zumba website). There are a wide variety of Zumba classes targeting specific participant groups, including children and elderly persons (Parcher A., Zumba website). The goals of Zumba are to improve strength, balance, coordination and cardiovascular endurance (Parcher A., Zumba website). Dimondstein (1985) states that, "The practice of making dance an adjunct of physical education has placed it in the same category as athletics or physical skills. Zumba although dance orientated is perceived as a physical exercise activity. This paper reviews the understanding of the popular novel emerging discipline Zumba which can be used worldwide as non-pharmacological form of promotive and preventive measure for various life style diseases. To summarize, the purpose of the current review was to examine the effectiveness of Zumba in improving the physical health of all, both those with health conditions and those considered healthy.

1.1 Zumba : Dance intervention

Approximately 15 million people take weekly Zumba classes in over 200,000 locations across 180 countries. Zumba classes are typically 45 minutes-1 hour long and are taught by instructors licensed by Zumba Fitness, LLC. The exercises include music with fast and slow rhythms, as well as resistance training. The music comes from the following dance styles: Cumbia, Salsa, Merengue, Mambo, Flamenco, Chachacha, Reggaeton, Soca, Samba, Hip hop music, Axé music and Tango. Squats and lunges are also included in it. There are nine different types of classes for different levels of age and exertion. Zumba Gold is a program designed for the needs of the elderly. Zumba Step is a lower-body workout that incorporates Zumba routines and step aerobics with Latin dance rhythms. Zumba Toning is for the people who do their workouts with toning sticks. Zumba Toning will target the abs, thighs, arms, and other muscles throughout the body. Zumba Toning provides participants with a cardio workout and strength training. Aqua Zumba classes are held in a swimming pool. The instructor leads the class poolside while participants follow in shallow water. Moves have been specially adapted to combine the same dance movements used in a Zumba Fitness class with those used in aqua fitness classes. Zumba in the Circuit combines dance with circuit training. These classes usually last 30 minutes and feature strength exercises on various stations in timed intervals. Zumba Kids and Zumba Kids Jr. classes are designed for children between the ages of 4 and 12. Zumba Sentao is a chair workout that focuses on using body weight to strengthen and tone the body. Strong by Zumba was launched in 2016. This specialty combines high intensity interval training with Synced Music Motivation (Wikipedia: Zumba).

1.2 Zumba: Physiological Mechanism

Zumba involves dance and aerobic exercise performed to energetic music. Convincing benefits of dancing activities on physiologic, endocrine, cognitive and psychological levels have previously been shown (Kattenstroth, J.C.; et.al. ; 2013, Belardinelli, R 2007, Kim, S.H.et.al.; 2011, Shimamoto, H.; 1998, Murrock, C.J.; 2014, Coubard, O.A.; et.al.; 2011, Duberg, A.; et.al.; 2013). Several studies revealed improved fitness, weight loss, reductions in cholesterol levels or inflammatory markers in women at risk after various forms of aerobic dancing Shimamoto, H.; et.al.; 1998, Gillett, P.A.; et.al.,1987, Murrock, C.J.; Gary, F.A. ; 2010, Gullu, E.; et.al.; 2013, Okura, T.; et.al. ; 2007, Mosher, P.E.; et.al, 2005, Williford, H.N et.al. 1998) including "aerobics", "step aerobics" and "cultural dances". Zumba as a type of fitness dance that combines Latin rhythms and aerobics has rapidly reached tremendous popularity lately (Thomson, W.R., 2012). Among the recognized benefits of doing regular aerobic exercise are: (Aerobic exercise: the health benefits. 2010.)

- Strengthening the muscles involved in respiration, to facilitate the flow of air in and out of the lungs
- Strengthening and enlarging the heart muscle, to improve its pumping efficiency and reduce the resting heart rate, known as aerobic conditioning
- Improving circulation efficiency and reducing blood pressure
- Increasing the total number of red blood cells in the body, facilitating transport of oxygen
- Improved mental health, including reducing stress and lowering the incidence of depression, as well as increased cognitive capacity .
- Reducing the risk for diabetes and lowering Hb A_{1c} levels for type 2 diabetics. (Snowling, N. J. ; Hopkins, W. G. ; 2006)

- As a result, aerobic exercise can reduce the risk of death due to cardiovascular problems. In addition, high-impact aerobic activities (such as jogging or using a skipping rope) can stimulate bone growth, as well as reduce the risk of osteoporosis for both men and women. In addition to the health benefits of aerobic exercise, there are numerous performance benefits: (Snowling, N. J. ; Hopkins, W. G. ; 2006)
- Increased storage of energy molecules such as fats and carbohydrates within the muscles, allowing for increased endurance
- Neovascularization of the muscle sarcomeres to increase blood flow through the muscles
- Increasing speed at which aerobic metabolism is activated within muscles, allowing a greater portion of energy for intense exercise to be generated aerobically
- Improving the ability of muscles to use fats during exercise, preserving intramuscular glycogen
- Enhancing the speed at which muscles recover from high intensity exercise
- Neurobiological effects: improvements in brain structural connections and increased gray matter density, new neuron growth, improved cognitive function (cognitive control and various forms of memory), and improvement or maintenance of mental health.(Aerobic exercise', Food and Fitness: A Dictionary of Diet and Exercise, Michael Kent, Oxford University Press, 1997).

Various researchers suggest that aerobic group exercise classes e.g. cycling, tabata, and Zumba taken regularly are effective in controlling weight, blood pressure, and body composition. (Delextrat.; 2016; Faulkner.; et al.; 2015; Lbujojevic.; et al., 2016; Tabata.; 1996; Thompson, 2016). Acute short term physiological responses to aerobic exercise include increased heart rate, blood pressure, breathing rate, and tidal volume. Long-term aerobic exercise participation is proven to increase the amount of maximal oxygen consumption during intense aerobic exercise (VO₂ max), lower resting blood pressure and heart rate, lower body fat mass, and increase muscle mass, while low levels of cardiovascular fitness are associated with increased risk of premature death (Ehrman.; et al.; 2009). Hence, Aerobic exercise plays an important role in decreasing the risk of cardiovascular disease (CVD), pulmonary diseases, and metabolic diseases (Pescatello; Arena; Riebe; Thompson; 2013). Both aerobic dance and Zumba incorporate large muscle groups for movement during class for aerobic endurance, strength training and flexibility. Exercise will also help to regulate hormonal changes during menopause (Eshbach.; 2016) and it reduces back pain, limit body weight gain and fat retention post pregnancy, (Ehrman et al.; 2009).

As Zumba is a form of aerobic exercise therefore, above mentioned physiological effects may be seen in Zumba dancers. These physiological benefits can be used as an alternatives or adjuncts to conventional medicines (Complementary and alternative medicine, CAM) for prevention of various diseases as well as promotion of health.

1.3 Zumba : Physiological effects on Human Body

1.3.1 Effect on Nervous System:

Various researchers began to investigate neurological effects of dance which requires complex mental coordination synchronizing music and movement. Dance constitutes a pleasurable intervention where brain's reward centers are stimulated by music and sensory motor circuits are activated by dance.

Studies using PET imaging have identified regions of the brain that contribute to dance learning and performance. These regions include the motor cortex, somatosensory cortex, basal ganglia, and cerebellum. The motor cortex is involved in the planning, control, and execution of voluntary movement. The somatosensory cortex, located in the mid region of the brain, is responsible for motor control and also plays a role in eye-hand coordination. The basal ganglia, a group of structures deep in the brain, work with other brain regions to smoothly coordinate movement, while the cerebellum integrates input from the brain and spinal cord and helps in the planning of fine and complex motor actions (Brown 2006; Calvo-Merino B; 2008 Cruz-Garza J. G.; 2014).

While some imaging studies have shown which regions of the brain are activated by dance, others have explored how the physical and expressive elements of dance alter brain function. For example, much of the research on the benefits of the physical activity associated with dance links with those gained from physical exercise, benefits that range from memory improvement to strengthened neuronal connections. Dance therapy is a creative arts therapy that has been defined by the American Dance Therapy Association as “the psychotherapeutic use of movement to further the emotional, cognitive, physical, and social integration of the individual.” (American Dance Therapy Association. 2013) Cross-sectional studies have shown that older adults who dance on a regular basis have greater flexibility, postural stability, balance, physical reaction time, and cognitive performance than older adults who do not dance on a regular basis. (Kattenstroth JC.; 2011) Zumba improves cognitive skills, such as visual recognition and decision-making. Hufner; et. al.; (2011) stated that

long-term balance training with its extensive vestibular, visual and sensorimotor stimulation is associated with altered hippocampal formation volumes in professional ballet dancers and hippocampus is crucial for long-term memory consolidation, learning and spatial navigation, but also for balancing. In addition, dance is included in the interdisciplinary field of neuroaesthetics, which unites the various forms of artistic expression and the neuroscientific examination of how the human brain perceives processes and executes various arts, such as dance. (Yarrow K.; 2009; Fairhall S. L.; 2008) Neuroaesthetics researchers have focused on how dance training affects the human mind in terms of the intrinsic workings of the human brain's neural architecture and the forces underlying the coordinated patterns of activity that support the thought, reasoning, action, and emotion that are involved in dance (Yarrow K.2009; Stevens C. 2010; Blasing B. 2012; Grosbras M.-H.2012; Cross E. S.2011; Cruz-Garza J. G. 2014). By neuroaesthetics studies neuroscience researchers can investigate the integration of the sensorimotor functions (Haggis J., 2010) elements of aesthetics (Cross E. S., 2011; Calvo-Merino B., 2008) and emotion (Sawada M., 2003) that arise from dance. To summarize, Dance form like Zumba seems a promising intervention for neuroplasticity in nervous system.

1.3.2 Effect on Cardio-respiratory System:

The first studies on Zumba revealed its sufficiency as a training method that is able to enhance cardio respiratory fitness (Luettgen, M.; 2012, Otto, R.M.; 201). The cardiovascular benefits of dance have been observed through aerobic dance forms such as Zumba (Jitesh. S.; et al.; 2016). The volunteers were made to practice zumba dance for two months and the variation in the blood pressure were evaluated. This study verified that blood pressure is altered by Zumba dance among hypertensive patients. Another study looked at the changes in aerobic fitness with Zumba performance (Delextrat.; Warner.; Graham.; Neupert.; 2016). It suggests that the Zumba participants showed a greater increase in VO₂ max.

Anja Rossmessl et. al. (2016) assessed the feasibility and effect of a 12-week Zumba Beat dance intervention on cardio respiratory fitness. Postmenopausal women with a body mass index (BMI) >30 kg/m² or a waist circumference >94 cm who were not regularly physically active were asked to complete a 12-week Zumba Beat dance intervention with instructed and home-based self-training sessions. Before and after the intervention, peak oxygen consumption (VO₂peak) was assessed on a treadmill. There was no apparent change in VO₂peak after the 12-week intervention period. The study concluded that 12-week Zumba Beat dance intervention may not suffice to increase cardio respiratory fitness in postmenopausal women.

A pilot study conducted in a population of middle-aged obese women with metabolic syndrome reported improvements in systolic and diastolic blood pressure after a 12-week intervention (Araneta. M. R.; Tanori. D.; [2005]).

Zumba is considered more technical than running and spinning, thus the inexperienced Zumba subjects exercised at a lower %HR max. Zumba is the only exercise session where the subjects had a significant correlation of 0.5-0.6 between rating of perceived exertion (RPE) and %HR max, accelerometer counts, and energy expenditure (EE). Zumba was perceived 18.8 to 23.3% less exhaustive. (Kjell Hausken.; Sindre M.; Dyrstad.; 2013)

As Zumba dance helps to reduce blood pressure in hypertensive patients therefore, it can be recommended as adjuvant therapy with regular hypertensive medication. (S.Jitesh et. al.; 2016) To conclude, Zumba dance intervention improves cardiovascular endurance and cardio-respiratory function.

1.3.3 Effect on Musculoskeletal System:

Researchers have shown that Zumba reduces neck-shoulder pain in the setting of a workplace intervention (Barene, S.; 2014). In young normal weight females, Zumba improves trunk strength endurance and balance (Donath, L.et.al.; 2014). Similarly resistance training, high intensity aerobic exercise and outdoor sports activities have beneficial effects on the musculoskeletal system (Paffenbarger RS.; Blair SN.; Lee IM.; 2001; Warburton DER.; Nicol CW.; Bredin SSD.; 2006.; Welsh L.; Rutherford O.; 1996.; Schuenke M.; Mikat R.; McBride J.; 2002, Borer KT.; 2005). Some of the benefits are described below:

1.3.3.1 Increased Lean Muscle and Bone Density

Exercise increases lean muscle mass which has numerous advantages e.g. improved energy metabolism, improved vascularity, improved posture, and improved support to the skeletal framework. Furthermore, exercise has also been shown to strengthen muscles and improve balance and co-ordination. These effects reduce the risk of falls and fractures especially in the elderly and contribute towards improved health. (Borer KT.; 2005)

Physical activity, esp. weight bearing exercise (resistance training) has been shown to be beneficial to bone health (Borer KT.; 2005). Exercise not only stimulates bone growth and the accumulation of minerals but also prevents osteoporosis in later life (Borer KT.; 2005; B+@rard A.; Bravo G.; Gauthier P.; 1997). Borer, in his study on neurohormonal influences on exercise induced growth, observed that high resistance training expresses

a 'growth gene' in the tissues exercised and this occurs without the intermediation of growth hormone or in the absence of abundant nutrients (Borer KT.; 1994).

Brisk walking (above 6.14 k/h and heart rate: 82.3% of age-specific maximum) provides sufficient mechanical loading on the bones to maintain bone density and prevent osteoporosis in postmenopausal women (Budgett R.; 1990).

Similarly, high impact aerobic activity was shown by Welsh and Rutherford to preserve bone density, in addition to strengthening muscles in postmenopausal women and men over 50 (Welsh L; Rutherford O.; 1996).

1.3.3.2 Strong and Supple Joints with Improved Joint Range of Motion

Exercise acts as the primary stimulus for production of synovial fluid and regular physical activity thus ensures healthy joints. Increased production of synovial fluid keeps joints well oiled, resistant to friction and makes them supple. This, combined with exercise induced improvements in suppleness of ligaments, contributes to an improved joint range of motion.

Mobility exercises like 'little circles' with arms or knees for mobilizing shoulders and knees respectively in dance interventions cause secretion of synovial fluid with resultant improvement in joint range of motion.

1.3.4 Effect on Body Weight and BMI:

A study done in two Bosnian universities showed that Zumba was effective in lowering body fat mass in women participating in the class for three times a week, for eight weeks (Ljubojevic; Jovanovic; Zrnic; Sebic; 2016).

A pilot study conducted in a population of middle-aged obese women with metabolic syndrome reported weight reductions of 2.07 pounds on average, as well as improvements in fasting triglycerides after a 12-week Zumba intervention (Araneta, M.R.; Tanori, D.; 2015).

Quite recently, studies also started to examine aspects of motivation, self-perceived fitness and autonomy. (Krishnan, S.; et. al.; 2015; Delextrat, A.A.; 2015). One of these studies found enhanced intrinsic motivation associated with fitness improvements, as well as reductions in body weight and fat mass after 16 weeks of Zumba dance in obese middle-aged women (Krishnan, S.; et.al. 2015).

Furthermore, Zumba is considered more technical than running and spinning, thus if the goal is maximum calories burned or maximum aerobic fitness, then, beginners should choose simpler exercises such as running or spinning. (Kjell Hausken; Sindre M. Dyrstad; 2013). Zumba has been shown to reduce fat mass and improve aerobic fitness in the setting of a workplace intervention (Barene, S. et. al.; 2014). The study which examined the exercise intensity of Zumba was conducted at Adelphi University (Otto et al.; 2011). It reported caloric expenditure during Zumba to be between 6.6 and 7.4 Kcal·min⁻¹ depending on the particular dance style being performed. Therefore Zumba may be promoted as a lifestyle intervention in reducing weight, BMI and incidence of obesity.

1.3.5 Effect on Reproductive System:

Several studies have shown that physical activity improves hormonal profile and reproductive function. These improvements include a decrease in abdominal fat, blood glucose, blood lipids and insulin resistance, as well as improvements in menstrual cyclicity, ovulation and fertility, decreases in testosterone levels and Free Androgen Index (FAI) and increases in sex hormone binding globulin (SHBG). Exercise will also help in controlling symptoms of menopause, including hot flashes, fatigue, weight gain, joint aches and pain, sleep disturbances, loss of bone density minerals, and depression and anxiety in elderly (Eshbach.; 2016).

In a study on dance labor group, women were instructed to do standing upright with pelvic tilt and rock their hips back and forth or around in a circle while their partner-who was instructed to stand in front of them, massaged their back and sacrum for a minimum of 30 minutes. During these movements, participants were instructed to rest their arms on their partner's shoulders. Women in this group were instructed to remain upright at least for 30 minutes to record pain score. Dance labor, which is a complementary treatment with low risk, can reduce the intensity of pain and increase the satisfaction of mothers with care during the active phase of labor. (S. Abdollahian et. al.; 2014). These studies suggest that physical activity like Zumba may improve reproductive health.

1.3.6 Effect on Endocrine System:

Ballet dancers and highly trained runners of either sex demonstrate suppression of gonadal function caused by chronic HPA activation. These subjects have increased evening plasma cortisol and ACTH levels, increased urinary free cortisol excretion, and blunted ACTH responses to exogenous CRH; males have low LH and testosterone levels, and females have amenorrhea. (Luger A, 1987;. Beitins IZ. 1986; Brooks-Gunn J, 1985)

Exercise initiates an endocrine response through activation of the sympathetic system in a feed-forward manner by the motor centre in the brain which is reflected by the increases in sympathoadrenal

activity. Exercise also leads to an increase in the production and release of growth hormone, testosterone, adrenocorticotrophic hormone, cortisol and prolactin that each has local and systemic effects (D Ball - 2015). This suggests effects of dance and exercise on the major endocrine axes in the body. Therefore further studies are needed to explore the effect of zumba on endocrine health.

1.3. 7 Effect on Psychosocial Health:

Multiple studies have also shown that the energetic dance class is effective in increasing psychological well-being and quality of life for women (Delextrat et al.; 2017; Nieri & Hughes, 2017). In young normal weight females, Zumba improves fitness and quality of life (Donath, L.; 2014). Similarly Anja Rossmeissl et. al. (2016) assessed the feasibility and effect of a 12-week Zum Beat dance intervention on psychosocial health. Postmenopausal women who were not regularly physically active were asked to complete a 12-week ZumBeat dance intervention. Before and after the intervention, several psychometric parameters (including quality of life, sports-related barriers and menopausal symptoms) were investigated. Result suggests quality of life had increased, and sports-related barriers had decreased. A 12-week ZumBeat dance intervention may increase women's quality of life. To summarize, Zumba is an exercise fitness program which can help in improving psychosocial health.

1.3. 8 Effect on Geriatric Health:

Dance has been found to be therapeutic for patients with Parkinson's disease. The primary motor symptoms of Parkinson's disease include bradykinesia (slowed movement), stiffness of the limbs and trunk, tremors, and impaired balance and coordination. It is these symptoms that dance may help alleviate. Dance can be considered a form of rhythmic auditory stimulation (RAS). In this technique, a series of fixed rhythms are presented to patients, and the patients are asked to move to the rhythms. Studies of the effects this technique has on patients with Parkinson's or other movement disorders have found significant improvements in gait and upper extremity function among participants. Interactive RAS offers a flexible, portable, low-cost, non-invasive therapeutic intervention that may improve the mobility, stability, and quality of life of Parkinson's Disease patients. (Michael J. Hove, 2012)

Similarly, Zumba Gold has been shown to be safely applied in elderly or even chronically-ill people (Bennett, P. et al; 2012; Sanders, M.E.; Prouty, J.; 2012), although two studies warn of possible injuries associated with Zumba fitness and the wrong footwear (Inouye, J. et al.; 2013; Schrimpf, C.; et al; 2014). To conclude, further research is needed to explore the role of Zumba in improving geriatric health.

2. CONCLUSION

Zumba intervention is both a dance and a fitness regime which leads to health benefits through aerobic activity. Further studies are required to have an in depth knowledge of mechanism of action of this aerobic dance form so that it can be utilized as a tool in Complementary and alternative medicine for improving health and well being.

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