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Effect Of Two Intervention Programmes -Traditional Greek Dance & Motor Games- On Heart Rate In Young Adults With Down Syndrome

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Abstract:
Background*: People with Down syndrome (DS) face significant difficulties with their heart rate and also, these individuals have an increased chance of developing obesity and metabolic disorders. However, their participation in dance and exercise programs can offer them many benefits. The aim of this study was to investigate the effect of two intervention programmes - traditional Greek dance and motor games - on the heart rate as an indicator of cardiovascular fitness of people with DS.*
Materials and Methods*: The study involved 42 young adults (21 boys and 21 girls) diagnosed with DS. The two intervention programs implemented included Greek traditional dance and movement games classes and were 12 weeks in duration. The frequency of delivery was 3 lessons per week of 60 minutes each. Survey data were collected with The Medisana Pulse Oximeter PM 100. The following statistical analyses were performed: a) descriptive and inferential statistics, b) t-test for independent samples, c) Anova analysis of repeated measures.*
Results*: The statistical analysis of the data shows that: a) there is a statistically significant difference from measurement to measurement for the factor "heart rate", b) there is a statistically significant interaction between the two intervention programs, c) the intervention program with the Greek traditional dance showed statistically significant differences in all the time points of the research, d) the intervention program with the movement games did not show statistically significant differences in all the time points of the research.*
Conclusion: *From the results of the study the authors conclude that a) a program of traditional Greek dance has a positive effect on the heart rate of patients with DS, b) a program of kinetic games has a positive effect on the heart rate of patients with DS.*
Key Word*: Aerobic capacity; Aerobic training; Cardiovascular capacity; Dance.*

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I. Introduction

One of the most important elements that contribute not only to maintaining but also to improving the health of the cardiovascular system is participation in physical activities. Its importance increases even more when this participation involves people with Down's syndrome (DS), individuals whose cardiovascular capacity is reduced compared to that of typically developing individuals. According to Baynard et al. (2008), these individuals have an increased chance of developing obesity and metabolic disorders.

Although the benefits of participating in physical activities have been demonstrated for both the general population and people with DS, the latter have a reduced participation in physical activities. This reduced participation is due to both physiological limitations resulting from the presence of DS and the lack of programs exclusively targeted at people with DS[2].

Research has shown that peak oxygen uptake is lower, by about 20-40%, in people with DS than in typically developing people. Furthermore, individuals with DS have reduced cardiac output, resulting in a significantly reduced ability to participate in physical activities[3,4,5]. However, many studies have shown the necessity of participation in organized physical activities since, through this, the individual will experience positive cardiovascular adaptations, including improved HR response, aerobic capacity and metabolic efficiency[6]. This is why Rimmer and Rowland (2008) consider it essential for people with various forms of disability to participate in organized physical activities.

The aim of the study by Giagkoudaki, Dimitros, Kouidi, and Deligiannis (2010) was to investigate the possible effects of a training program on heart rate variability (HRV) indices in people with DS. The term "Heart Rate Variability" refers to changes in the time interval between each heartbeat. This change in the heart rate reflects the ability of the autonomic nervous system to regulate heart function in response to internal and external factors. High variability usually indicates a healthy autonomic nervous system and is associated with improved stress response, better adaptability and overall better body health[9]. The study involved 10 people diagnosed with DS and 10 healthy people. All 20 subjects were fitted with a Holter to assess autonomic nervous system activity on a 24-hour basis with time and frequency domain analysis. A 6-month exercise program was applied to the subjects with DS. From the results obtained from the reassessment of autonomic nervous system activity, the authors concluded that individuals with DS have autonomic nervous system dysfunction. This dysfunction can be improved through exercise targeting the function of the parasympathetic system.

The findings of Giagkoudaki, Dimitros, Kouidi, and Deligiannis (2010) are in agreement with the findings of Mendonca, Pereira, and Fernhall (2013) that participation in physical activities that include aerobic exercise bring about significant improvements in heart rate variability and overall cardiovascular fitness in people with DS. Similar conclusions were reached by Cai and Baek (2022) who, considering that in individuals with DS functional ability is at significantly lower levels than those of typically developing individuals, conducted a study to determine the possible effect of a basketball training programme on their functional ability. The study involved 22 adult individuals with DS, aged 24±6 years, divided into two equal groups. The duration of the program followed by the experimental group was 24 weeks with a frequency of 3 times per week. The duration of each training session was 60 minutes. Aerobic capacity was assessed by the 16 m modified shuttle-run test or the PACER test. From the results of the study, the authors concluded that participation in a basketball exercise program improves aerobic capacity in individuals with DS.

According to Hojlo, Milliken, Baumer and Davidson (2022) and Shields and Taylor (2015), dance and movement games are two types of physical activities that can improve cardiovascular endurance, motor coordination, and socialization for people with developmental disabilities. Reinders, Bryden, and Fletcher (2015) also said that taking part in organized dance activities lets people meet new people and be more active.

Research has shown that participation in Greek traditional dance classes contributes to the improvement of mobility and cardiovascular endurance in patients with Parkinson's disease[18], to the improvement of neuromuscular coordination and cardiovascular capacity of people with disabilities[15,16,17]. More specifically, in their study, Douka, Zilidou, Lilou, and Manou (2019) sought to ascertain the impact of an interventional Greek traditional dance program on the functional capacity of individuals over the age of 60. The study's participants were 130 individuals aged 67 years who were enrolled in the program. The intervention program spanned 32 weeks, with sessions occurring biweekly. Each session was scheduled to last for a duration of 75 minutes. The program's intensity was methodically escalated, commencing with moderate levels and culminating in intense exercises. The study's findings, as outlined by the study's authors, concluded that Greek traditional dance, when performed as an aerobic activity, serves as a significant instrument in enhancing the health and well-being of older individuals. This assertion is substantiated by the observed improvements in the subjects' physical condition and functional capacity.

Vordos, Kouidi, Mavrovouniotis, Metaxas, Dimitros, Kaltsatou, and Deligiannis (2017) conducted a study to evaluate the effect of a Greek traditional dance program on the jumping ability, muscle strength, and endurance of the lower limbs of patients with chronic heart failure. The study population comprised 40 subjects with a mean age of 73.2 years (standard deviation ± 4.7 years) who were diagnosed with chronic heart failure. The experimental group, comprising 20 subjects, participated in a program consisting of Greek traditional dance, utilized as an aerobic exercise. The program spanned a duration of 12 weeks. The findings of the study indicated that the utilization of Greek traditional dance for the rehabilitation of patients suffering from chronic heart failure is a safe practice that can yield positive outcomes.

The objective of the research conducted by Malkogeorgos, Malkogeorgou, Argiriadou, Mavrovouniotis, and Mavrovouniotis (2020) was to examine the impact of an interventional program comprising Greek traditional dance on the cardiorespiratory capacity of adults. The study population comprised 40 subjects with a mean age of 35-55 years. The intervention program was designed to span a duration of 24 weeks, with participants attending three sessions per week. Each dance session was 60 minutes in duration. The intensity of the dance routines ranged from moderate to high. The maximal aerobic capacity (VO2max) of the participants was assessed using the Rockport one-mile walk test. Additionally, the study collected information on the subjects' resting heart rate, diastolic, and systolic blood pressure. The analysis of the results revealed a statistically significant increase in VO2max from the baseline to the final measurement, while both diastolic and systolic blood pressure exhibited a statistically significant decrease. The authors concluded that a moderate-to-high intensity Greek traditional dance program contributes to the improvement of aerobic capacity and cardiorespiratory fitness in adult subjects.

Giazitzioglou's (2022) case study sought to ascertain the impact of participating in an organized program of Greek traditional dance on the enhancement of cardiorespiratory function in patients diagnosed with Parkinson's disease. The program spanned a duration of three months, encompassing a total of 36 sessions of Greek traditional dance (with three sessions per week). The duration of each session was 30 minutes for the first two months and 40 minutes for the third month. Cardiorespiratory function was assessed using a maximum oxygen preconditioning test. The subsequent data analysis revealed an enhancement in the patient's cardiorespiratory function, as evidenced by an increase in maximum oxygen uptake, concurrently accompanied by a decrease in blood pressure and heart rate.

The aim of the study by Koutsandreou, Wegner, Niemann and Budde (2016) was to investigate the effect of different types of exercise on the working memory (WM) of 1st graders. The study involved 71 primary school students, aged 9-10 years (M = 9.4 years), who were randomly assigned to one of the three groups created. Two-(cardiovascular exercise group and motor exercise group)- were experimental while the third was the control group. The programme was of 10 weeks duration. Each week there were 3 sessions of 45 minutes each; the sessions were held outside school hours. The program followed by the cardiovascular exercise group was aimed at improving cardiovascular fitness through participation in running exercises and various motor games of moderate to vigorous intensity.The program followed by the motor exercise group was aimed at improving the body's gross and fine motor coordination through various motor coordination games using different types of balls, racquets, skipping ropes, balloons, and balance pads. Data analysis revealed that subjects participating in the motor exercise group improved working memory to a greater extent than students participating in the cardiovascular exercise group, demonstrating that exercises based on various forms of motor games can have equally good results as other forms of exercise.

Similar results were obtained in a study by Gallahue and Ozmun (2006) a decade earlier, according to which motor games have as good effects as other forms of exercise, improving heart rate, aerobic capacity and overall physical activity in children and adults diagnosed with mental retardation. The results of the research of Quiroga Murcia, Kreutz, Clift, and Bongard (2010) are in line with the above studies, according to which mobile games are as beneficial as other physical activities in improving cardiovascular health. They stress, in fact, that their effectiveness depends on the duration of their application as well as their intensity.

The aim of this study was to investigate the effect of two intervention programmes - traditional Greek dance and motor games - on the heart rate as an indicator of cardiovascular fitness of people with DS.

II. Material And Methods

In the survey participated 42 people with DS, aged 20 - 30 years. Criteria for participation in the study were that they were of good health, had not been diagnosed with cardiovascular problems that would prohibit their participation in physical activities, and could respond positively to verbal messages. The participants came from the Vlach Association of Efkarpia/ Thessaloniki "The Holy Spirit". All individuals in the sample belong to type T21 (Typical Trisomy 21), and are characterized by mild mental retardation. By random allocation (drawing of lots), participants were divided into two equal experimental groups. The first experimental group implemented a Greek traditional dance program while the second implemented a motor games program.

Study Duration: 1st of October 2024 to 31st of January 2025.

Sample size: 42 participants with Down syndrome.

Inclusion criteria:
1. People with Down syndrome.
2. Either sex.
3. Aged 20 to 30 years.
4. People who belong to type T21 (Typical Trisomy 21).
5. Participants who can respond positively to verbal messages.

Exclusion criteria:
1. Participants with physical disabilities.
2. Participants who had been diagnosed with cardiovascular problems.
3. Participants who participate at the same time in other dance or motor games programs.

Procedure methodology

After For the 42 participants, permission was requested and obtained from their parents, since these individuals live with their families. Also, permission was asked from the administrators of the Vlach Association of Efkarpia. This was done after the assurance that the participants can leave the project at any time

they want. It was also made clear that the data collected will be used only for scientific purposes. The objectives of the project and the procedure for conducting the project were submitted to the Ethics Committee of the Democritus University of Thrace, from which permission to conduct the project was requested and obtained.

Intervention programme

The programme lasted 12 weeks with a frequency of 3 times per week. The duration of each session was 60 minutes. A total of 36 sessions of Greek traditional dance and 36 sessions of movement games were conducted.

For the elaboration of both intervention programs there was collaboration with the doctors who attended the participants considering that people with Down syndrome usually present various forms of heart diseases. In addition, the guidelines of the World Health Organization[22], were taken into account, according to which:

(a) All adult individuals with chronic health problems should participate in aerobic physical activities of moderate intensity for at least 150-300 minutes or

(b) Participate for 75-150 minutes per week in vigorous-intensity aerobic physical activity; or

(c) Participate for 75 to 150 minutes per week in aerobic physical activity of moderate to vigorous intensity

(d) Participate at least 3 times a week in physical activities whose content focuses on exercises that promote balance, mobility and muscle strengthening. The aim is to improve their functional capacity in order to reduce or eliminate the risk of injuries from falls.

Finally, for the elaboration of the two intervention programmes, the principles that should govern a physical activity such as specialisation, progression, overload and individualisation were taken into account. According to IARC (2018) and Siegel, Miller and Jemal (2017) these principles should be in line with the principles proposed by the Frequency Intensity Time Type (FITT). That is, the frequency (the number of exercise per week), the intensity (the degree of difficulty, the percent load taking into account the maximum heart rate or activities that will increase the heart rate from the rate one has when at rest), the time (the duration of the exercise) and finally, the type of exercise performed should be precisely defined. However, a prerequisite for a successful outcome of the exercise should be that it is individualized exercise taking into account one's needs, the limitations imposed by the physical condition, and the dynamic evolution of the general and specific goals of the exercise[23,24].

The choice of both the dances and the games was made taking into account their intensity since both programs had to be distinguished for the same intensity and burden they would cause to the participants. As for the Greek traditional dance program, the dances had to be distinguished for their simplicity and not require special dance skills from the participants. The first part of each lesson (5-10 minutes) included rhythmic movements, the analysis and execution of movement patterns and its purpose was to prepare the body for the load that was to follow. For this reason, the rhythmic treatment of the exercises was relatively slow and progressively developed into accelerated. In the second part (40 - 45 minutes) the main part of the programme, i.e. the performance of the dances, was carried out. The intensity of performance was increasing, reaching up to 70% of the participant's maximum heart rate, while the training methods used were continuous and interval training. The third part, which lasted 5 to 10 minutes, was all about getting the body back to normal. This was done through dances and gentle exercises that involved rhythm and stretching. People learned the dances on the first day of the week. This was done by studying the dances' individual movements and then putting them back together as complete dances. On the other two days, the dances were performed as a whole.

Regarding the program with the movement games, an effort was made, as mentioned above, to be of similar intensity and to bring the same burden to the participants as the program of Greek traditional dance. The structure of the programme was also in three parts, with the first part including rhythmic and stretching exercises aimed at preparing the participants' bodies for the programme that was to follow. The second part contained motor games among which there were ball games - football, basketball and volleyball - various relay races and games with pins. Finally, the third part consisted of stretching exercises and low-intensity motor activity, since the aim of this part was to restore the body's functioning to normal levels.

The heart rate of the students was counted and recorded during each class. Specifically, heart rate was recorded three times: before the start of the lesson, after the end of the lesson, and half an hour after the end of the lesson. In total, 36 heart rate recordings were made: 36 before the start of the lesson, 36 immediately after the end of the lesson, and 36 half an hour after the end of the lesson.

Measurement instrument

The Medisana Pulse Oximeter PM 100, which is a finger pulse oximeter, was used to measure and record the heart rate. This instrument is also used to assess the oxygen levels in the blood. The function of this oximeter in the use of certain sensors with the integration of which in the finger of the person is carried out the detection of the fluctuation of blood flow generated due to the heartbeat. Furthermore, the heart rate of the

person is displayed on the instrument's screen every minute. Finally, a graphical representation of the heart rate over time is displayed on the screen.

Statistical analysis

Statistical analysis of the data was performed using the Statistical Package for Social Sciences version 26 (SPSS Inc., Chicago, IL). The following statistical analyses were performed:

a) Descriptive and inferential statistics data with central tendency and dispersion indicators (mean, standard deviation),

b) T-test for independent samples to test for possible differences with respect to the two experimental groups at initial measurement,

c) Repeated Measures Analysis to examine any differences between the groups (experimental group 1 and experimental group 2) and the measurements (initial-final and re-measurement) of the intervention programme.

The significance level was set at $p < .05$.

III. Result

We created three new variables to represent the three –"before the lesson", "after the lesson" and "half an hour after the lesson"- measurements. To do so, we took the sum of the questions' scores for each measurement and divided it by the number of measurements in that measurement.

Firstly, a t-test for independent samples was performed to test whether there were statistically significant differences in the heart rate factor at the beginning between the group that participated in the dance program and the group that participated in the motor games. The results (Table 1) show that there are no statistically significant differences in the heart rate factor between the two groups. Therefore, it was assumed that the two groups have the same starting point before the start of the intervention program.

Table no 1: Means - standard deviation and t-test values for the factor "heart rate" at the "Before the lesson" measurement.

	Total		**Dance**		**Motor games**				
Heart rate	**M**	**SD**	**M**	**SD**	**M**	**SD**	**t**	**df**	**Sig.**
	86.68	1.18	86.22	2.17	87.18	1.21	-1.76	40	.09

A special kind of statistical analysis was used to study the data. This analysis was used for two factors, one of which was repeated measures. The analysis showed a statistically significant interaction between the two factors ($F_{2, 80}=6.61$; $p<0.05$). When we looked at how the two factors interacted, we saw that the repeated factor "measurement" had a statistically significant effect for both the "first experimental group/Greek traditional dance" ($F_{2, 39} = 13893.946$; $p< 0.05$) and the "second experimental group/motor games" ($F_{2, 39} = 11920.808$; $p< 0.05$). However, the Bonferroni multiple comparison test showed that while there were statistically significant differences between all the time points of the measurement in the first experimental group, there was no statistically significant difference between the first and third measurements in the second experimental group. This is because the significance level was only higher than 0.05 (Sig. = 0.066) in this combination. Looking at the M (table 2), it can be seen that although the second experimental group has a lower heart rate than the initial one, this is not statistically significant.

Table no 2: Means-Standard deviation and interaction for the two experimental groups at before, after and half an hour after the lesson measurement.

		Measurement					
		Before the lesson		After the lesson		Half an hour after the lesson	
Factor	Group	M	SD	M	SD	M	SD
Heart rate	Dance	86.22	2.17	144.03	.58	84.81	2.08
	Motor games	87.18	1.21	144.12	.98	86.64	1.06

IV. Discussion

The objective of the present study was to examine the impact of two intervention programmes – traditional Greek dance and motor games – on the heart rate of individuals with Down syndrome as a measure of their cardiovascular fitness.

Consequently, two programmes were developed: one incorporating Greek traditional dance and the other comprising motor games of the same duration and intensity. The programmes were developed in accordance with the World Health Organization's (2020) recommendations for exercise for specific population groups, as well as the Frequency Intensity Time Type guidelines[23,24].

Intensity was the criterion for the selection of both the dances and the movement games, since the two programmes had to impose the same load on the participants for them to be comparable. The dances that were

selected were of a simple nature and comprised the two basic kinetic patterns that govern Greek traditional dance: the kinetic pattern in two and the kinetic pattern in three. Consequently, no specialized dance competencies were demanded of the participants. The intensity of the performance was moderate and increased over time. The maximum heart rate of the participants reached 70% at the end of the performance. The training methods employed encompassed continuous and interval training, with the specific approach being adapted to the respective phase of the training period.

As mentioned above, the two programs should have the same training volume and intensity in order to compare the results of the two groups. Thus, the program related to motor games, which also aimed to improve cardiac function, consisted of three parts and included games with soccer balls, volleyball, basketball, as well as running relays and games with pins.

Heart rate was measured on a daily basis, with the data categorized into three levels. The first level corresponded to the resting heart rate, defined as the subject's heart rate prior to the initiation of the lesson. The second level pertained to the heart rate immediately following the conclusion of the lesson. The third level related to the heart rate experienced by the subject half an hour after the termination of the lesson. The third control was performed to ascertain the time required for the heart rate to return to its pre-exercise level. Therefore, 36 resting heart rate recordings were made, 36 after the end of the course to check the burden of the program and 36 half an hour after the end of the course to check the rate of recovery of cardiac function.

The t-test for independent samples demonstrated that there were no statistically significant differences in the factor "heart rate" prior to the initiation of the program. Consequently, a comparison of their subsequent measurements is feasible. To facilitate the control at the initial measurement and the subsequent two, three new variables were created to represent the 36 measurements recorded at the three stages/levels of the program implementation. The three new variables were: "heart rate before the lesson", "heart rate after the lesson", and "heart rate half an hour after the lesson".

The analysis of variance for dependent samples, performed through the SPSS statistical package, for two factors, one of which is repeated, revealed a statistically significant interaction between the two factors. Specifically, a statistically significant interaction between the repeated factor "measurement" and both experimental groups was observed. This finding indicates that the program exerted a statistically significant influence on both experimental groups. Consequently, the initial experimental group, which was engaged in Greek traditional dance, exhibited performance that was statistically significantly different at all measurement time points.

This finding indicates that the program administered to the initial experimental group yielded the anticipated outcomes. Specifically, the intensity of the selected dances elicited the anticipated effects on the participants' heart rate at the program's conclusion. A similar outcome was observed in the re-measurement conducted half an hour after the program's conclusion. The intensity of the selected dances was not sufficiently low to allow for expeditious recovery and reversion to a quiescent state. In fact, as evidenced by the mean heart rate values, the post-intervention readings were lower compared to the participants' initial heart rate measurements. This outcome aligns with the program's intended objective. The objective of the program was to induce positive changes or a reduction in heart rate, thereby enabling the heart to function with a reduced number of beats and, consequently, operate in a more restful manner.

The findings of this study are consistent with those of other research, including those by Gupta et al. (2011), which demonstrate that engagement in physical activities can have a beneficial impact on cardiac function, and Rimmer and Rowland (2008), which suggest that individuals with diverse forms of disability can only experience improvements in cardiac function through participation in structured physical activities. The findings of this study are consistent with those of Giagkoudaki et al. (2010), who reported that a 6-month exercise program had a beneficial effect on cardiac function. Conclusively, the findings of the present study align with those of Giagkoudaki et al. (2010), Mendonca, Pereira, and Fernhall (2013), and Cai and Baek (2022), which demonstrate that participation in organized aerobic exercise activities by individuals with DS has a favorable impact on their cardiac and aerobic fitness.

In regard to the impact of Greek dance on the cardiac function of participants, the findings of the present study are consistent with those of the research conducted by Douka, Zilidou, Lilou, and Manou (2019). This research posits that Greek traditional dance, classified as an aerobic activity, serves as a pivotal instrument in enhancing the health of elderly individuals. It contributes to the enhancement of their physical well-being and functional capacity. The findings of the present study are consistent with those of studies such as those by Vordos et al. (2017), Malkogeorgos et al. (2020), and Giazitzioglou (2022), which demonstrate that participation in structured Greek traditional dance classes leads to substantial positive enhancements in cardiac function and aerobic capacity among participants.

As for the second experimental group, the group that implemented a program with motor games, the results were partially as expected. This is because while there was a statistically significant difference between first - second and second - third, there was no statistically significant difference between third and first

measurement. These results mean that the motor games program produced the expected results from the first to the second measurement and from the second to the third measurement. That is, the selected intensity of the dances was appropriate since the heart rate of the participants increased accordingly and the heart rate returned to normal levels half an hour after the end of the program. The same was not observed between the third and the first measurement, since the heart rate was lower than the initial one, but this difference was not statistically significant.

The results of the study align with those of Gallahue and Ozmun (2006), who found that motor games have comparable benefits to other forms of exercise in enhancing heart rate, aerobic capacity, and overall physical activity in children and adults diagnosed with mental retardation. The findings of the present study are consistent with those of Quiroga Murcia, Kreutz, Clift, and Bongard (2010), who demonstrated that kinetic games are as efficacious as other physical activities in enhancing cardiovascular health. This assertion is further corroborated by the results of Koutsandreou et al. (2016) and Kuznetsova et al. (2022) also support this view, stating that exercises based on various forms of kinetic games can yield equally positive results as other forms of exercise in terms of enhancing cardiovascular fitness and overall health.

V. Conclusion

From the statistical analysis of the data and the discussion that followed, it was found that interventional programs with Greek traditional dance and movement games have a positive effect on the cardiovascular function of adults with DS.

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