Changes in Pelvic Floor Muscle Tone after 'Jumping Fitness' Training—A Case Study

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Abstract

Aims: Previous studies confirm the existence of a beneficial component of mechanical vibration and oscillation during trampoline exercises. Researchers have been interested in the possibility of using these exercises in the process of strengthening pelvic floor muscles and in cases of stress urinary incontinence. This study aimed to evaluate changes in pelvic floor muscle tone after 8 weeks of systematic 'jumping fitness' training and performing a follow-up observation of the maintenance of this effect after 9 months.

Case report: This study involved a young woman without symptoms of stress urinary incontinence who began practicing 'jumping fitness' 3 times a week for 2 months. After the end of the training cycle, there was an increase in the bioelectrical activity of the pelvic floor muscles in all muscle groups tested, both during the contraction and relaxation phases. However, 9 months after the end of training, pelvic floor muscle activity decreased in some measurements.

Summary: In the case of the patient studied, the proposed form of recreation may constitute a type of prophylactic training to prevent pelvic floor muscle weakness. However, the long-term effect of such training on the condition of the pelvic floor should be assessed.

Key words

jumping fitness training,
trampoline workout,
pelvic floor muscles

Introduction

Jumping® is an original type of dynamic fitness training system on trampolines that was developed in 2001 by Czech trainers Tomáš Buriánek and Jana Svobodová. It is a dynamic training system performed on specially designed single-person sport trampolines. It is a combination of slow and fast jumps, dynamic sprints, variants of traditional dance steps and aerobic steps. It also includes strength training, balancing exercises and relaxation, all of which combine to form an effective interval training programme. Trainings can have different forms, depending on the level of experience of the trainees. This type of trampoline training is considered gentle on the joints and effective in training the abdominal muscles, as well as limbs, buttocks and deep trunk (core) muscles. 'Jumping fitness' training is also recommended as an endurance workout. The exercises are conducted to the rhythm of energetic music, which is an additional stimulating factor for more intense workouts [1].

Based on a literature review, it should be noted that this form of training is recommended in cases of spinal disc degeneration, osteoarthritis, cardiovascular (hypertension) and respiratory disorders, as well as in overweight and osteoporosis [2, 3, 4].

Currently, researchers are interested in the possibility of using training in the process of strengthening pelvic floor muscles and in cases of stress urinary incontinence due to the existence of a beneficial component of mechanical vibration and oscillation during trampoline training.

Aims

The purpose of this study was to evaluate the changes in pelvic floor muscle tone by measuring the bioelectrical activity following 8 weeks of systematic 'jumping fitness' training and to observe the maintenance of this effect after 9 months follow-up observations.

Case report

Our subject was a 23-year-old woman who was a physiotherapy student (body height: 174 cm, weight: 62 kg, BMI: 20.48 kg/m2) with a moderately active lifestyle and no regular/professional sport activity. She reported engaging in physical activity (cycling, swimming in a pool and general training exercises) recreationally 2–3 times a week and spending a major part of her days standing and moving. She travelled by car and bicycle and did not follow any specific diet. She did not report any history of urogenital dysfunction or any complaints of pain. The subject reported an irregular and painless menstrual cycle (lasting 34–38 days, of which 7–9 days of menstruation). At the time of the study, the woman was sexually active and did not use hormonal contraception or other hormonal treatments. She suffered from hypothyroidism and constantly took L-thyroxine at a dose of 37.5 µg/day. At the age of 14, she was diagnosed with bilateral idiopathic scoliosis (right-sided in the thoracic spine and left-sided in the lumbar spine).

For the purposes of this study, the woman began to do regular 'jumping fitness' training (3 times a week for 2 months). She trained in the same sport club and training classes, which ensured identical conditions, course and intensity of training. During this period, the woman reduced her previous sports activities in favour of 'jumping fitness' training.

Three series of pelvic floor muscle activity measurements were taken during the study: (1) a baseline measurement before training (M0), (1) a control measurement at 8 weeks after training (M01) and (3) a follow-up measurement at 9 months after the study (M2). The pelvic floor muscle tone was measured using a surface electromyography (sEMG) device NeuroTrac MyoPlus4 (Verity Medical Ltd., Tagoat, Ireland). In addition, an endovaginal electrode Optima 3 (Sugar International, Gémenos, France) and a reference electrode (hypoallergenic, self-adhesive, round, 2-cm diameter) were used. The functional recording of the bioelectrical activity of the pelvic floor muscles during contraction and relaxation was carried out. A single measurement was performed in the 'Work/Rest Assessment' mode; this lasted 55 seconds, during which the women, according to a sound signal from the computer, contracted and relaxed the pelvic floor muscles 5 times. The contraction and relaxation phases lasted 5 seconds each. During one round of sEMG measurements, the activity of 4 pelvic floor muscle groups was examined: (1) anterior superficial muscles, (2) anterior deep muscles, (3) posterior superficial muscles and (4) posterior deep muscles.

The mean values of the muscle activity collected from the sEMG transmission channel were recorded in the form of electromyograms displayed on the monitor during the measurements in red colour (Figure 1). The examination was not preceded by a biofeedback test, and the woman performed the contractions intuitively. Before taking the measurements, the woman was instructed about the full procedure. The examination was performed in the supine position, with the lower limbs placed on rehabilitation wedges to ensure the greatest possible degree of relaxation of the examined muscles and to enable their unrestricted contraction (Figure 2). All activities were performed by a sole investigator in a closed research room and in private (screen, sheet for covering, etc.), so that the woman could feel comfortable and safe. To minimize the risk of any movement artefacts interfering with the recording, the basic rules of electromyographic measurements were followed.

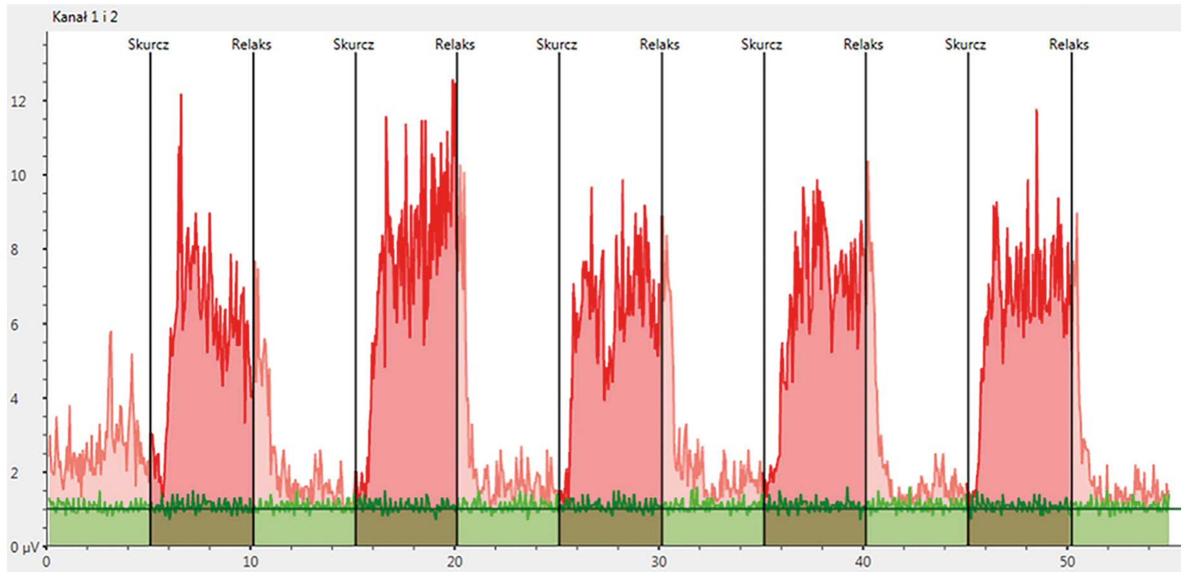

Figure 1. The mean values of the muscle activity collected from the sEMG.

The sEMG device was placed on the therapeutic bed, ensuring that the cables were not twisted or did not hang over the edge of the bed. No other electronic devices were present in the examination area. During the measurement, it was ensured that the patient did not make any additional body movements. Because of the intimate nature of the study, the application of the endovaginal electrode was performed by the woman herself (according to the established principles and recommendations of the manufacturer; a properly placed electrode should be completely positioned anteriorly in the vagina, leaving only the handle outside). Hypoallergenic ultrasound gel was used during the application.

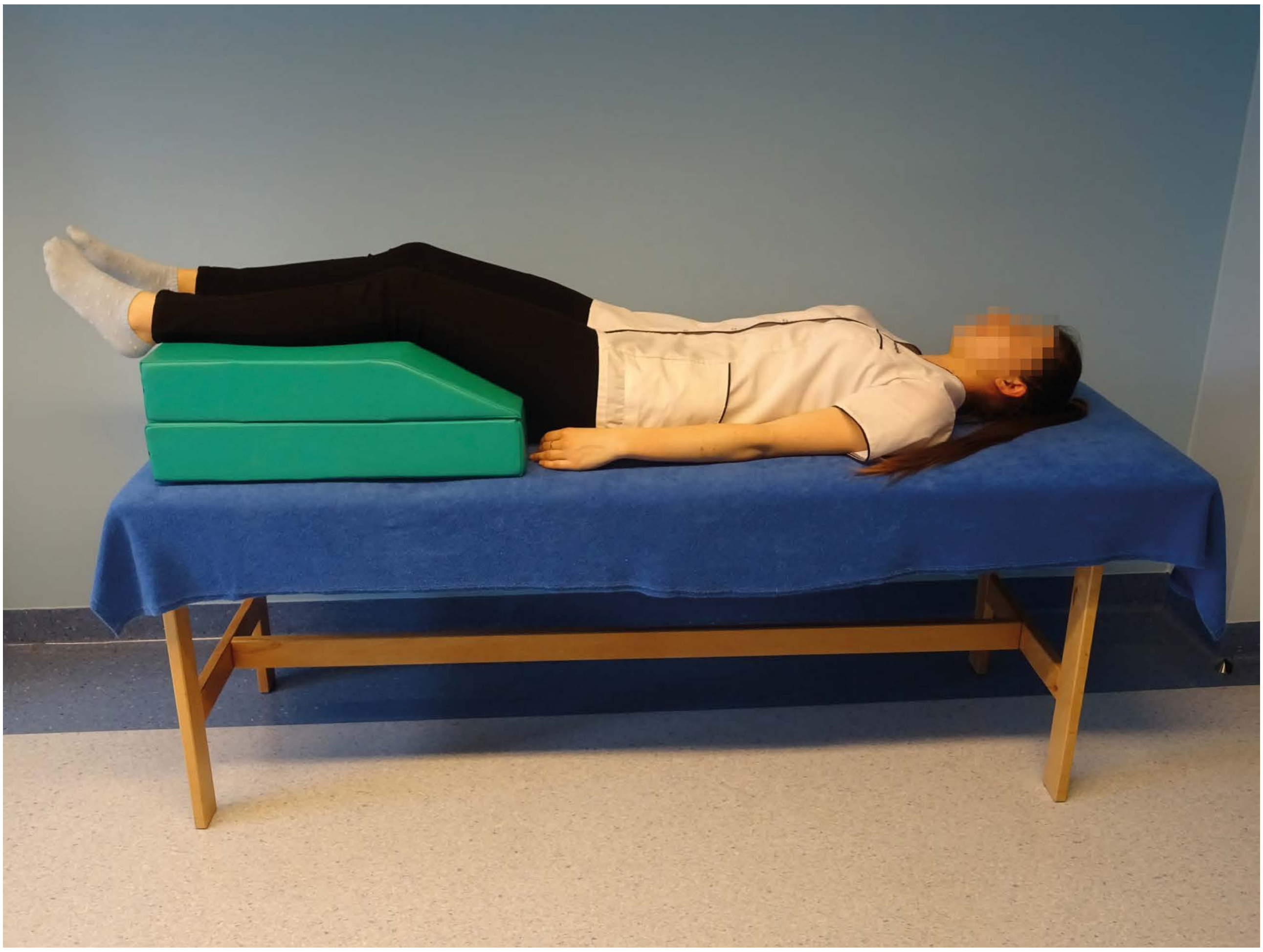

Figure 2. Supine position performed in the examination.

Table 1 shows the results obtained when measuring the functional bioelectrical activity of the pelvic floor muscles during the contraction phase. After the training cycle, increased bioelectrical activity of the pelvic floor muscles was noted in all muscle groups during both contraction and relaxation.

For example, the functional activation of the anterior superficial muscles after the training was 140.68% of the baseline measurement. However, 9 months after the end of the 'jumping fitness' programme, the contraction tone reached (in the case of 3 muscle groups) values lower than during the baseline measurement (100%). The greatest decrease (about 24.1%) was observed in the posterior deep muscles. Only the activity of the anterior superficial muscles was higher than at baseline.

Table 2 shows the results for the pelvic floor muscle relaxation phase. An increase in resting tone was observed in all muscle groups, both after 8 weeks of attending 'jumping fitness' training and after 9 months after completion. The anterior superficial muscle group showed the greatest resting activity. The follow-up examination revealed a still significantly increased value of this tone, which was 320% of the baseline measurement.

Table 1. Changes in functional activity of pelvic floor muscles before and 8 weeks and 9 months after completing the 'jumping fitness' training cycle.

Muscle group tested	M0 [μV]	M1 [μV]	M2 [μV]
Anterior superficial muscles	5.9 (100%)	8.3 (140.68%)	6.8 (115.25%)
Anterior deep muscles	6.7 (100%)	7.2 (107.46%)	6.4 (95.52%)
Posterior superficial muscles	8.4 (100%)	8.6 (102.38%)	5.7 (67.87%)
Posterior deep muscles	8.3 (100%)	9.2 (110.84%)	6.3 (75.9%)

Legend: M0—baseline measurement before training, M1—control measurement at 8 weeks after training, M2—follow-up measurement at 9 months after the study and μV—microvolts.

Table 2. Changes in resting activity of pelvic floor muscles before and 8 weeks and 9 months after completing the 'jumping fitness' training cycle.

Muscle group tested	M0 [μV]	M1 [μV]	M2 [μV]
Anterior superficial muscles	0.5 (100%)	1.8 (360%)	1.6 (320%)
Anterior deep muscles	1.4 (100%)	1.6 (114.29%)	1.5 (107.14%)
Posterior superficial muscles	0.9 (100%)	1.7 (188.89%)	1.3 (144.44%)
Posterior deep muscles	1.2 (100%)	1.6 (133.33%)	1.7 (141.66%)

Legend: M0—baseline measurement before training, M1—control measurement at 8 weeks after training, M2—follow-up measurement at 9 months after study and μV—microvolts.

Discussion

So far, there are only a few reports that directly examine trampoline training. Several researchers have investigated jumping training and jumping itself and their effects on parameters related to pelvic floor muscle activity. This allows us to confront the results of this case study and its relevance and to try to answer whether 'jumping fitness' training could be beneficial for women.

A study conducted by Swedish researchers [5] on a group of young women who were regularly trained on trampolines may be used as an example. Eliasson et al. assumed that during trampoline jumping, the pelvic floor is exposed to large forces and thus decided to investigate the incidence of urinary incontinence in a group of elite female trampoline jumpers. The study involved 35 young women aged between 12 and 22 years. The incidence of incontinence episodes was studied via a questionnaire, and the severity of urinary leakage was assessed using a pad test. Pelvic floor muscle strength was measured using a perineometer device. The results indicate that factors such as frequency and training length increase the risk of incontinence, and the presence of incontinence in female trampolinists was statistically higher than in non-training women.

Similar findings were reported by Da Roza et al. [6] in their study assessing relationships between sport performance level, training volume and urine leakage in young female trampolinists. A group of 22 non-children female athletes at the national level were enrolled in the study. Screening was performed with a questionnaire including a section on incontinence. The results of this study also confirmed the high incidence of urinary incontinence in young female trampolinists and the correlation between the intensity of training and the risk of pelvic floor muscle dysfunction.

In opposition to the two above-mentioned papers, there is a study by Moser et al. [7], which compared pelvic floor muscle activity in women with stress urinary incontinence and healthy women during two types of jumping tasks. The bioelectrical activity of the pelvic floor muscles during different phases of drop jumps and counter movement jumps was evaluated using a triple pole endovaginal electrode. High activity of pelvic floor muscles was observed in all phases of jumping. The authors concluded that vertical jumps may be a beneficial factor in the rehabilitation of urogenital dysfunctions.

The greatest agreement with our work was shown by the study by Saeuberli et al. [8], who aimed to investigate pelvic floor muscle activity in young, healthy women during drop jumps and jumps on single-person trampolines. The methodology of the study was similar to that used in the study mentioned above. Muscle activity was measured using sEMG and a triple pole vaginal probe during jumps from a height of 15, 30 and 45 cm and trampoline jumps at a rate of 75 and 90 jumps/minute. Similar to the results from our case report, significant pelvic floor muscle activity was demonstrated for both types of jumps.

It is uncertain whether the phase of the menstrual cycle affects pelvic floor muscle activity. Indeed, Micussi et al. [9] conducted an analysis of pelvic floor muscle bioelectrical activity in women during the follicular, ovulatory and luteal phases of the menstrual cycle and its correlation with estradiol and total testosterone levels. A group of 30 non-maternal women aged between 20 and 30 years with ovulatory menstrual cycles were enrolled in the study. Muscle activity was recorded using sEMG and an endovaginal electrode. The findings demonstrated that pelvic floor muscle activity was higher during the luteal phase and strongly correlated with estradiol levels. These results suggest that hormonal fluctuations during the menstrual cycle can modify pelvic floor muscle activity.

In contrast, the most recent study in this field by Dos Rais Nagano et al. [10], involving 20 healthy female patients, showed that hormonal changes occurring during different phases of the menstrual cycle do not affect the duration and strength of contraction of the pelvic floor muscles.

Similar inaccuracies could be observed in terms of the relationship between hormonal contraceptives and pelvic floor muscle bioelectrical activity. A cohort study conducted by Illadou et al. [11] on Swedish female twins found that subjects using oral hormonal contraception had a significantly lower overall risk of urinary incontinence symptoms.

However, Champaneria et al. [12] reported a contrasting observation in a study on the effect of hormonal contraception use on pelvic floor function. This study suggests that oral contraceptives may increase the risk of pelvic floor dysfunction in the form of painful bladder and vulvar vestibulitis. Therefore, hormonal contraceptives do seem to have an effect on pelvic floor structures.

As demonstrated by the above-mentioned studies, the fact that the woman in our case report did not use oral hormonal contraception might explain the differences in the results we obtained, especially from the follow-up analysis.

In light of the data presented above, there are undoubtedly many limitations to this study. First of all, only one clinical case was examined, which does not allow for any conclusions to be drawn. Since this is an exploratory study, patients with pelvic floor dysfunction were not considered. The duration of the study should also be extended so that the subjects undergo training for at least a few months to obtain more reliable results. Furthermore, our work did not take into account all the factors that may contribute to variable pelvic floor muscle activity, such as the phase of the menstruation cycle in which the measurements were taken and the skeletal structure and pelvic alignment of the subjects. Relatively low values of muscle activity may be due to the lack of biofeedback implementation—i.e., visualization of muscle activity on the computer screen so that the patient can see the effects of contraction and relaxation. Importantly, our subject had not previously performed any similar tests, which may indicate a lack of awareness of exactly where the pelvic floor muscles are and how to activate them, which, in the context of the growing problem of incontinence among young women, seems to be of great importance. On the other hand, the study is probably the first attempt to evaluate the effect of 'jumping fitness' on pelvic floor muscle activity in women as a form of recreation rather than professional sport. Our findings are partially in line with those reported by other authors and may be a good starting ground for further studies on a larger number of people and with a longer training period. It may also be interesting to take measurements immediately after training. In this case, it seems appropriate to include jumping as part of the rehabilitation of pelvic floor dysfunction. Subsequently, it would be beneficial to try to characterize the type and duration of this form of exercise in order not to lead to muscle fatigue but to stimulate muscle activity.

Summary

In this case of a woman undergoing 'jumping fitness' training, it was noted that the programme may have had an indirect role in increasing the bioelectrical activity of the subject's pelvic floor muscles. It is not possible to determine whether the changes observed during follow-up observations are a true consequence of the 'jumping fitness' training cycle. In this particular case, this proposed form of recreation may constitute a kind of preventive training against pelvic floor muscle weakness. However, the long-term effect of such training on the condition of the pelvic floor muscles should be assessed in future studies.

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