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Pliometric and virtual training for prevention of injury in young women: a qualitative approach

Treinamento pliométrico e virtual para prevenção de lesões em mulheres jovens: uma abordagem qualitativa

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ABSTRACT
The aim of the study was to explore the opinions of the volunteers about the plyometric training protocol associated with resistance (PTRE) and virtual (VT) exercises for injury prevention. This approach was chosen considering that patients' perceptions in general could be neglected. Data collection took place with two Focus Groups (FGs) and to this end, an invitation was made to seven participants from both groups who had already completed the training. A meeting was held, with an average duration of 60 minutes for each intervention group, and a trained moderator conducted it; the sessions were recorded on audio and later transcribed for analysis. The participants reported the increase of physical conditioning, endurance and muscle strength in both training sessions. It was concluded that in PTRE, the issue of improved balance and stability of lower limbs was highlighted, while in VT the improvement of concentration and disposition for the daily routine.

Keywords: Focus group. Plyometric training. Qualitative research. Virtual reality exposure therapy.

RESUMO
O objetivo do estudo foi explorar as opiniões das voluntárias de um protocolo de treinamento pliométrico associado a exercícios resistidos (TPER) e virtual (TV) para prevenção de lesões. Essa abordagem foi escolhida, pois as percepções dos pacientes em geral podem ser negligenciadas. A coleta de dados ocorreu com dois grupos focais (GFs), e para isso formalizou-se o convite a sete participantes de cada um deles que já houvessem finalizado o treinamento. Realizou-se um encontro, com duração média de 60 minutos para cada grupo de intervenção, e um moderador treinado o conduziu; as sessões foram gravadas em áudio e transcritas posteriormente para análise. As participantes relataram em ambos os treinos o aumento do condicionamento físico, resistência e força muscular. Concluiu-se que no TPER foi mais destacada a melhora do equilíbrio e estabilidade de membros inferiores, já no TV isso ocorreu em relação à concentração e à disposição para a rotina diária.

Palavras-chave: Grupo focal. Pesquisa qualitativa. Terapia de exposição à realidade virtual. Treinamento pliométrico.

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INTRODUCTION

The female population is more prone to lower limb injuries - both athletes and sedentary women - and studies have shown that neuromuscular training can be effective in reducing injuries, such as, for example, anterior cruciate ligament (ACL) training, in young women.[1-3] In order to minimize the occurrence of such sports injuries, several preventive exercise programs are developed for athletes who participate in different sports, mainly for women. This meets the need to think and invest also in prevention, and not only for the treatment of dysfunctions already installed. For this, programs containing plyometric exercises stand out, with the purpose of changing the kinematics of the lower limbs, with an increase in the eccentric torque of the hip and the functional performance.[4]

Another method of physical training of recent investigation is through virtual rehabilitation. Using games called exergames, its objectives involve the exploration of body movement in activities such as running, jumping, lowering or lying down, using graphic representations in the virtual environment and enabling the interaction of the individual with the electronic device, through a system computer that allows sensory feedback, visual, auditory or tactile.[5]

Both workouts contribute to the activities performed during the routine of daily living. In addition, individual perceptions can influence the reaction to the given stimulus, such as, for example, pain, which can be graded based on its intensity, the suffering it provides and the functional impairment it triggers. All these factors can interfere with daily activities and participation in social roles.[6]

In order to prevent injuries that cause pain and promote health, research has been growing and bringing protocols designed especially for a specific population and with exercise programs focused on the individual.[7] However, studies are needed that consider the view of participants who have different biopsychosocial contexts. It is important to know how such practices reflect on their bodies and minds, which is possible with qualitative data analysis. In this sense, the focus group (FG) technique brings such a contribution, through its traditions as the effectiveness in communication and group dynamics, in order to improve the future perspectives and practices in the interventions, based on the interaction of individuals with treatments, and how it can influence the outcome.[8,9]

In addition to movements and muscle strengthening, training promotes motivation to develop a certain skill, having representativeness within the activity of daily living, and encouragement to exercise[3,10]. Among so many possibilities, the focus of this study was the meaning of this training for the volunteers, from their emotional perception to their physical change. It is noteworthy that these were topics highly addressed, since the search for self-knowledge is present daily and that any meaning given to the practice of physical exercise inserted in that routine is important and through the focus group, social integration is also perceived between them. It is considered that there is always an educational component in these practices, because, in addition to the exchange of information, there is the discovery of limits and behavior, representing the degree of disposition and psychological and emotional well-being of an individual.

Given the above, seeking to understand the experience of participating in training groups and incorporating it into the lives of the participants, the objective of this study was to explore the opinions and perceptions of volunteers from the plyometric training protocol associated with resistance and virtual exercises to prevent injuries.

METHODOLOGY

This qualitative research is part of a quasi-experimental study, with intervention through

physical exercise, designed to understand how phenomena occur through biopsychosocial processes and to cover discussions in the midst of research.[11] It was approved by the Research Ethics Committee under number 2.073.109, and all participants signed an Informed Consent Form after due explanation of the research.

The focus group (FG) technique was used, which gathers people in order to discuss a specific and relevant topic for the study in question. In the task of collecting information and opinions, it is not relevant to have a social and economic leveling among the participants, but it is necessary to ensure a safe and peaceful environment for the exchange of experiences.[8]

The total sample consisted of 14 women participants (n = 14), 11 of whom attended the FG.[12] They were recruited through the dissemination of the project on the premises of the Federal University of Triângulo Mineiro and were aged between 18 and 30 years. Participants were selected by an interview, with questions about the level of physical activity and health status. The sample included only healthy and physically active women, who practice physical activities at least three times a week, for at least 30 minutes of training or activity. Those outside the age group and those with serious health problems, current or previous injuries to the lower limbs, signs of inflammation, pain and joint instability were not included.

The selected women were randomly assigned (through a simple draw) to two study groups. After the volunteers participated in a study on the effectiveness of different interventions, a group gathered the participants of plyometric training, associated with resistance exercise (PTRE), and another, those of virtual training (VT), with the game Your Body Shape Fitness Evolved 2012/Xbox 360º Kinect®. The training sessions were developed over an eight-week period, with sessions of three times a week, totaling 24 sessions of approximately 50 minutes. All training was conducted by the same duly trained professional.

PTRE had three phases (Chart 1). The first, carried out during the initial two weeks, consisted of jumping activities with less difficulty. Thus, four basic elements were stimulated: 1) correct posture and alignment of the body throughout the jump; 2) jumps without latero-lateral and anteroposterior deviations; 3) soft landings by rolling the forefoot to the heel; and 4) instant preparation for the next jump. Phase 2, the fundamentals phase, took place in the following three weeks and aimed to create a resistance base for the next phase, by increasing the difficulty and the repetition time of the activities. Finally, in phase 3, which occurred in the last three weeks, the activities focused on improving performance through exercises that encouraged maximum heights and distances and involving one-foot support.

Chart 1. Plyometric Training Program Associated with Resistance Exercise

Exercise	Duration or repetition
Phase 1 – Technique (2 weeks)	
1. Transverse Abdominis Awareness (5 sec)	2 x 15 rep
2. Wall jumps	20 sec
3. Athletic position (5 sec)	5 rep
4. Squat jumps (60º degree knee flexion)	15 sec
5. Lunge jumps	15 sec
6. Horizontal jump + athletic position (5 sec)	8 rep
7. 180-degree jumps	20 sec
8. Forward-backward jumps over a line line	20 sec
9. Forward jump over a barriers (3)	8 rep
10. Lateral-lateral jumps over a line	20 sec
11. Lateral jump over line + vertical jump	8 rep
12. Drop landing + athletic position	8 rep
13. Knee extension in Open Kinetic Chain (90º-45º)	3 x 15 rep
14. Knee flexion in Open Kinetic Chain (0-90º)	3 x 15 rep
15. Side lying hip abduction + extension in Open Kinetic Chain (5 sec)	3 x 15 rep

(Continua)

16. Prone hip extension + lateral rotation in Open Kinetic Chain (5 sec)	3 x 15 rep
Phase 2 – Fundamentals (3 weeks)	
1. Prone hip extension + lateral rotation in Open Kinetic Chain (10 sec)	2 x 15 rep
2. Athletic position in single-leg standing(5 sec)	5 rep
3. Wall jumps	30 sec
4. Squat jumps (60º degree knee flexion)	2 x 15 sec
5. Hip flexion jumps	15 sec
6. Triple horizontal jump + vertical jump	6 rep
7. 180-degree jumps	15 sec
8. Lunge jumps	15 sec
9. Forward jump over a barrier + jump onto platform	6 rep
10. Lateral-lateral jumps over a barrier	2 x 15 sec
11. Forward-backward jumps over a barrier	2 x 15 sec
12. Anterior drop landing + maximum vertical jump	6 rep
13. Side drop landing + maximum vertical jump	6 rep
14. Single-leg vertical jump + maintenance of athletic position (5 sec)	6 rep
15. Knee extension in Open Kinetic Chain	3 x 12 rep
16. Knee flexion in Open Kinetic Chain	3 x 12 rep
17. Prone hip abduction + lateral rotation in Open Kinetic Chain on 4 supports (5sec)	3 x 12 rep
18. Prone hip extension + lateral rotation in Open Kinetic Chain on 4 supports, with the knees bent (5sec)	3 x 12 rep
Phase 3 – Performance (three weeks)	
1. Prone bridge with transverse abdominis contraction (10 sec)	1 x 15 rep
2. Maintenance of single-leg athletic position (5 sec)	5 rep
3. Hip flexion jumps	2 x 15 rep
4. 180-degree jumps	20 sec
5. Lunge jump with trunk rotation to the side of the support limb	20 sec
6. Maximum horizontal jump + maximum vertical jump	6 rep
7. Forward-backward single-leg jumps over a barrier	15 sec
8. Lateral-lateral single-leg jumps over a barrier	15 sec
9. Single-leg horizontal jump + maintenance of athletic position (5 sec)	4 rep
10. Side drop landing + maximum vertical jump + maximum horizontal jump	6 rep
11. Forward single-leg jumps over barriers (2) + jump onto platform	4 rep
12. Side (2) and medial (2) single-leg jumps over barriers (2) + jump onto platform	8 rep
13. Single-leg drop landing + maximum vertical jump	4 rep
14. Knee Extension in Open Kinetic Chain (90º-45º)	3 x8 rep
15. Knee Flexion in Open Kinetic Chain (0-90º)	3 x 8 rep
16. Single-leg support + contralateral hip abduction	3 x 8 rep
17. Prone hip extension + lateral rotation in Open Kinetic Chain on 4 supports	3 x 8 rep

(Conclusão)

rep – repetition; sec – seconds

Source: Adapted from Baldon et al. (2014)

VT protocols (Chart 2) were also divided into three phases, of increasing difficulty, using two protocols simultaneously: 1) exercises from the game Your Body Shape Fitness Evolved 2012; and 2) Nike Kinetic Training exercises. Phase 1, carried out during the first two weeks, consisted of lower difficulty jumping activities, with a primary focus on the appropriate technique. In the following three weeks, phases 2 and 3 had the same objective as the PTRE protocol, including activities with greater functional demand on the lower limbs in phase 3, with a focus on improving performance, with maximum heights and distances.

Chart 2. Virtual training program

(Continua)

Exercise	Duration or repetition
Phase I - Technical (1-2 weeks)	
1. Warm Up: Juggle It	120 seg.
2. Warm Up: Kick It	120 seg.
3. Warm Up: Hu-la-la	120 seg.
4. Run The World: NY Broadway	400 m.
5. Jump Rope: Easy	120 seg.
6. Workout: Glutes 100% A	
- Knee up-side kick – D	8 rep.
- Sumo squat	8 rep
- Knee up-side kick – E	8 rep
7. Workout: Glutes 100% B	
- Dumbbell Knee up-side kick – D	8 rep.
- Dumbbell squat	8 rep.
- Dumbbell Knee up-side kick - E	8 rep.
- Dumbbell Knee up-side kick - D	8 rep.
- Dumbbell squat	8 rep.
- Dumbbell Knee up-side kick – E	8 rep.
8. Workout: Leg 100% A	
- Step squat	8 rep.
- Sumo squat	8 rep.
- Side-to-side lunge	8 rep.
9. Workout: Leg 100% B	
- Dumbbell step squat	8 rep.
- Dumbbell squat	8 rep.
- Back Lunge	8 rep.
- Dumbbell step squat	8 rep.
- Dumbbell squat	8 rep.
- Back Lunge	8 rep.
Phase II – Fundamental (3-5 weeks)	
1. Run The World: NY Times Square	600 m.
2. Jump Rope: Medium	120 seg.
3. Workout: Glutes 100% C	
- Braced Squat	8 rep.
- Dumbbell sumo squat	8 rep.
- Lunge	8 rep.
- Braced Squat	8 rep.
- Dumbbell sumo squat	8 rep.
- Lunge	8 rep.
4. Workout: Glutes 100% D	
- Offset back lunge - D	8 rep.
- Sumo squat	8 rep.
- Offset back lunge - E	8 rep.
- Dumbbell knee up-side kick - D	8 rep.
- Dumbbell step squat	8 rep.
- Dumbbell knee up-side kick - E	8 rep.
- Step side lunge - D	8 rep.
- Sumo rising	8 rep.
- Step side lunge - E	8 rep.
- Offset back lunge - D	8 rep.
- Sumo squat	8 rep.
- Offset back lunge - E	8 rep.
- Dumbbell knee up-side kick - D	8 rep.
- Step squat	8 rep.
- Dumbbell knee up-side kick – E	8 rep.
5. Workout: Leg 100% C	
- Bicep comb lunge - D	6 rep.
- Globet squat	6 rep.
- Bicep comb lunge - E	6 rep.
- Bicep comb lunge - D	6 rep.
- Globet squat	6 rep.
- Bicep comb lunge – E	6 rep.
6. Workout: Leg 100% D	

(Continua)

(Continua)

- Bicep comb lunge – D	4 rep.
- Dumbbell squat	4 rep.
- Bicep comb lunge - E	4 rep.
- Muscle Man Twist - D	4 rep.
- Dumbbell sumo squat	4 rep.
- Muscle Man Twist - E	4 rep.
- Knee-up Side-kick - D	8 rep.
- Squat	8 rep.
- Knee-up Side-kick - E	8 rep.
- Bicep comb lunge - D	4 rep.
- Dumbbell squat	4 rep.
- Bicep comb lunge - E	4 rep.
- Muscle Man Twist - D	4 rep.
- Dumbbell sumo squat	4 rep.
- Muscle Man Twist - E	4 rep.
Phase III – Performance (6-8 weeks)	
1. Run The World: 5th Avenue	800 m.
2. Jump Rope: Hard	81 seg.
3. Workout: Glutes 100% E	
- Back lunge	6 rep.
- Goblet squat	6 rep.
- Curtsy lunge raise	6 rep.
- Single side lunge - D	6 rep.
- Step squat	6 rep.
- Single side lunge - E	6 rep.
- Dumbbell knee up-side kick - D	12 rep.
- Dumbbell sumo squat	12 rep.
- Dumbbell knee up-side kick - E	12 rep.
- Single side lunge - D	12 rep.
- Step squat	6 rep.
- Single side lunge - E	12 rep.
- Back lunge	6 rep.
- Goblet squat	6 rep.
- Curtsy lunge raise	6 rep.
4. Workout: Leg 100% E	

(Conclusão)

- Offset back lunge – D	12 rep.
- Curtsy lunge raise	6 rep.
- Offset back lunge - E	12 rep.
- Tap side tap back - D	8 rep.
- Sumo squat	8 rep.
- Tap side tap back - E	8 rep.
- Muscle Man Twist - D	6 rep.
- Dumbbell squat	12 rep.
- Muscle Man Twist - E	6 rep.
- Tap side tap back - D	8 rep.
- Sumo squat	8 rep.
- Tap side tap back - E	8 rep.
- Offset back lunge - D	12 rep.
- Curtsy lunge raise	6 rep.
- Offset back lunge – E	12 rep.

R – right; L – left; sec – seconds; rep – repetitions; m – meters.
Source: Research data.

After 24 sessions, data were collected with two FGs, and for this purpose, the invitation to seven participants from each group was formalized so that, by the date of the meetings, they had already completed the training. A meeting was organized, with an average duration of 60 minutes, for each intervention group; in the FG of the volunteers from the PTRE protocol, five volunteers attended, and from the VT protocol, six volunteers - the absences were justified. A trained moderator, accompanied by two observers, led the groups, and the sessions were audio recorded and later transcribed in full for analysis. Initially, the objectives of such sessions were explained, the way they would record the speeches and address the fact of the confidentiality of the records and names.[13] A guiding script was used to talk about the training protocols and the perception of competencies in daily life activity, according to Chart 3.

Chart 3. Focus group script

Training protocol	What did you think of the training exercises? Have you done similar exercises before? Did you feel any pain or discomfort during training? What did you find easier and more difficult in training? Have you ever taught or talked about these exercises to anyone?
Perception of competencies in the daily life activity	What were you like before training? How are you today? How important is this training for your life? Will you continue to exercise regularly? Were there changes in your body? Which are? Did you notice changes in mood or sleep quality?

Source: Research data

For data presentation, thematic content analysis was used, which reaches the meanings brought by the participants and which best meets the health theme, because it refers to an affirmation to a certain subject. In this way, such analysis seeks to capture the meaning that makes up the communication so that it can describe and interpret the content and achieve an understanding of its real meanings at a level that will mean something for the intended objective.[14,15]

It is divided into three stages: 1) pre-analysis; 2) exploration of the material; and 3) treatment of results, inference and interpretation.[14,15] The pre-analysis consists of systematizing the initial thoughts to interpret the collected data, reading the content already transcribed and organizing the material to be analyzed. For this, there are steps to be taken, such as floating reading, constitution of the corpus (choice of documents) and formulation of hypotheses and objectives.[14.15]

The exploration of the material is the systematic analysis according to the categories. In this phase, paragraphs become units of record, and keywords are identified and categories are sought. In the treatment of results, inference and interpretation, when the categories formed were interpreted as units of analysis, and the inferences and predicted interpretations are made.[14,15]

RESULTS

Eleven volunteers participated in this clipping for FG - five in the PTRE group and six in the VT group - identified by numbers. Regarding age, the group was relatively young, with an average of approximately 22 years (21.67 ± 2.70 and 21.95 ± 2.72), respectively. Citations were categorized into units (the protocol and the perception of competencies in daily life activity) from the PTRE group - Chart 4 -, and another from VT - Chart 5 -, with the subunits (training characteristics, muscle pain/weakness), physical and emotional coping and changes before and after training).

In the PTRE FG, two units were identified: 1) training protocol; and 2) perception of competencies in the daily living activity. As for the first, two subunits were defined:

- Physical benefits of training: better jumping has been reported; reduction in knee instability; strengthening and better body awareness.
- Muscle pain/weakness: absence or reduction of pain and strengthening of the lower limbs has been reported.

Chart 4. Protocol unit and perception of competencies in the daily life activity of the Plyometric Training Group Associated with Resistance Exercises

Subunit	Citation
Training characteristics	**Volunteer 1:** *"I saw that my knee swayed much less"; "Very big improvement in jumping and instability, I think it's a very good training""* **Volunteer 2:** *"The stages advance, it is not easy". "Training is effective for that, I feel more strengthened. The training gave me confidence, even in small quantities ... effective training, very good, I liked it"* **Volunteer 3:** *"I started to fix everything I did, and to jump, we have to cushion"* **Volunteer 4:** *"I saw improvement"* **Volunteer 5:** *"It was not a very difficult training, but it is not easy, it was a training that required muscles, physical effort"*
Muscle pain/weakness	**Volunteer 1:** *"My knee swayed a lot, in exams and tests they saw that there is nothing, it is a weakness"; "Training itself did not cause any pain"* **Volunteer 2:** *"I am not in pain"* **Volunteer 3:** *"The training never caused me pain, even when I changed phases"* **Volunteer 4:** *"In the first session, I felt a lot of pain, in the second session, I arrived without pain, always like this, with changes"* **Volunteer 5:** *"I don't have any knee problems, sometimes I feel a little pain due to the wrong step, and I felt an improvement"*
Physical and emotional coping	**Volunteer 1:** *"The training was easier for strengthening... One thing I had difficulties with was jumping over barriers"; "I commented, finished ..., explaining some exercises"* **Volunteer 2:** *"And training is effective for that, I feel more strengthened, both physically and emotionally"; "After I started training, I started to notice a lot of things, wow, I'm jumping wrong here, I have to step better, wow, I'm stabilizing better after I do this kind of jump"; "I think easy exercises were the strengthening ones for sure, but I found the isometric ones a little difficult"* **Volunteer 3:** *"I started to think in a totally different way than I thought before, it was very good"* **Volunteer 4:** *"Tuckjump is very difficult for me ... strengthening was easier to do,"* **Volunteer 5:** **"***Easy were the strengthening exercises, and difficult, the barrier, in which it seems that I am even afraid to step on the barrier"; "Doing physical exercise helps you both emotionally and physically, reduces your stress, improves to deal with the routine"*
Changes before and after training	**Volunteer 1:** *"I don't have the instabilities I had before training"; "Lower limb mass gain"; "Physical activity, in general, I am happier"* **Volunteer 2:** *"Physically my body remained the same"; "What changed was, for example, I feel the muscle stronger, the knee more stable, the ankles more stable, the hip, I have no pain in my lower back"; "I felt ready for things"* **Volunteer 3:** *"I didn't feel much difference apparently, but it was because my diet was all wrong at the end of the period"* **Volunteer 4:** *"I had a lab coat that wasn't closing anymore, it came back closing"; "Lower limb hypertrophied a little"; "Disposition really improves"* *Eu tinha um jaleco que não tava abotoando mais, ele voltou abotoar"; "hipertrofiou um pouco de membro inferior"; "disposição melhora mesmo"* **Volunteer 5:** *"I felt an improvement to jump and the balance issue"; "Mass gain"; "Mood, I think has improved, and disposition too"*

Source: Research data.

Chart 5. Protocol unit and perception of competences in the daily life activity of the virtual training group.

Subunit	Citation
Training characteristics	**Volunteer 1:** *"I would imagine it would be more, but then during training we realize that it is getting harder and I realized that it really worked, and I started to like it a lot;" "Do you imagine: will this have worked?"; "What I liked here, that has the trainer, here she looks at us, corrects, you do the exercises correctly"*
	Volunteer 2: "*Running kills, but for me, the shoulder lifting exercises were terrible"; "The time that changes the phase that is hard"*
	Volunteer 3: *"In the first training sessions, we never put faith, whether it will improve or not. Only in the first few training sessions, wow, I was really upset. Only then you will realize that your fitness is improving"; "Short of breath (laughs)"-* [about running]
	ipo, nos primeiros treinos a gente
	Volunteer 4: *"I find it a challenge"; "That was great, loved it"*
	Volunteer 5: *"People, but it is not possible, it is very nice and it seems that it is leisure, it is not possible to give any results or improve"; "So on the first day of training I thought it was very different, I had never seen the Xbox for training. I died in the first training, but I thought it was really cool"; "For me it was very hard just to exercise leg and butt"*
	Volunteer 6: *"I like physical activity like that, physical exercise"; "And I'm going to buy a game, seriously"*
Muscle pain/weakness	**Volunteer 1:** *"In the same exercises she said, I can only do it with 1 kg. And I think it's muscle weakness"*
	Volunteer 2: "*No, just a discomfort. Muscle pain from physical exercise"*
	Volunteer 3: "*In the first one, we already start the run. Then, you're already running, you're already very tired very quickly*"
	Volunteer 4: "*Gym pain. Muscle pain"*
	Volunteer 5: "*I felt muscle pain"*
	Volunteer 6: "*I felt a lot more pain at first. In the first training sessions we had, I felt a lot of pain in my legs ... it was a gym pain"; "Nowadays they ask me 'Are you in pain?' I say 'no'"*
Physical and emotional coping	**Volunteer 1:** *"I still find the run more difficult* (they all seem to agree), *because I hate the run"; "For me it was like a way of distracting (...) We come here, we kind of forget about everything we have to do, from college"*
	Volunteer 2: *"I told them, it's cool, it's fun, but it kills"; "I was thin* [regrets]*" -* [about mass gain]
	Volunteer 3: *"You demand from yourself"; "Wow, I won't be able to do the rest, it will get worse and I won't do it" (laughs); "You will see that it is improving your physical conditioning"; "I always had to doze off, otherwise I couldn't replenish my energies"; "You are more willing to study, to go to class"*
	Volunteer 4: "*I also thought it would not work, and I did notice a difference… with my body and also in my daily life"; "When I started, I said: I won't be able to do this ... But it was the other way around: I was adapting, I was improving"; "I was going to train, I said, I won't do it. And it was the opposite, I think we could do everything willingly"; "Sleep was terrible. And as soon as I started training it was super improved"*
	Volunteer 5: *"I am not a person who likes physical activity very much, sometimes I suffered"; "running is more difficult"; "I watched them* [volunteers of plyometric training] *having to jump with that knee there almost on the forehead, I said 'Guys, I wouldn't ever do that'"; "I usually go crazy. So, for me it was a way for me to be able to disconnect from everything and relieve all my tension"*
	Volunteer 6: *"I was hesitant about personal problems, I was unable to lose weight, which is something we can do with this game"; "For me, overcoming"; "Funny that those who do plyometrics they say: 'Wow, I won't be able to do that there' (laughs)"; "The run is the one that kills"; "I believe it makes us feel much happier".*
Changes before and after training	**Volunteer 1:** *"Sleeping hasn't improved much"; "Physical conditioning has improved a lot... I have more willingness... when I train, I fell better"; "Cellulite has decreased"*
	Volunteer 2: *"I reached a better conditioning, lower limb resistance"; "I didn't lose any weight. I gained a lot of mass"*
	Volunteer 3: *"In the last session, my run is much better than in the first. You see that it works"; "My physical conditioning improved a lot".*
	Volunteer 4: *"Better"; "I'm sure woke up much better"; "The rest of the day seems to be going better. I thought it was different"; "In the butt too - gaining muscle mass in the leg"*
	Volunteer 5: *"I started to notice a huge difference in conditioning, and in resistance"; "The mood has improved a lot. I don't get tired all day"; "I'm sleeping a lot better, and it helped me a lot for this end of the semester"; "The mood was very different"; "It gave me results in the leg, in the butt"; "Improved strengthening"*
	Volunteer 6: *"It improves the physical conditioning, to climb stairs, I don't get breathless"; "Before training I was a little more discouraged... You sleep better, you wake up better, you are willing to do things"; "Achieving a better quality of life"*

Source: Research data

In the unit of perception of competences in the daily living activity, the participants indicated physical and/or emotional coping and changes after training. As for physical and/or emotional coping, most of them highlighted the spread of exercise practice, ease in strength training, difficulty in isometry exercises and emotional improvement. In relation to changes after training, reports of movement control, muscle hypertrophy, physical disposition, reduction of low back pain, weight loss and happiness were identified.

In VT FG, the same units were identified: training protocol and perception of competencies in the daily life activity. In the training protocol unit, the subunits were listed:

- Training characteristics - the results reported were, satisfaction, satisfaction in performing supervised exercises, physical conditioning, fun, innovations - I had never seen the Xbox directed for training - and difficulty.
- Muscle pain/weakness/discomfort - few pains in the early stages, muscle weakness and gym pain have been reported after exercise.

In the unit of competencies in the daily living activity, there were the subunits:

- Physical and emotional coping - distraction, fun, difficulty, postural self-monitoring in daily living activities, physical conditioning, disposition, improved sleep and relaxation were identified.
- Changes after training - no improvement in sleep, disposition, cellulite reduction, lower limb resistance, hypertrophy, physical conditioning, disposition, endurance, better sleep and better quality of life have been reported.

Between the groups, it is interesting to note that, for the PTRE FC, training characteristics were interpreted as the physical benefits that these exercises provided. Physical and emotional coping was described as physical benefits of training and emotional improvement, whereas changes after training were seen as physical benefits and happiness.

In turn, in the VT FG, training characteristics were more diverse (innovation, fun and satisfaction); physical and emotional coping was related to relaxation, improved sleep and other physical benefits. Finally, changes after training are related to physical benefits, improved sleep and better quality of life.

DISCUSSION

Volunteers of the physical exercise program carried out with PTRE and VT with Exergames noticed physical and psychological improvements. According to the reports, there was an experience that required physical effort, but it was effective and encouraging, thus confirming the importance of lower limb injury prevention programs in women.

An analysis of subgroups showed that the larger the volume of neuromuscular training, the greater the prophylactic effectiveness of the program and the greater the benefit in reducing ACL injuries in female athletes[14]. This was detected in speeches of the FG, when the participants indicated the physical benefits of training such as reduced knee instability, with no pain. This audience is more likely due to several factors, such as axial compression, shear force in the anterior tibialis, knee abduction and internal tibial rotation, which significantly increase the ACL tension, making the knee valgus one of the main mechanisms of this type of injury[3,16] and that, when minimized, can reduce the risk of these injuries.[17] With PTRE, there was a relationship between this prevention and the reported improvement in body awareness.

Speeches in Chart 4 show the influence on physical and emotional coping, in which the participants expose their facilities in training, as in resistance exercises, and the difficulties, as in barriers and jumping exercises. They exhibited progress in disposition, greater stability and strengthening of

lower limbs; three women emphasized the different way of thinking after the exercises, emotionally improving the way of leading the routine of daily life. These are vital items according to a systematic review that lists the training components for a successful injury prevention program such as strength training, plyometrics along with balance, proprioception and education with feedback on the correct technique.[18]

Results of Sugimoto[19] corroborate the previous information, since they found four variables as significant predictors of ACL injury reduction in female athletes. Seventy-three percent of the variability in prophylactic effectiveness is explained by the four components, which include: young participants; neuromuscular training for more than 20 minutes; frequency greater than twice a week, with variations in exercises; and use of verbal feedback. The intervention process in the training is in accordance with these predictors, and with that it can be seen, through the testimonies of the participants, the increase in muscle strength and stability in the post-training.

For this to happen, training had to favor the biomechanical changes evidenced in the meta-analysis so that neuromuscular and proprioceptive training could reduce knee injury in general[20] and plyometrics improve physical fitness.[21] In virtual reality, these stimuli are incited, making the participant use their physical and motor skills, such as agility, coordination, strength and balance.[22]

These skills are important due to the influence of muscles, especially the trunk, on the dynamic stability of the lower limbs during high-speed activities. In this way, the hip-trunk complex is necessary for the dynamic stability of the trunk to act together and be based on neuromuscular control.[23] In addition, it is noticed that motivation and happiness in a training program such as exergame are essential to obtain a good performance.[24,25]

In this virtual training, the most noticeable characteristic during the FG was to believe that a virtual game can be used as a training protocol and generate satisfactory results. Bonnechère, Jansen, Omelina and Van Sint Jan[26] found this ability to motivate virtual games to be an advantage, and in particular the immediate feedback during training. This was confirmed in the statements found in Chart 5 which indicated the overcoming; at first, the participants thought it would not work, but when they started, they noticed the degree of difficulty in the phases, especially in running, and the muscle pain /=weakness present momentarily in training, with gradual improvement. Subsequently, they realized the overcoming that was, with increased willingness and the fun of performing the training with a quality virtual game. Changes in the body were noticeable, with muscle mass gain and physical conditioning.

The aforementioned sessions provided increased physical conditioning, endurance and muscle strength. In PTRE, improvement in balance and stability of lower limbs was more prominent, whereas in VT, improvement in concentration and disposition for daily routine, even with effect on sleep. Therefore, it was verified, in a qualitative study, that the need to be attentive to the screen, to respond correctly during the game, can awaken the perception of improvement in cognitive aspects[27]. In addition, Microsoft Kinect® is able to reproduce the player's body, through a virtual avatar, which facilitates the context of the game, because when there is a body reproducing the movements, virtual reality is more favorable.[28]

According to Vojciechowski[29], physical activity with the XBOX 360 Kinect®, performed twice a week, for 30 minutes, provided an improvement in the activity level, self-perception of health status and condition of the abdominal muscles and upper limbs with strength and endurance, agility and speed, and can be used to promote the active health of young adults. In PTRE, unforeseen movements with verbal feedback are used to map movements, generate learning and improve training.[19,30] Concomitantly to this, strengthening and balance exercises, as well as awareness and that increase agility, are used as proprioceptive stimuli needed in this training modality.[20]

Our findings reflect that the practice of systematic exercises goes beyond the physical benefits,

interfering with the daily life and emotional health of the volunteers. This is corroborated in a study whose participants were diagnosed with low back pain.[12]

CONCLUSION

According to the reports presented in this study, the participants identified the physical and emotional benefits that the training brought after 24 sessions. This is reinforced when they report that supervised exercises – both PTRE and VT - improve physical conditioning and postural self-correction, in addition to reducing pain, providing happiness and fun and better-quality sleep.

The results found are supported by the literature and show the importance of preventing injuries with programs that provide incentives with visual and auditory feedback. It is believed that the information contained here is useful to propose protocols with the same focus.

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