Case Study
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Assessment of the strength of the pelvic floor musculature in women who practice Mat Pilates.

Avaliação da força muscular do assoalho pélvico em mulheres praticantes de Mat Pilates.

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Abstract
Introduction: The Pilates Method is a program of physical and mental training that works the body as a whole, aiming to gain muscle strength, mainly at the central region formed by the abdominal muscles, spine and pelvic floor, and to promote stretching and flexibility. **Objective**: To investigate the effects of this technique in the pelvic floor muscle activity, noting the type of fiber was more work during the practice of this activity in soil (Mat Pilates). **Methodology**: It was a character study of interventional, observational, descriptive, conducted during the months from March to May 2011, in which six women aged between 35 and 65 years, who underwent Mat Pilates classes twice a week, was rated the strength of pelvic floor, by Perina® perineometer pressure before and after eight classes. **Results**: It was observed that all the volunteers had increased the muscle strength in both types of muscle fibers, and 84% ($p < 0.05$) had greater gain in Type 2 fibers. **Conclusion**: The Mat Pilates influences in the increase of the pelvic floor muscle strength it and can be used to prevent dysfunction of these muscles.
Keywords: Pilates, Strengthening, Pelvic Floor.

Resumo
Introdução: O Método Pilates é um programa de treinamento físico e mental que trabalha o corpo como um todo, tendo como objetivo o ganho de força muscular, principalmente da região central, formada pelos músculos abdominais, da coluna e assoalho pélvico, além de promover alongamento e flexibilidade. **Objetivo**: Verificar os efeitos desta técnica na atividade muscular do assoalho pélvico, observando qual tipo de fibra será mais trabalhada durante a prática desta atividade no solo (Mat Pilates). **Método**: Estudo de caráter interventivo, observacional e descritivo, realizado durante os meses março a maio de 2011, no qual participaram seis mulheres com idade entre 35 e 65 anos, que realizaram aulas de Mat Pilates, duas vezes por semana. Foi avaliada a força do assoalho pélvico, através do perineômetro de pressão Perina®, antes e após a realização de oito aulas. **Resultados**: Observou-se que todas as voluntárias ganharam força muscular nos dois tipos de fibras, sendo que 84% ($p < 0,05$) delas tiveram maior ganho nas fibras do tipo 2. **Conclusão**: O Mat Pilates influencia no aumento da força muscular do assoalho pélvico, podendo ser usado como forma de prevenção para o aparecimento de disfunções desta musculatura.
Palavras-chave: Método Pilates, Fortalecimento, Assoalho Pélvico.

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INTRODUCTION

Every day the Pilates method developed by Joseph Humbertus Pilates in the early twentieth century has gained new adepts. The number of practitioners grew over 500% just in the last year.[1] It was created with the purpose of conditioning the body as a whole, encouraging integration of mind and body, achieve muscle control, coordination and harmony in movement.[2]

The Pilates method is a program of physical and mental training that works the body as a whole, and is dedicated to exploring the potential of changing it. Currently, it has been the subject of various studies that seek to demonstrate the benefits reported by practitioners of the method.[3]

The exercises can be performed on the ground (Mat Pilates), with the therapeutic ball or devices with a spring mechanism that place a greater resistance or facilitate the implementation of ball movements, also presented different in degrees of difficulty. Aiming to correct muscle imbalances, improve posture, flexibility, body awareness and fitness. Practiced regularly and correctly, Pilates can help you achieve many physical and emotional benefits. These elements help to improve the perception of quality of life of its practitioners.[4,5]

The use of the therapeutic ball promotes the training of weakened pelvic floor muscles, and being an indispensable intermediary, ideal for the movements in training these muscles instrument. The exercises are functional and can be accomplished in several ways.[6]

Thus, Pilates aims to gain muscle strength, stretching and flexibility, searching through the contraction of stabilizing muscles more control for the execution of movements, which should be performed slowly and in a few repetitions. The benefits depend on the correct execution of the exercises, which is based on six principles, which are: *Breathing, concentration, fluidity, precision, centralization and control of movement.*[3]

Abdomen muscles should be worked along with all the principles of the method to provide better results. The abdominal musculature interacts with the muscles of the spine and the pelvic floor, forming the center of force or "powerhouse", as it is called by Joseph Pilates.[7-10]

Among these abdominal muscles, the transversus abdominis is the most requested during the exercises, having as its primary function, until recently, the implementation of vital physiological activities such as defecation, cough or childbirth. Currently, we try to link it to other activities of great importance, such as stabilization of the lumbar spine, synergism with the pelvic floor muscles, and as a key component of respiratory mechanics.[11] In Pilates method practice is requested to contraction and the transverse support, achieving greater pelvic stabilization, and increased strength of the perineal muscles during exercise execution.[8]

Therefore, the pelvic floor should also be included in this "powerhouse" for the way that this arrangement of muscles and ligaments connect to the central nervous system of the deep abdominal muscles. The strengthening of this central region, then, can promote good outcomes for patients with dysfunctions.[12]

The pelvic floor or pelvic diaphragm is formed by muscles, ligaments and fascia. The muscle tissue of this region is composed of Type 1 fibers responsible for endurance and prolonged contractions, and Type 2 fibers to rapid contractions.[13] The pelvic musculature has support functions, and support the pelvic organs; sphincter controlling the output of urine, feces and gases; and sexual function in contraction during the act, increasing vaginal sensations. Faulty or improper function is an etiological factor in the onset of various diseases such as pelvic organ prolapse, sexual dysfunction, urinary incontinence or fecal among others. [14]

Functional training of the pelvic floor can be used as a form of treatment, which consists of specific muscle contractions that compose and has benefits as improved body perception and awareness of the pelvic region, increased vascularization, tone and strength muscle, keeping this muscle group strengthened. Moreover, exercises that aimed the perineum contraction avoids a variety of physical problems that occur in the later periods of life, preventing and treating various problems that arise with the weakening of muscles.[15,16]

This way, this study aimed to verify the effects of Mat Pilates in pelvic floor muscle activity, noting which type of fiber is longer worked for practicing the method.

METHOD

It was realized an interventional, observational and descriptive study, attended by women enrolled in Mat Pilates group of Projeto de Responsabilidade Social, Escola de Postura and Terapia Manual of Centro Universitário Estácio do Ceará.

Women who underwent Mat Pilates classes twice a week on alternate days for 60 minutes per session were included in the research; have begun their sexual life and could not have or diseases of the pelvic floor. Pregnant women were excluded from the study; who performed other type of physical activity or physical therapy as osteopathy or urodynamic; who could not, even with all attempts to raise awareness of the researcher, contract the pelvic floor muscles correctly during the evaluation.

In data collection, which occurred between the months of March to May 2011, a preliminary evaluation of the pelvic floor was performed; and soon after was initiated Mat Pilates classes in group. During the exercise sessions were conducted at the proposed soil by Joseph Pilates: diaphragmatic breathing, stretching of the anterior, lateral and posterior muscle chains, flexibility and joint mobility of the spine, recruitment of deep abdominal muscles and pelvic floor being used as accesso-

ries the therapeutic ball and elastic waistband.[4] At the end of the intervention were evaluated again, and thus followed the behavior of the strength of the pelvic floor muscles during this period, it is noteworthy that all evaluations and Mat Pilates classes were conducted by the same therapists to develop properly fit the function.

To measure the degree of strength of the pelvic floor muscles, was used the perineometer pressure Perina®, the brand QuarkTM, graded 0-48 mmHg, assessed the Type 1 fibers of endurance and prolonged contractions and Type 2 rapid and strong contraction. During the evaluation, a vaginal probe coated by a non-lubricated latex condom into the vaginal canal was introduced. To reduce the resistance to the passage of the vaginal canal probe, we used a drop of water-based gel on the probe tip. After perineometer be on the vaginal probe was inflated by a pear. The amount of air introduced into the probe was just enough for the woman to referring a better coupling of the probe to the vaginal canal. The volunteer then pressed with full force to probe for 1 second and then performed a sustained contraction for 6 seconds. Each type of contraction was repeated 3 times. The values obtained for each type of contraction, was calculated an arithmetic average.

The data were analyzed statistically using the Microsoft Office Excel 2007 and SigmaPlot version 11.0 software and are expressed as mean ± standard error of the mean (SEM), presented in the form of graphs and tables.

The study followed the guidelines of Resolution no. 196/96 of the National Health Council[17] were preserved the ethical aspects of research with human beings, and ensuring the confidentiality, anonymity, non-use of information in loss of individuals and the use of information only for the purposes specified in the search. Furthermore, data collection was initiated only after the approval of the Centro Universitário Estácio do Ceará Ethics Committee, protocol number 016/11.

RESULTS

The sample consisted of six women aged 35-65 years on average 49.66 ± 9.64 years. Among the volunteers evaluated two reported having taken no pelvic surgery, and the other had one or two caesarean sections and had no natural childbirth. When asked about the degree of knowledge about pelvic floor, 50% (n = 3) reported they did not know, and for the role of physiotherapy in this muscle, 67% (n = 4) said they had no knowledge about physiotherapy performance.

In the analysis of measuring the degree of pelvic floor muscle strength was observed that the mean values obtained from contractions of fiber Type 1 and 2 before and after performing the Pilates Mat differences were statistically significant ($p < 0.05$, Student's t test) in 84% (n = 5) of the volunteers in both fibers (Table I and II).

When comparing mean gain between the fibers of Type 1 and 2 (7.16 ± 1.53 mmHg vs 10.90 ± 2.5 mmHg, respectively) after the practice of Mat Pilates, there was a greater gain in fast fibers (Type 2) in 84% (n = 5) of the volunteers, however, this difference was not statistically significant ($p > 0.05$, Student's t test) (Graph 1).

Table I. Evaluation of pelvic floor strength, through averaging the contractions of muscle fibers Type 1. Fortaleza/CE, 2011.

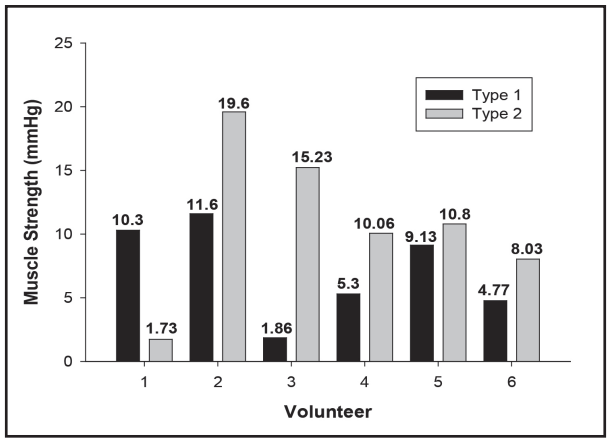
Volunteer	Mean Before	SEM	Mean After	SEM	P Value
1	0.10	0.10	10.40	0.83	0.006*
2	0.00	0.00	11.60	0.00	< 0.01*
3	11.60	0.00	13.46	0.93	< 0.01*
4	0.16	0.16	5.46	0.26	0.005*
5	0.33	0.20	9.46	0.66	0.006*
6	4.43	0.76	9.20	2.01	0.06

* Standard Error of the Mean = SEM; $p < 0.05$ – statistically significant difference.

Table II. Evaluation of pelvic floor strength, by averaging the contractions of muscle fibers of Type 2 Fortaleza/CE, 2011.

Volunteer	Mean Before	SEM	Mean After	SEM	P value
1	0.10	0.10	1.83	0.53	0.09
2	1.20	0.87	20.80	3.20	0.02*
3	2.90	0.00	18.13	1.06	< 0.01*
4	0.00	0.00	10.06	0.73	< 0.01*
5	0.26	0.14	11.06	0.26	0.001*
6	2.10	0.70	10.13	0.66	0.02*

*Standard Error of the Mean = SEM; $p < 0.05$ – statistically significant difference.



Graph 1: Comparison of pelvic floor strength after the Mat Pilates classes, as means of contractions of muscle fibers of Type 1 and 2. Fortaleza/CE, 2011. * Data expressed as mean.

DISCUSSION

A pelvic floor with poor or improper function may be an etiological factor for urinary incontinence and other disorders related to the perineal muscles. Thus, to succeed in the gain of pelvic floor muscle strength the perineal awareness becomes important.[14]

The study of Matheus[18], performed in 40 women, showed that 100% of these were unaware of the function and operation of the pelvic floor. According to the study, proprioception and body awareness are necessary for true increase in volume and muscle tone, as in 85% of the volunteers gave a positive result after being held proprioception exercises and awareness of the pelvic region.

In this study, we observed a significant increase in muscle activity in most women, when compared to initial assessments obtained before the practice of Pilates Mat, both in slow twitch fibers as in fast twitch fibers. These data confirm the study by Andreazza and Sierra[14], who found that Pilates as well as the practice of other physical exercise influences the degree of pelvic floor strength, whereas inactive women had inferior results to those practiced exercises, the authors verified that physical inactivity causes negative effects to the pelvic floor.

Corroborating these findings, Bernardes et al.[19] showed quantitatively that, physiologically, the muscular activity of Type 2 fibers is higher than Type 1 fibers, as voluntary contraction of the pelvic floor acts more specifically on Type 2 fiber, causing hypertrophy, potentiating the strength of perineal contraction. Nolasco et al.[6] add that the fast twitch fibers are more recruited during activities that increase intra abdominal pressure such as coughing, lifting weights and exercises.

It is noteworthy that the Type 1 fibers are responsible for antigravity action of the pelvic floor muscles, and Type 2 are recruited during the sudden increase in abdominal pressure, thus contributing to the increase in urethral pressure. Exercises that work muscles that can improve their function, and that support muscle building is due to functional changes of muscle fibers.[20]

Regarding the data found in this study as the average in the strength of contraction of Type 2 fibers were higher than those of Type 1, Moreno,[21] Moreira and Arruda[22] state that the slow contraction fibers are highly resistant and therefore produce contraction for long periods in spite of the contraction force tends to be relatively low order. On the other hand, Type 2 fibers are highly exhaustive but produce high order of strength in fast contraction and are capable of producing more power.

The data found in this study are strengthened by the study of Serpa[23] conducted with 10 women and 10 sedentary Pilates practitioners, in which it was observed that the average muscle activity in both fibers were higher in 100% of women practitioners Pilates, when compared to sedentary females.

In this study only one practitioner, the older, the Type 2 fibers did not obtain a greater than average amount of Type 1. Aging, according to Jesus and Boas[24] cause changes in the lower urinary tract, which occur even in the absence of disease. The force of contraction of the detrusor, bladder capacity and the ability to postpone urination apparently decrease. In older women, the decrease of collagen in the pelvic muscles and fascia associated with increased cross-bridges of fibrous tissue, which decreases the elasticity occurs; and hence muscle strength.[22]

Despite a decline in overall muscle strength in female population over 60 years, was assigned as the cause, in part, to the loss of Type 2 muscle fibers.[25] However, the study by Caetan and Tavares[26], in older women diagnosed with urinary incontinence who used Pilates to intervene in the pelvic floor, showed that the method was effective reducing urinary leakage and increasing the muscular strength of the perineum.

It is important to remember that the combination of techniques is a very opportunistic strategy in treating these patients, especially in relation to the complexity of satisfaction and avoid reductionism present in each method.

The study had some limitations, especially with regard to the reduced number of the sample, however, we emphasize that the goals have been achieved, and suggest new research that attempts to prove that the longer practicing the method, would have a more significant gain in strength of muscle contraction the fibers of both Types 1 and Type 2 as well as the inclusion of a control group for comparison of Pilates with other techniques used in physical therapy to strengthen the perineal region.

CONCLUSION

The Mat Pilates influences the contraction force of the pelvic floor muscle fibers and could be suggested as a means of prevention or treatment to the onset of dysfunction of these muscles.

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