Sportis
Revista Técnico-Científica del Deporte Escolar, Educación Física y Psicomotricidad
Scientific Technical Journal of School Sport, Physical Education and Psychomotricity

Editor: University of A Coruña. A Coruña. Spain
ISSN-e 2386-8333
E-mail: sportis.journal@udc.es Web: https://revistas.udc.es

Artículo Original. Integrative flexibility training to improve joint mobility and range of movement in jazz dancing girls. Vol. 7, n.º 3; p. 425-447, septiembre 2021. https://doi.org/10.17979/sportis.2021.7.3.8572

Integrative flexibility training to improve joint mobility and range of movement in jazz dancing girls

Entrenamiento de flexibilidad integradora para mejorar la movilidad articular y el rango de movimiento en bailarinas de jazz

Liliana Aracely Enríquez del Castillo; Luis Alberto Flores Olivares; Ramón Candia Luján; Susana Domínguez Esparza; Natanael Cervantes Hernández*

Autonomous University of Chihuahua. Faculty of Physical Culture Sciences.

*E-mail correspondence author:: ncervantes@uach.mx

Cronograma editorial: *Artículo recibido 16/06/2021 Aceptado: 16/08/2021 Publicado: 01/09/2021*
https://doi.org/10.17979/sportis.2021.7.3.8572

Para citar este artículo utilice la siguiente referencia: Enríquez, L.A.; Flores, L.A.; Candia, R.; Domínguez, S.; Cervantes, N. (2021). Integrative flexibility training to improve joint mobility and range of movement in jazz dancing girls. Sportis Sci J, 7 (3), 425-447 https://doi.org/10.17979/sportis.2021.7.3.8572

Contribución específica de los autores: Introducción (LAEC, SDE), Método (LAFO, RCL, SDE), Resultados (NCH, LAFO), Discusión y conclusiones (LAEC, NCH, LAFO)

Financiación: No existió financiación para este proyecto.

Consentimiento informado participantes del estudio: Se obtuvo el consentimiento informado de los participantes del estudio.

Conflicto de interés Los autores declaran que no existe conflicto de intereses

Sportis
Revista Técnico-Científica del Deporte Escolar, Educación Física y Psicomotricidad
Scientific Technical Journal of School Sport, Physical Education and Psychomotricity

Editor: University of A Coruña. A Coruña. Spain
ISSN-e 2386-8333
E-mail: sportis.journal@udc.es Web: https://revistas.udc.es

Artículo Original. Integrative flexibility training to improve joint mobility and range of movement in jazz dancing girls. Vol. 7, n.º 3; p. 425-447, septiembre 2021. https://doi.org/10.17979/sportis.2021.7.3.8572

Abstract

Flexibility is one of the physical capacities associated with improved performance in jazz dancers girls. However, jazz training being a complex physical activity is not only based on flexibility training, it also focuses on the development of motor skills, technique, posture, and rhythm. Therefore, it is important to demonstrate whether a passive stretching training, with minimum frequency, generates favorable results on flexibility. The purpose of this study is to determine the effect of flexibility training on active and passive range of motion (ROM), as well as joint mobility in girls jazz dancers by chronological caracterizar la muestra age group. 30 jazz dancers with an average age of 8.5 ± 1.6 years with no more than four years practicing professional sports practice, enrolled in an integrative flexibility training program developed once a week for 12 weeks, and were assessed for active and passive hip joint mobility through goniometry in conjunction with six flexibility tests. There was an increase in all flexibility variables with a moderate size-effect, except for the joint ROM in active and passive left abduction and active right flexion, which had a high effect. In conclusion, training focused on static exercises can be considered an effective strategy to develop ROM, because it's possible to increase flexibility and stretch in lower extremities with a frequency of once a week in jazz dancing girls.

Keywords

Flexibility; Physical activity; ROM; Static stretching; Young dancers.

Resumen

La flexibilidad es una de las capacidades físicas asociadas con la mejora del rendimiento en las niñas bailarinas de jazz. Sin embargo, el entrenamiento del jazz al ser una actividad física compleja no solo se basa en el entrenamiento de la flexibilidad, también se centra en el desarrollo de las habilidades motoras, la técnica, la postura y el ritmo. Por lo tanto, es importante demostrar si un entrenamiento de estiramiento estático de frecuencia mínima, genera resultados favorables en flexibilidad. El propósito de este estudio es determinar el efecto del entrenamiento de flexibilidad sobre el rango de movimiento (ROM) activo y pasivo, así como la movilidad articular en bailarinas de jazz de niñas por cronológico para caracterizar la muestra de grupos de edad. 30 bailarines de jazz con una edad promedio de 8.5 ± 1.6 años con no más de cuatro años practicando deporte profesional, inscritas en un programa de entrenamiento de flexibilidad integral desarrollado a realizarse una vez por semana durante 12 semanas. Se les evaluó la movilidad articular de cadera de forma activa y pasiva mediante goniometría junto con seis pruebas de flexibilidad. Hubo un aumento en todas las variables de flexibilidad con un efecto de tamaño moderado, excepto el ROM articular en abducción izquierda activa y pasiva y flexión derecha activa, que tuvo un efecto alto. En conclusión, el entrenamiento centrado en ejercicios estáticos puede considerarse una estrategia eficaz para desarrollar el ROM, y aumentar la flexibilidad así como los estiramientos en el tronco inferior con una frecuencia de una vez a la semana en las bailarinas de jazz.

Sportis. Revista Técnico-Científica del Deporte Escolar, Educación Física y Psicomotricidad
Scientific Technical Journal of School Sport, Physical Education and Psychomotricity
Editor: University of A Coruña. A Coruña. Spain
ISSN-e 2386-8333
E-mail: sportis.journal@udc.es Web: https://revistas.udc.es

Palabras clave

Actividad física; Estiramientos estáticos; Flexibilidad; ROM; Jóvenes bailarinas.

Introduction

The current viral epidemic due to covid-19 has largely modified the lifestyles of the population worldwide. During social isolation, there has been a significant decrease in physical activity and an increase in sedentary behavior (Castañeda-Babarro, Arbillaga-Etxarri, Gutiérrez-Santamaría & Coca, 2020). Recently, the World Health Organization (2020) has proposed new guidelines to increase levels of physical activity and decrease sedentary behavior. However, faced with this new viral outbreak, the practice of physical activity and sport needs to be adapted from home or should be carried out with protective measures in safe spaces, which mainly include the use of a mask, keep a distance between 1.5 to 2 meters, prioritize individual training activities and reinforce hygiene measures (Kalazich, et al., 2020).

On the other hand, leading organizations world wide have recommended the practice of physical activity, including muscle strengthening exercises such as jumping, squats and push-ups, aerobic exercises such as jogging, walk around the house and dance, and flexibility exercises and stretching (Rodríguez, Crespo, & Olmedillas, 2020). Dancing is one of the activities that can increase satisfaction (Abilleira, Fernández-Villarino & Prieto-Troncoso, 2017), well-being, motivation, adherence to physical activity, improve motor control, balance, kinesthetic awareness, and flexibility (Sabaananth, 2021).

One of the physical activities, that generate greater adherence in girls are those based on rhythmic recreational activities In a study carried out by Salazar, Juarez, Andrade, Peña, Arellano and Hernández, (2016) where they described the perception of the benefits that stimulate sports and recreational activities in physical-motor, cognitive, social and interpersonal skills, finding that the aerial dance was the discipline that develops more physical-motor skills at a perceptual level compared to other sports taught in a summer course.

Among dance disciplines, Jazz is one of the fuller which involves specific techniques are required such as classical ballet, corporal expression, contemporary dance, and gymnastic elements (Infante, 2019; Gioia, 2013), where flexibility is an element significant to be able to

Sportis Revista Técnico-Científica del Deporte Escolar, Educación Física y Psicomotricidad
Scientific Technical Journal of School Sport, Physical Education and Psychomotricity
Editor: University of A Coruña. A Coruña. Spain
ISSN-e 2386-8333
E-mail: sportis.journal@udc.es Web: https://revistas.udc.es

develop it properly (Morillas, 2019) since it requires a high degree of complexity, precision, coordination and aesthetics (Colcha, & Ortiz, 2018). It was observed in female dancers aged 8 to 16 years old who performed jazz, specific anatomical characteristics in comparison to non dancer girls, such as major range of motion (ROM) in the lower back and hamstrings as age increases and stable levels of ankle plantar flexion and hip external rotation (Steinberg, et al., 2006).

Physical capacities are developed according to training, which is suggested to be carried out during the sensitive phases of development (Ramos, & Taborda, 2001), coinciding with this fact, Bolívar, Cardona, Naranjo, and Rodríguez, (2018) mention that it is around 12 years of age when the period of completion of the development of physical capacities is reached; however, some authors suggest that the main progress in physical capacities is generated during puberty (Guillamón, Cantó, & López, 2018; Márquez & Celis, 2016). In flexibility, elongation occurs in muscle and tissue intramuscular connective tissue rather than the tendon, which is substantially stiffer than muscle (Hernández, 2007).

It has been documented that flexibility development took place mostly between 6 to 12 years, which is a sensitive period for somatic and morphological changes (Malina, Bouchard, & Bar-Or, 2004). Different studies based on stretching training programs have observed in this range of age an increase in flexibility levels in the experimental groups with respect to control groups (Donti, Papia, Toubekis, Donti, Sands, & Bogdanis., 2018; Mayorga-Vega, Merino-Marban, Sánchez-Rivas, & Viciana, 2014; Coledam, Arruda, & Oliveira, 2012).

Flexibility is perhaps the capacity most important in dance since it has functional links with the dancer's technique and alignment, besides it provides the aesthetic function that it requires (Cervantes, 2017) and that involves a full ROM, without restrictions or pain, influenced by muscles, tendons, ligaments, bone structures, adipose tissue, skin and associated connective tissue, which allows movements with the maximum possible range without suddenness and with no harm (Hernández, 2007; Ubaque, 2019). However, flexibility is usually one of the least studied and stimulated during training (Hernández, 2007; Soto, 2015) and which tends to decrease with age if it is not given adequate importance (Sánchez, Ramírez, & de Ávila, 2020).

Sportis. Revista Técnico-Científica del Deporte Escolar, Educación Física y Psicomotricidad. Scientific Technical Journal of School Sport, Physical Education and Psychomotricity
Editor: University of A Coruña. A Coruña. Spain
ISSN-e 2386-8333
E-mail: sportis.journal@udc.es Web: https://revistas.udc.es

Flexibility, such as aerobic capacity, can quickly deteriorate during detraining (Hernández, 2007). Mayorga-Vega, et al. (2014), found that an eight-weeks stretching training program, two sessions per week, can improve the hamstring extensibility in children, but after five weeks of detraining the flexibility levels drop back to the baseline line. Recommendations for minimizing the effects of detraining, particularly during social isolation, have been presented in disciplines such as soccer, powerlifting, and combat sports for adolescents and adults (Herrera-Valenzuela, Valdés-Badilla, & Franchini, 2020; Domínguez, Arjol, Crespo, & Fernández, 2020).

The sports situation has been limited in the use of sports spaces and training times derived from the restrictions due to the COVID-19 pandemic, so it is important to promote effective methodologies that maintain and improve physical capacities. Although, the evidence in jazz dancing children is limited on the prescription of minimal-sufficient exercise to maintain physical fitness, particularly flexibility, which is one of the main components in this discipline and has already been addressed previously. The present research aims to assess the effect of a flexibility training based on static exercise on active and passive ROM and joint mobility as a function of chronological age, in girls Jazz dancers with only one weekly session.

Material and method

This quasi-experimental study was registered and approved by the Scientific Committee of the Faculty of Physical Culture Sciences under folio number 13022018-118. It adheres to the guidelines of the Declaration of Helsinki (World Medical Association, 2017) as well as the regulations of the General Health Law on Research for the Health of the United Mexican States (DOF, 2014). All participants granted their consent of voluntary participation and parents/guardians signed the respective informed written consent.

A total sample of 30 girls selected by the convenience with an average age of 8.5 ± 1.6 years with no more than four years practicing professional sports practice, with a sports consolidation in the practice of jazz, without orthopedic antecedents or with injuries that

Sportis Revista Técnico-Científica del Deporte Escolar, Educación Física y Psicomotricidad
Scientific Technical Journal of School Sport, Physical Education and Psychomotricity
Editor: University of A Coruña. A Coruña. Spain
ISSN-e 2386-8333
E-mail: sportis.journal@udc.es Web: https://revistas.udc.es

prevented evaluations and training, neither girl had presented menarche. These girls were invited to participate through their coach and with the authorization of their tutor.

The passive hip extension test, passive hip abduction test, passive straight leg elevation test are probably the most used, these measurement methods are being employed to evaluate iliopsoas, adductor, hamstring, rectus femoris, respectively. Despite being indirect measures, the main American medical organizations consider them appropriate (American Academy of Orthopedic Surgeons, 1965; American Medical Association, 2001).

Despite the fact that in clinical evaluations, the reliability of a measure is determined by human factors such as experience or training in the administration of the test, variations in the evaluation methodology and variability related to the participant and/or the instrument used.

The inclusion criteria were that each participant was duly registered in the dance academy where the training would be applied; that the parent or tutor sign the consent letter, that they comply with all the initial and final evaluations, as well as a minimum attendance of 80% to the training. The exclusion criteria were that the participant attends another dance academy or that they dance in a professional or semi-professional way; that they practice some other type of sporting activity during this time -since only the effect of the training will be evaluated without any confusing variable as another class could bias the results-, as well as that the participant suffered some motor disability or injury that prevented him from attending the training.

The evaluations were conducted by two professionals related to the area (one performed the tests and the other ensured the proper testing position of the participants during the evaluation). They were held in one session at the same time of day and under the same environmental conditions as the rest of the participants. The landmarks (greater trochanter, lesser trochanter, acromion, iliac crest) were marked with semi-permanent ink to minimize confusion. Each stretching session and evaluations was performed at a similar time of day for each participant.

The study variables such as weight and height were evaluated with the Inner Scan Body Composition Monitor BC-568; to do this, the girls were asked to stand barefoot on the equipment's foot position indicator. Height was determined with the manual stadiometer,

Sportis
Revista Técnico-Científica del Deporte Escolar, Educación Física y Psicomotricidad
Scientific Technical Journal of School Sport, Physical Education and Psychomotricity
Editor: University of A Coruña. A Coruña. Spain
ISSN-e 2386-8333
E-mail: sportis.journal@udc.es Web: https://revistas.udc.es

using the technique of the International Society for the Advancement of Kinanthropometry (Stewart, Marfell-Jones, Olds & Hans, 2019).

The participants were familiarized with how to undergo the flexibility tests to reduce the influence of learning on the measurement, after the familiarization protocol was concluded, each participant completed each of the tests.

Before conducting the initial evaluations, the participants were asked to perform jumps on one leg, hit a ball and climb a wooden training cube, to observe which is their dominant limb, since Batista, Bobo, Lebre, and Ávila-Carvalho (2015), mention that the dancers have a dominant asymmetry. The limb on which at least two of the three tests were performed was designated the dominant limb. To assess hip flexibility, tests previously performed on elite Spanish athletes were taken as specific tests (Gómez-Landero, López, & Vernetta, 2013) using a wooden box, Mediagauge digital goniometer, and Lufkin brand metallic tape.

The joint angle assessment (JAA) was performed with the following tests: Deep body flexion, dorsal flexion, trunk forward flexion, spagat, abduction and hip flexion which show a high level of confidence (Cejudo, de Baranda, Ayala & Santonja, 2015; Estrada, 2018, Rodriguez, 2020).

Deep body flexion, the girl in a sitting position must have flexed her trunk forward without flexing her legs, extending her arms and the palm of her hand on the strip positioned in the wooden box, trying to get as far as possible. For the trunk forward flexion, flexion the standing girl must have flexed the trunk down without flexing her legs, extending her arms, and trying to get as low as possible.

For the dorsal flexion, previously the coxofemoral joint and the lateral epicondyle of the humerus were indicated; then, the distance between these points and the floor was measured with the metallic tape. Lateral split the lowest point of the body (lower edge of the pubic symphysis) was assessed with the metal tape with the floor in a horizontal plane.

For the abduction, the axis of the goniometer was placed in the center of the anterosuperior ilea crest (ilium); the girl was asked to generate adduction to take the value both actively and passively. Hip Flexion, the goniometer was placed at the center of the ileac

Sportis. Revista Técnico-Científica del Deporte Escolar, Educación Física y Psicomotricidad
Scientific Technical Journal of School Sport, Physical Education and Psychomotricity
Editor: University of A Coruña. A Coruña. Spain
ISSN-e 2386-8333
E-mail: sportis.journal@udc.es Web: https://revistas.udc.es

crest at the height of the ischium, the girl was asked to flex her leg to take the value both actively and passively. It is possible to see an example of these measurements (figure nº 1).

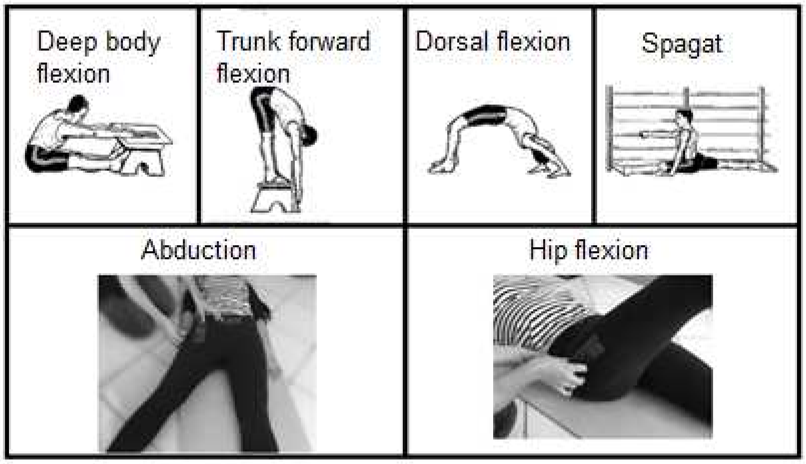

Figure n.º1: Exemplification of evaluations. In figure 1 it is possible to appreciate the way in which they were carried out.

The flexibility training consisted of 12 exclusive sessions, often once a week with the structure proposed by Oliva (2007), who mentions that three phases must be understood in the teaching of physical and sports education: Initial phase (warm-up), central phase (development) where the main exercises are carried out with greater effort and final phase (calm down). The justification of a good warm-up before sports practice is essential for the development of the central phase, as well as the return to calm, understood as favoring a better dynamics of the efforts, both at the initial level of the work that favors intense efforts later, as well as recovery (Ruiz, 2008).

Initial phase: Each session began with a specific warm-up for jazz dance which lasted about 10 minutes. The girls geted in 5 lines to do the first exercises, made movements like displacements, crawl and jumps to elevate body temperature and blood flow. Later they made a circle where the instructor stood in the center and through direct command indicated movements of joint lubrication movements, 8 repetitions for two series following the natural movement according to the joint.

Central phase: the 12 exercises described below were performed without ballistic movements, holding the position for 20 seconds at the moment of exhalation. Total accumulated stretching time is 16 minutes per set. The complete session was about 48

Editor: University of A Coruña. A Coruña. Spain
ISSN-e 2386-8333
E-mail: sportis.journal@udc.es Web: https://revistas.udc.es

minutes. Due to other studies (Hatano, Suzuki, Matsuo, Kataura, Yokoi, … & Iwata, 2019; Takeuchi, & Nakamura, 2020) showing that it is possible to improve flexibility with shorter times per session, a methodological design was proposed where training sessions are 16 minutes in order to reduce training days trying to obtain similar results. The typology and order of the exercises were designed according to the objective of the study and the methodology proposed by the authors mentioned above, where the main focus is flexibility in the hip.

Trunk flexion to the front: they touched the tips of their feet; with their legs shoulder-width apart.

Trunk flexion to the front: they touched the tips of their feet for ten seconds on each side, then, in this same position, they touched the tips of their feet with the opposite hand for one second on each side for 20 repetitions. Legs wide apart.

Trunk flexion to one leg touching the tip of their foot with both hands for ten seconds with each leg; in a sitting position. Legs wide apart.

Trunk flexion to the front; head, chest, and abdomen trying to touch the ground, with the arms stretched in front trying to reach the furthest thing from the body; in a sitting position, with arms crossed in front, while with the opposite arm they applied resistance; in cross-legged position (butterflies) head down; in a kneeling position, with the buttocks touching their heels, the trunk was flexed in front with the arms also stretched out in front and the head down; double-sided splits, squats, and sustained back arches. All of them performed one by one for four series.

Final phase or closing: it consisted of a stretch aimed at flexibility which was made up of a series of supervised exercises and directed by the correct execution of these (Figure n° 2) about the last 1 minutes of the set. In the final part of the class, the participants performed balancing movements and more toning movements, mainly involving the flexibility of the lumbar spine and the hip according to Takeuchi and Nakamura (2020) who show that with 20 seconds of static stretching it is possible to improve hip flexibility. All movements were associated with breathing, generally taking place at the moment of exhalation. At the end of these 12 sessions, the final flexibility diagnosis was made again. The active stretches performed by the time in which the position was held (figure nº 2)

Sportis. Revista Técnico-Científica del Deporte Escolar, Educación Física y Psicomotricidad
Scientific Technical Journal of School Sport, Physical Education and Psychomotricity
Editor: University of A Coruña. A Coruña. Spain
ISSN-e 2386-8333
E-mail: sportis.journal@udc.es Web: https://revistas.udc.es

Figure n.º 2. Specific stretch for flexibility preparation. In this figure you can see the active stretches performed by the time in which the position was held.

Statistic analysis

All variables were reported in means and standard deviation, before and after physical training. The t Student test was applied for related samples to identify the changes in each of the flexibility variables due to the training effect. Besides, the effect size was estimated based on the calculation of Cohen's d and was classified as low <0.35, small from 0.35 to 0.79, moderate from 0.80 to 1.49, and high ≥1.5 based on the recommendations of the National Strength & Conditioning Association (Rhea, 2004).

On the other hand, two groups were generated based on chronological age: the 7 to 9-year-old group (G-07-09) and the 10 to 12-year-old group (G-10-12), to identify the inter-subject effect of chronological age on the changes in each of the flexibility variables due to physical training, based on a repeated-measures analysis of variance (ANOVA). All tests were performed at a 95% confidence level.

Results

The average and standard deviations of each of the flexibility variables before and after the intervention, where it can be observed that there were changes in all the variables ($p<0.01$), except in the passive adduction movements. and active right hemisphere (table nº 1). Based on the effect size, it could be observed that the greatest changes were in the passive and active adduction movements of the left hemisphere (2.3 and 1.9, respectively), and in the

Sportis. Revista Técnico-Científica del Deporte Escolar, Educación Física y Psicomotricidad. Scientific Technical Journal of School Sport, Physical Education and Psychomotricity

Editor: University of A Coruña. A Coruña. Spain

ISSN-e 2386-8333

E-mail: sportis.journal@udc.es Web: https://revistas.udc.es

active right flexion JAA movement (1.8); followed by JAA passive right flexion, JAA active left flexion and JAA passive left flexion, with an effect size of 0.97, 1.18 and 1.12, respectively.

Table nº 1. Mean, standard deviation and effect size of the flexibility variables before and after training.

Variable	**Pre-training**		**Post-training**		**Mean**	**SD**	**Error**	**CI at 95%**		**t value**	**P value**	**Size effect**
	Mean	SD	Mean	SD				**lower**	**upper**			
Deep body flexion (seatting)	10.2	4.9	11.1	5.0	-0.90	0.26	.058	-1.02	-0.78	-15.39	.000	0.18
Trunk forward flexion (coxo-femoral)	40.6	4.1	43.9	4.9	-3.29	2.63	.588	-4.52	-2.05	-5.59	.000	0.73
Trunk forward flexion (lateral humeru´s epicondyle)	25.6	4.5	28.7	5.2	-3.08	3.44	.770	-4.69	-1.47	-4.00	.001	0.64
Standing trunk flexion	5.9	4.1	7.9	3.7	-1.99	1.00	.224	-2.45	-1.52	-8.86	.000	0.51
Spagat	11.3	6.1	8.4	5.4	2.85	2.20	.491	1.82	3.88	5.81	.000	-0.50
Active left abduction	78.1	11.1	101.4	9.1	-23.27	13.46	3.010	-29.57	-16.97	-7.73	.000	**2.30**
Passive left abduction	99.7	16.5	125.0	10.2	-25.30	18.36	4.106	-33.89	-16.71	-6.16	.000	**1.90**
Active right abduction	91.5	28.4	99.0	11.2	-7.54	29.87	6.679	-21.52	6.44	-1.13	.273	0.38
Passive right abduction	119.6	37.5	123.5	10.9	-3.90	34.49	7.712	-20.04	12.25	-0.51	.619	0.16
JAA active right leg flexion	93.0	7.8	108.2	8.5	-15.17	8.25	1.844	-19.03	-11.31	-8.23	.000	**1.86**
JAA passive right leg flexion	127.2	15.0	141.9	15.4	-14.75	7.93	1.773	-18.46	-11.04	-8.32	.000	0.97
JAA active left leg flexion	95.7	18.4	115.7	15.4	-20.03	11.95	2.673	-25.62	-14.44	-7.49	.000	1.18
JAA passive left leg flexion	125.5	10.3	136.9	10.2	-11.46	7.76	1.735	-15.09	-7.82	-6.60	.000	1.12

SD= Standard deviation. CI= Confidence interval. JAA= Joint Angle Assessment.

On the other hand, when performing the repeated measures ANOVA, it was observed that the changes in the variables of dorsiflexion (coxofemoral), dorsal flexion (lateral epicondyle of the humerus), and active left flexion in the JAA are a function of chronological age. The summary of the models is displayed ($p < 0.05$). For dorsiflexion (coxofemoral), improvements were found in both chronological age groups; however, the largest effect size was observed in the G-10-12 ($p < 0.001$) with 1.1, considered moderate (Table nº 2)

Sportis. Revista Técnico-Científica del Deporte Escolar, Educación Física y Psicomotricidad
Scientific Technical Journal of School Sport, Physical Education and Psychomotricity
Editor: University of A Coruña. A Coruña. Spain
ISSN-e 2386-8333
E-mail: sportis.journal@udc.es Web: https://revistas.udc.es

Table nº 2. Tests of the inter-subject effects of chronological age on changes in flexibility variables due to physical training.

Source	Sum of squares type III	fd	Mean square	F	p value
Dorsal flexión (coxo-femoral)					
Intersection	71453.6	1	71453.6	3052.1	.000
Chronological age	289.8	1	289.8	12.4	.002
Error	421.4	18	23.4		
Dorsal flexion (humeru´s lateral epicondyle)					
Intersection	29620.6	1	29620.6	949.9	.000
Chronological age	217.8	1	217.8	7.0	.017
Error	561.3	18	31.2		
JAA active left leg flexion					
Intersection	449528.1	1	449528.1	1184.1	.000
Chronological age	2757.3	1	2757.3	7.3	.015
Error	6833.4	18	379.6		

Chronological age was measured ordinally in two groups: Group 1: 7-9 years, Group 2: 10-12 years: FI=Freedom degree.

Furthermore, for dorsiflexion (lateral humerus epicondyle), only in G-07-09 significant differences were found due to training (p = 0.003); and for active left flexion JAA, changes were observed in both age groups; however, the greatest improvements in flexibility were in G-07-09 with an effect size of 2.1, considered high (table nº 3).

Table nº 3. Mean, standard deviation and effect size of the pre and post training flexibility variables by chronological age group.

	Pre-training		Post-training		Mean	SD	Error	CI at 95%		T value	P value	Size effect
	Mean	SD	Mean	SD				Lower	Upper			
Dorsal flexion (coxo-femoral)												
G-07-09y (n=11)	38.8	3.0	40.8	2.6	-2.0	1.5	0.46	-3.03	-0.97	-4.30	**0.001**	0.71
G-10-12y (n=9)	42.8	4.2	47.6	4.5	-4.9	2.9	0.97	-7.01	-2.62	5.02	**0.001**	1.10
Dorsal flexion (humeru´s lateral epicondyle)												
G-07-09y (n=11)	23.5	2.6	26.5	2.9	-3.0	2.5	0.76	-4.70	-1.30	-3.90	**0.003**	1.09
G-10-12y (n=9)	28.1	5.1	31.3	6.2	-3.2	4.5	1.49	-6.61	0.28	-2.12	0.067	0.57

Editor: University of A Coruña. A Coruña. Spain
ISSN-e 2386-8333
E-mail: sportis.journal@udc.es Web: https://revistas.udc.es

JAA active left leg flexion												
G-07-09y (n=11)	86.4	13.1	110	8.9	-23.6	17.7	4.42	-33.50	-5.30	-5.30	**0.001**	2.15
G-10-12y (n=9)	107	18.1	123	19	-15.7	5.6	1.87	-19.97	-11.36	-8.39	**0.001**	0.84

SD= Standard deviation; CI= Confidence interval; Chronological age was measured ordinally in two groups: Group 1: 7-9 years, Group 2: 10-12 years:

Discussion

Flexibility is one of the physical capabilities that is quickly lost with detraining (Díaz, 2006), so its training is important for all the benefits obtained, already discussed above. During the current COVID-19 pandemic, levels of physical activity have reduced considerably, and a decrease in physical fitness is expected. Because of this, it is important to propose more efficient methodologies for the practice of physical activity, guaranteeing the maximum benefits with the minimum risks. On the other hand, we consider that the present training program can be carried out within the new recommendations for a safe return to physical activity spaces, as well as from home.

Although flexibility work is basic for both men and women, this work was only performed on women. This is because in Mexico the inclusion of different activities is limited by a stereotypical practice of physical activity where men prefer activities such as soccer or American football, baseball, karate, while women lean towards volleyball, yoga, spinning, aerobics or dance activities (Dosal, Mejia, & Capdevila, 2017). Nevertheless it would be interesting to evaluate the effect of training programs focused on flexibility in men.

The present work is one of the first studies to analyze the effect of physical training based on postural hygiene exercises and stretching on the active and passive range of mobility in girls jazz dancers, concerning their chronological age; where a significant increase was observed in all flexibility variables, except both active and passive adduction of the right hemisphere. Likewise, in the dorsal flexion of the coxofemoral, dorsal flexion of the lateral epicondyle of the humerus, and active left flexion JAA, the improvements were in function of chronological age only; where, the greatest gains in the dorsal flexion of the coxofemoral were observed in the subgroup of age 10 - 12 years, while, in the other two measurements, the main gains were in the subgroup of 7 to 9 years.

Sportis
Revista Técnico-Científica del Deporte Escolar, Educación Física y Psicomotricidad
Scientific Technical Journal of School Sport, Physical Education and Psychomotricity
Editor: University of A Coruña. A Coruña. Spain
ISSN-e 2386-8333
E-mail: sportis.journal@udc.es Web: https://revistas.udc.es

It has been observed in the literature how regular dance practice at an early age has benefits at the motor level. Polak and Wojtuń-Sikora (2020) observed increases in flexibility, balance, strength, and agility in girls aged 7 to 10 years due to the effect of dance-based physical activity.

Among all the dance activities, Jazz seems to be an optimal strategy to increase levels of physical activity at an early age. O'Neill, Pate, and Hooker, (2012) observed higher levels of vigorous physical activity in girls aged 11 to 18 who performed Jazz compared to those who performed ballet; likewise, those who have more time invested in dance training presented greater moderate-vigorous physical activity compared to those with less time training. On the other hand, dancing is one of the most preferred activities in girls, which fosters greater motivation and adherence to physical activity programs (Resaland, et al., 2018).

Some researchers such as Akagi and Takahashi (2014); Blazevich, et al., (2014); Guissard and Duchateau (2004); La-Roche and Connolly (2006) and Umegaki et al., (2015) mention that the benefits in joint mobility obtained through flexibility training are possible, however, the methodology used and the training time is different, so the present study shows that it is possible to increase flexibility with only one session per week. However, authors such as Halbertsma and Göeken (1994) and Weppler and Magnusson (2010), agree that the mechanisms that point to increases in ROM are uncertain concerning training since the neurological and physiological adaptations are different depending on the ages, populations and even more so the different training sessions, agreeing that this effect may be possible due to changes in the nervous system and that this has a direct effect on ROM.

Studies on flexibility, such as that of Galvez, Tequiz, Chichiaza, Terpan, Rodríguez and Carchipulla, (2020) after performing four specialized mesocycles in gymnastics training, show flexibility increases in children; as well as Brusco, Blazevich & Pinto (2019), who conclude that after a six-week training it is possible to reach significant changes in ROM, obtaining significant values as in the present study, but in a greater number of training times. Diaz (2013) found flexibility improvements after a dance training lasting three months, which was not focused on developing this capacity; however, in the study by Niaradi and Batista

Sportis
Revista Técnico-Científica del Deporte Escolar, Educación Física y Psicomotricidad
Scientific Technical Journal of School Sport, Physical Education and Psychomotricity
Editor: University of A Coruña. A Coruña. Spain
ISSN-e 2386-8333
E-mail: sportis.journal@udc.es Web: https://revistas.udc.es

(2018), after developing a holistic gymnastics program once a week, observed significant flexibility changes with a low-frequency training, which coincides with our study.

When it comes to short training periods, studies such as that by Takeuchi and Nakamura (2020) show that with 20 seconds of static stretching at the high intensity it is possible to improve hip flexibility, eliminating the stiffness of the hamstrings muscle-tendon unit, a situation that occurred in our study with the same duration of sustained stretching, thus achieving a moderate and high effect, and this improvement could be attributed to the age of our study participants.

In the study by Hatano et al., (2019), after aiming to determine the effects of static stretching on the hamstrings and the duration of these effects, they were able to observe that with 300 consecutive seconds of passive stretching, valued at 10, after 20 and 30 minutes, changes in ROM were observed. Although in our study it was 16 minutes per series, it should be noted that a greater number of exercises were contemplated, since it was sought to increase the flexibility of the hip in a general way, evaluated through six different tests, so that a greater number of positions were necessary to achieve the objective. Body composition and morphological conditions of the dancers could affect the flexibility development (Silva, & Bonorino, 2008) so that in future studies it would be convenient to assess these characteristics.

In relation to the comparison of different methods to develop flexibility, works by Lykesas, Giossos, Chatzopoulos, Koutsouba, Douka, and Nikolaki (2020) point out the importance of warm-up focused on static flexibility for sessions that involve working at the maximum of the joint range, unlike dynamic flexibility, proposed for sessions where the joint range requirement will be lower. Delmiro and Pinto (2020) used the proprioceptive neuromuscular facilitation method in jazz dancers, where no significant difference was observed when compared with the results with static flexibility.

The present research presents some limitations. The lack of a control group made it impossible to completely conclude that the improvements in the different flexibility variables were due to training; however, these types of pre-post designs can provide important results. Also, the maturation state of the participants was not measured, which may provide more

Sportis
Revista Técnico-Científica del Deporte Escolar, Educación Física y Psicomotricidad
Scientific Technical Journal of School Sport, Physical Education and Psychomotricity
Editor: University of A Coruña. A Coruña. Spain
ISSN-e 2386-8333
E-mail: sportis.journal@udc.es Web: https://revistas.udc.es

information than chronological age, so it is recommended that the maturation state be considered in future studies.

Conclusion

In conclusion, training focused on static exercises can be considered an effective strategy to develop ROM, increasing flexibility and stretching in lower extremities with a frequency of once a week in jazz girls dancers aged 7 to 12 years, achieving effects mainly in the non-dominant side. In Addition to observing a greater response to static flexibility training in the group of 10 to 12 in hip joint and foot joints than in the group of 7 to 9 years.

References

Abilleira, M., Fernández-Villarino, M., & Prieto-Troncoso, J. (2017). Influencia de la Danza en el autoconcepto del alumnado de Educación Primaria: análisis comparativo con otras actividades físicas. Sportis, 3(3), 554-568. https://doi.org/10.17979/sportis.2017.3.3.2244

Akagi, R., & Takahashi, H. (2014). Effect of a 5-week static stretching program on hardness of the gastrocnemius muscle. Scandinavian journal of medicine & science in sports, 24(6), 950-957. https://doi.org/10.1111/sms.12111

American Academy of Orthopaedic Surgeons (1965). Joint Motion: Method of Measuring and Recording. Chicago: Park Ridge

American Medical Association. (2001). Guides to the Evaluation of Permanent Impairment (4th ed.) Milwaukee, WI.

Batista, A., Bobo, M., Lebre, E., y Ávila-Carvalho, L. (2015) Flexibilidad en gimnasia rítmica: asimetría funcional en gimnastas júnior portuguesas. Apunts. Educación física y deportes, 2 (120), 19-26. https://doi.org/10.5672/apunts.2014-0983.es.(2015/2).120.03

Blazevich, A. J., Cannavan, D., Waugh, C. M., Miller, S. C., Thorlund, J. B., Aagaard, P., & Kay, A. D. (2014). Range of motion, neuromechanical, and architectural adaptations to plantar flexor stretch training in humans. Journal of applied physiology, 117 (5), 452-462. https://doi.org/10.1152/japplphysiol.00204.2014

Sportis. Revista Técnico-Científica del Deporte Escolar, Educación Física y Psicomotricidad
Scientific Technical Journal of School Sport, Physical Education and Psychomotricity
Editor: University of A Coruña. A Coruña. Spain
ISSN-e 2386-8333
E-mail: sportis.journal@udc.es Web: https://revistas.udc.es

Bolívar, H. M., Cardona, K. I., Naranjo, J. C., y Rodriguez, J. D. (2018). Efectos de un programa de entrenamiento para el mejoramiento de la condición física en niños futbolistas. Impetus, 10(1), 11-22. https://doi.org/10.22579/20114680.161

Brusco, CM., Blazevich, AJ., & Pinto, RS. (2019). The effects of 6 weeks of constant-angle muscle stretching training on flexibility and muscle function in men with limited hamstrings' flexibility. Europan Journal of Applied Physioly. 119 (8),1691-1700 https://doi.org/10.1007/s00421-019-04159-w

Castañeda-Babarro, A., Arbillaga-Etxarri, A., Gutiérrez-Santamaría, B., & Coca, A. (2020). Physical activity change during COVID-19 confinement. International Journal of Environmental Research and Public Health, 17(18), 6878. https://doi.org/10.3390/ijerph17186878

Cervantes, I. (2017). Efecto de un programa de estiramientos de la musculatura isquiosural en bailarinas. Doctoral dissertation. Universidad Católica San Antonio de Murcia. Murcia, España. https://doi.org/10.14349/sumapsi.2020.v27.n2.1

Cejudo, A., de Baranda, P. S., Ayala, F., & Santonja, F. (2015). Test-retest reliability of seven common clinical tests for assessing lower extremity muscle flexibility in futsal and handball players. Physical Therapy in Sport, 16(2), 107-113. DOI: 10.1016/j.ptsp.2014.05.004. https://doi.org/10.1016/j.ptsp.2014.05.004

Colcha, M. J., & Ortiz, P.G. (2018). Método de flexibilidad activa en el rango de movilidad articular del split de las niñas de la categoría menores en la rama femenina de gimnasia artística. Doctoral Tesis. Universidad de Ambato. Ecuador. https://doi.org/10.19137/qs.v2i0.746

Coledam, D. H., Arruda, G., Oliveira, A. (2012). Chronic effect of static stretching performed during warm-up on flexibility in children. Revista Brasileira de Cineantropometria e Desempenho Humano, 14(3): 296-304. DOI: 10.5007/1980-0037.2012v14n3p296. https://doi.org/10.5007/1980-0037

Delmiro, A, & Pinto, N. V. (2020). Evaluación de la flexibilidad en las ballerinas de jazz presentadas al método de facilitación neuromuscular propioceptiva. Research, Society and Development, 9(6), e146963568. https://doi.org/10.33448/rsd-v9i6.3568 https://doi.org/10.33448/rsd-v9i6.3568

Editor: University of A Coruña. A Coruña. Spain
ISSN-e 2386-8333
E-mail: sportis.journal@udc.es Web: https://revistas.udc.es

Artículo Original. Integrative flexibility training to improve joint mobility and range of movement in jazz dancing girls. Vol. 7, n.º 3; p. 425-447, septiembre 2021. https://doi.org/10.17979/sportis.2021.7.3.8572

DOF. Diario Oficial de la Federación. (2014). Reglamento de la ley general de salud en materia de investigación para la salud. In Cámara de Diputados del H. Congreso de la Unión. México.

Díaz, P. E. H. (2006). Flexibilidad: evidencia científica y metodología del entrenamiento. PubliCE Standard.1-22.

Diaz, R. (2013). Flexibilidad en adultos mayores por medio de la danza aeróbica. Universidad del Valle instituto de Educación y Pedagogía en el recinto departamento de Educación Física y Deportes Ciencias del Deporte Santiago de Cali. https://doi.org/10.17533/udea.efyd.v37n1a01

Domínguez, E., Arjol, J., Crespo, R., & Fernández, C. (2020). Regreso al entrenamiento y la competición en el fútbol profesional después de la alerta sanitaria del covid-19 con énfasis en los efectos del confinamiento durante el desentrenamiento. Revista de Preparación Física en el Fútbol, 1-8. https://doi.org/10.2307/j.ctt21kk0xm.8

Donti, O., Papia, K., Toubekis, A., Donti, A., Sands, W. A., & Bogdanis, G. C. (2018). Flexibility training in preadolescent female athletes: Acute and long-term effects of intermittent and continuous static stretching. Journal of Sports Sciences, 36(13), 1453-1460. https://doi.org/10.1080/02640414.2017.1397309

Dosal, R., Mejía., M., & Capdevila L. (2017) Deporte y equeidad de género. Econimía UNAM, 14 (40),121-133. https://doi.org/10.1016/j.eunam.2017.01.005 https://doi.org/10.1016/j.eunam.2017.01.005

Estrada, Y. (2018). Revisión sistemática sobre las baterías de evaluación usadas en el examen de la condición física. Rev. Colomb. Rehabil, 9, 62–71. https://doi.org/10.30788/revcolreh.v9.n1.2010.216

Galvez, N., Tequiz, W., Chichiaza, C., Terpan, R., Rodríguez, S., & Carchipulla, S.. (2020). Potenciación de la capacidad flexibilidad en la gimnasia artística masculina infantil. Lecturas: Educación Física y Deportes, 24 (261), 46-56. https://doi.org/10.46642/efd.v24i261.1943

Gioia, T. (2013). Historia del jazz. Madrid, España: Turner.

Gómez-Landero Rodríguez, L. A., López Bedoya, J., & Vernetta Santana, M. (2013). Evaluación de la flexibilidad activa y pasiva en trampolinistas españoles. Revista

Sportis. Revista Técnico-Científica del Deporte Escolar, Educación Física y Psicomotricidad
Scientific Technical Journal of School Sport, Physical Education and Psychomotricity
Editor: University of A Coruña. A Coruña. Spain
ISSN-e 2386-8333
E-mail: sportis.journal@udc.es Web: https://revistas.udc.es
Open Access Creative Commons

Internacional de Medicina y Ciencias de la Actividad Física y el Deporte.13 (49) 55-72. https://doi.org/10.5672/apunts.2014-0983.es.(2012/1).107.08

Guillamón, A., Cantó, E., & López, P. (2018). La educación física como programa de desarrollo físico y motor. Emás F: revista digital de educación física, (52), 105-124. https://doi.org/10.15332/tg.mae.2018.00400

Guissard, N., & Duchateau, J. (2004). Effect of static stretch training on neural and mechanical properties of the human plantar-flexor muscles. Muscle & Nerve: Official Journal of the American Association of Electrodiagnostic Medicine, 29 (2), 248-255. https://doi.org/10.1002/mus.10549

Halbertsma, J. P., & Göeken, L. N. (1994). Stretching exercises: effect on passive extensibility and stiffness in short hamstrings of healthy subjects. Archives of physical medicine and rehabilitation, 75 (9), 976-981. https://doi.org/10.1016/0003-9993(94)90675-0

Hatano, G., Suzuki, S., Matsuo, S., Kataura, S., Yokoi, K., Fukaya, T., Fujiwara, M., Asai, Y., & Iwata, M., Hamstring (2019). Stiffness Returns More Rapidly After Static Stretching Than Range of Motion, Stretch Tolerance, and Isometric Peak Torque. Journal Sport Rehabilitation, 28 (4), 325-331. https://doi.org/10.1123/jsr.2017-0203

Hernández, P (2007). Flexibilidad: Evidencia Científica y Metodología del Entrenamiento. PubliCE. 1-78.

Herrera-Valenzuela, T., Valdés-Badilla, P., & Franchini, E. (2020). Recomendaciones de entrenamiento intervalado para atletas de deportes de combate olímpicos durante la pandemia del COVID-19. Revista de Artes Marciales Asiáticas, 15, 1-3. https://doi.org/10.18002/rama.v15i1.6230

Infante, S. (2019). Time to movie. Doctoral dissertation. Corporación Universitaria Minuto de Dios. Bogotá, Colombia. https://doi.org/10.11600/1692715x.16211

Kalazich, C., Valderrama, P., Flández, J., Burboa, J., Humeres, D., Urbina, R., & Valenzuela, L. (2020). Orientaciones Deporte y COVID-19: Recomendaciones sobre el retorno a la actividad física y deportes de niños niñas y adolescentes. Revista chilena de pediatría, (AHEAD), 0-0. https://doi.org/10.32641/rchped.v91i7.2782

Sportis Revista Técnico-Científica del Deporte Escolar, Educación Física y Psicomotricidad
Scientific Technical Journal of School Sport, Physical Education and Psychomotricity

Editor: University of A Coruña. A Coruña. Spain
ISSN-e 2386-8333
E-mail: sportis.journal@udc.es Web: https://revistas.udc.es

La-Roche, D. P., & Connolly, D. A. (2006). Effects of stretching on passive muscle tension and response to eccentric exercise. The American Journal of Sports Medicine, 34 (6), 1000-1007. https://doi.org/10.1177/0363546505284238

Lykesas, G., Giossos, I., Chatzopoulos, D., Koutsouba, M., Douka, S., & Nikolaki, E. (2020). Effects of Several Warm-Up Protocols (Static, Dynamic, No Stretching, Greek Traditional Dance) on Motor Skill Performance in Primary School Students. International Electronic Journal of Elementary Education, 12(5), 481–487. Retrieved from https://www.iejee.com/index.php/IEJEE/article/view/1155. https://doi.org/10.26822/iejee.2020562138

Malina, R. M., Bouchard, C., & Bar-Or, O. (2004). *Growth, maturation, and physical activity*. Human kinetics.

Márquez, J. y Celis, C. (2016). Capacidades Físicas Básicas: Su desarrollo en la edad escolar. Wanceulen SL.

Mayorga-Vega, D., Merino-MArban, R., Sánchez-Rivas, E., Viciana, ,J. (2014). Effect of a short-term static stretching training program followed by five weeks of detraining on hamstring extensibility in children aged 9-10 years. Journal of Physical Education and Sport, 14(3), 355-359. https://doi.org/10.4100/jhse.2014.91.18

Morillas, E. P. (2019). Apuntes para la mejora de la flexibilidad en bailarines. Revista del Centro de Investigación Flamenco Telethusa, 12(14), 23-29.

Niaradi, F. D., & Batista, C. G. (2018). Effect of holistic gymnastics in the flexibility of girls between 10 and 12 years. Journal of Physical Education, 29, 1-10 https://doi.org/10.4025/jphyseduc.v29i1.2954

Oliva, J. (2007). Calidad De Enseñanza En Educación Física y Deportiva y Discurso Docente: El Caso De La Comunidad De Madrid. Revista De educación. 334: 447-467 https://doi.org/10.35537/10915/42995

O'Neill, J. R., Pate, R. R., & Hooker, S. P. (2012). The contribution of dance to daily physical activity among adolescent girls. International journal of behavioral nutrition and physical activity, 8 (1), 1-8. https://doi.org/10.1186/1479-5868-8-87

Sportis Revista Técnico-Científica del Deporte Escolar, Educación Física y Psicomotricidad
Scientific Technical Journal of School Sport, Physical Education and Psychomotricity

Editor: University of A Coruña. A Coruña. Spain
ISSN-e 2386-8333
E-mail: sportis.journal@udc.es Web: https://revistas.udc.es

Polak, E., & Wojtuń-Sikora, B. (2020). Changes in motor skills among early school aged girls under the influence of regularly practiced dance. Research in Dance Education, 1, 1-16. https://doi.org/10.1080/14647893.2020.1867089

Ramos, S., & Taborda, J. (2001). Orientaciones para la planificación del entrenamiento con niños. Apunts: educación física y deportes, 65, 45-52. https://doi.org/10.5672/apunts.2014-0983.es.(2015/2).120.06

Resaland, G. K., Aadland, E., Andersen, J. R., Bartholomew, J. B., Anderssen, S. A., & Moe, V. F. (2019). Physical activity preferences of 10-year-old children and identified activities with positive and negative associations to cardiorespiratory fitness. Acta Paediatrica, 108 (2), 354-360. https://doi.org/10.1111/apa.14487

Rhea, M. R. (2004). Determining the magnitude of treatment effects in strength training research through the use of the effect size. Journal ofstrength and conditioning research, 18, 918-920. https://doi.org/10.1519/00124278-200411000-00040

Rodríguez, D. A. (2020). Bondades y deficiencias del Eurofit en la evaluación de las capacidades físicas en escolares. Revisión sistemática. Tesis. Universidad Cesar Vallejo. Peru.

Rodríguez, M., Crespo, I., & Olmedillas, H. (2020). Exercising in times of COVID-19: what do experts recommend doing within four walls?. Revista espanola de cardiologia (English ed.), 73(7), 527. https://doi.org/10.1016/j.rec.2020.04.001

Ruiz, J. A. B. (2008). El calentamiento y la adaptación del organismo al esfuerzo. Wanceulen SL.

Sabaananth, S. (2021). Dance and walking: towards resurgence to healthy life during Covid lockdown. Bharathiar National Journal of Physical Education and Exercise Science (ISSN: 0976-3678) e-ISSN Applied (International Peer-Reviewed Journal), 12(1), 4-10.

Salazar, C., Juárez, R., Andrade, A., Peña, C., Arellano, C., & Hernández, A. (2016). Percepción del beneficio de los deportes y actividades recreativas en habilidades para la vida en niños y adolescentes de Ciudad Juárez, México. Sportis: Revista Técnico-Científica del Deporte Escolar, Educación Física y Psicomotricidad, 2(3), 356-378. https://doi.org/10.17979/sportis.2016.2.3.1524

Sportis Revista Técnico-Científica del Deporte Escolar, Educación Física y Psicomotricidad
Scientific Technical Journal of School Sport, Physical Education and Psychomotricity
Editor: University of A Coruña. A Coruña. Spain
ISSN-e 2386-8333
E-mail: sportis.journal@udc.es Web: https://revistas.udc.es

Sánchez, L. L., Ramírez, L. R., & de Ávila Martínez, Y. (2020). Ejercicios de flexibilidad para la gimnasia artística en el sexo masculino. Revista científica Olimpia, 17, 794-806.

Silva, A.H. & Bonorino, K.C. (2008). BMI and flexibility in ballerinas of contemporary dance and classical ballet. Fitnes Performance Journal; 7(1):48-51. https://doi.org/10.3900/fpj.7.1.48.e

Soto, D. (2015). Las capacidades físicas y su incidencia en la danza y baile contemporáneo en la sección de danza de la Universidad Nacional de Loja. Tesis. Universidad Nacional de Loja. Ecuador. https://doi.org/10.36955/riulcb.2015v2n1.004

Steinberg, N., Hershkovitz, I., Peleg, S., Dar, G., Masharawi, Y., Heim, M., & Siev-Ner, I. (2006). Range of joint movement in female dancers and nondancers aged 8 to 16 years: anatomical and clinical implications. The American journal of sports medicine, 34(5), 814-823. https://doi.org/10.1177/0363546505281805

Stewart, A., Marfell-Jones, M., Olds, T. y Hans, d. R. (2019). Protocolo internacional para la valoración antropométrica (1ª ed.). United Kingdom. Sociedad Internacional para el Avance de la Cineantropometría.

Takeuchi, K., & Nakamura, M. (2020) Influence of High Intensity 20-Second Static Stretching on the Flexibility and Strength of Hamstrings. Journal Sports Science Medicine. 19 (2), 429-435.

Ubaque, J. G. (2019). Flexibilidad: ¿Capacidad fundamental? Valoración de sistema LDF enfatizado en la flexibilidad. Revista Siembra CBA, (1), 23-35

Umegaki, H., Ikezoe, T., Nakamura, M., Nishishita, S., Kobayashi, T., Fujita, K., & Ichihashi, N. (2015). Acute effects of static stretching on the hamstrings using shear elastic modulus determined by ultrasound shear wave elastography: differences in flexibility between hamstring muscle components. Manual therapy, 20 (4), 610-613. https://doi.org/10.1016/j.math.2015.02.006

Weppler, C. H., & Magnusson, S. P. (2010). Increasing muscle extensibility: a matter of increasing length or modifying sensation?. Physical therapy, 90 (3), 438-444. https://doi.org/10.2522/ptj.20090012

Artículo Original. Integrative flexibility training to improve joint mobility and range of movement in jazz dancing girls. Vol. 7, n.º 3; p. 425-447, septiembre 2021. https://doi.org/10.17979/sportis.2021.7.3.8572

World Health Organization (2020). Estrategia mundial sobre régimen alimentario, actividad física y salud. Recuperado de: Https://www.who.int/dietphysicalactivity/pa/es/#:~:text=Se%20considera%20actividad%20f%C3%ADsica%20cualquier,registradas%20en%20todo%20el%20mundo).

World Medical Association. (2017). Declaración de Helsinki. Principios éticos para la investigación en seres humanos. Boletín del Consejo Académico de Ética en Medicina. 1(2), 239-243. https://doi.org/10.17126/joralres.2013.009