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EFFECTS OF A PHYSICAL EXERCISE PROGRAM ON PELVIC FLOOR MUSCULAR ACTIVITY IN PREGNANT WOMEN WITH STRESS URINARY INCONTINENCE

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ABSTRACT

Urinary incontinence is experienced by all women and men who suffer as a real handicap. It is a real public health problem. The objective of this research is to study the effect of a physical exercise program on the muscular activity (strength and endurance) of the pelvic floor and the symptoms of urinary incontinence (quantity, frequency of urinary leakage, overall quality of life). This is an intervention study of 114 pregnant women with stress urinary incontinence selected at the National University Hospital Center in Cotonou (CNHU-HKM). We used the noprobability method and the reasoned sampling technique for the choice of women. The subjects were randomized into two groups: an experimental group of 48 women in the exercise program and a control group of 66 sedentary women. Pelvic floor muscle activity and urinary incontinence symptoms were assessed using a PFX2 perinometer, the Pad Test and the Ditrovie Scale questionnaire, respectively. The results showed that the exercise program significantly increased pelvic floor muscle activity (42.91% for maximal strength and 35.05% for dynamic endurance), significantly reducing the amount of loss. urinary frequency, and improves the overall quality of life of women with incontinence.

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INTRODUCTION

Pregnancy and childbirth lead to significant physiological and anatomical adaptations to a woman's body and life. These changes can be reversible or permanent. Urinary incontinence (UI), which affects between 10% and 40% of the female population, all ages combined, represents one of these functional and multifactorial changes (Dumolilin2010). Although it is common among the female population, UI remains a poorly understood, underestimated and misidentified problem. Among known risk factors, pregnancy can weaken pelvic floor muscles (PFM), particularly because of the increased weight (Jouffroy 2006). 30 to 50% of perineal sphincter disorders appear during pregnancy. In the general population, 64% of incontinent women experienced first leaks during pregnancy (Fayt *et al.,* 2006). These symptoms recorded during pregnancy may be related to the weakening of muscle activity in the pelvic area. Several prevention and treatment methods have been recommended by several organizations: The Society of Obstetricians and Gynecologists of Canada issued a clinical guideline that states (Robert *et al.,* 2006): "The implementation of pelvic floor exercises should

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be recommended for women with stress incontinence. The Canadian Association and the European Urological Association as well as the Canadian Network for Women's Health also recommend the practice of perineal exercises to treat UI. The same recommendations were made by the National Agency for Accreditation and Evaluation in Health (ANAES, 2003): Perineal reeducation, alone or associated with biofeedback or electrostimulation for the treatment of stress incontinence. In practice, it is most often focused on pelvic floor strengthening programs. They have been defined as programs of voluntary muscular contractions of the pelvic floor, taught and supervised by a health professional. However, more comprehensive methods of rehabilitation are still poorly implemented in the context of urinary incontinence in women during pregnancy. Given the synergy that exists between the abdominal and pelvic muscles, we deem it necessary to evaluate the effect of a pelvic-perineal rehabilitation program that will take into account the pelvis, the abdominal and dorsal musculature and the pelvic statics of the pelvis. the patient of the pregnant woman suffering from stress urinary incontinence. Our program is composed of prenatal exercise and a program adapted from Lawani *et al.* (2003) and on the other hand exercises that combine strength and endurance and strength exercises.

MATERIAL AND METHODS

Framework and type of research: The present study is an intervention carried out among pregnant women suffering from stress urinary incontinence at the University Clinic of Obstetric Gynecology (CUGO) of the National University Hospital Center in Cotonou (CNHU-HKM) and the Department of Physical Medicine and of Rehabilitation at CNHU-HKM in Cotonou from July 2018 to November 2018. The Laboratory Biomechanics and Performance (LaBioP) of the National Institute of Youth, Physical Education and Sport (INJEPS), served as a framework for support to the realization of this study.

Population and sampling: The sample is composed by reasoned choice of women who are incontinent during exercise. A total of 127 participants meeting the selection criteria were recruited. Four women gave up before the start of the program, two were removed for the threat of premature delivery and seven women dropped out during the program. Finally, 114 women suffering from stress urinary incontinence were available, agreed to participate regularly in the program and were able to complete the experiment. The subjects were divided into two groups: - an experimental group of 48 women with exercise incontinence in the third trimester of pregnancy who are undergoing a physical exercise program;

- a control group of 66 women who are incontinence-stressed during the third trimester of pregnancy who do not undergo any program.

Criteria of inclusion

Have a low risk third trimester pregnancy and no history of urinary incontinence before this pregnancy. Pregnancy was considered low risk after confirming to the woman the absence of conditions maternal education on obstetric risks that determines pregnant women eligible for perinatal follow-up

- Suffering urinary incontinence
- Be willing and available to participate in all sessions
- To be multiparous or primiparous
- Have a body mass index (BMI) between 18 kg / m^2 and 25 kg / m^2
- Be willing and available to participate in all sessions
- Have freely given written informed consent

Criteria of no-inclusion

- Be under 18 years old
- Wear a risky pregnancy
- Do not show symptoms of urinary incontinence
- Have a body mass index (BMI) greater than 25 kg / m^2
- Present diseases related to the cardiovascular and respiratory systems

Criteria of exclusion: Women were excluded from the study if they had other types of stress urinary incontinence than SUI, had previously undergone uro-gynecological surgery, had a serious urinary tract infection or vaginal irritation, and any other conditions that might interfere with evaluation of PP muscle function.

Data collection tools and techniques

- A Seca weigh scale, accurate to the nearest 100 g and maximum capacity 150 kg to measure the body weight of pregnant women.
- A height of two meters, graduated in centimeters to measure the standing height of pregnant women. These anthropometric data will enable us to determine the Body Mass Index (BMI). - Questionnaire of the Ditrovie scale is a quality of life scale of micturition disorders, validated, sensitive, specific, self-administered and comprising 10 items scored from 1 to
- The overall sum (out of 5) allows the quantitative evaluation of the repercussion. Thus, a total score close to 1 corresponds to patients who are uncomfortable in their activities, their psyche, their sleep and with an excellent quality of life; the scores close to 5 reflect extreme discomfort in the activities, with a psyche, a sleep and a quality of life very disturbed.
- A PFX2 pressure periometer to assess perineal muscle activity. In practice, a receptor vaginal probe is placed which generally records the force of perivaginal contraction (pubococcygeal and iliococcygeal bundles of the anus-levator muscle) and the patient is asked to perform voluntary contraction exercises of these peri-vaginal muscles. vaginal. This technique makes it possible to objectify the contraction of the pelvic floor muscles, thus the active work provided by the patient, via a screen connected to the intravaginal probe (Dinc *et al.,* 2009).
- **The Pad Test:** It consists of the weighing of a protection, possibly before and after a series of codified exercises (for the short test pad), in order to quantify the leaks, It makes it possible to objectify the reality and the importance urinary leakage on exertion heart rate monitor to monitor women's heart rate during exercise.

Studied variables

Dependent variables

- Muscle activity (strength and endurance) of the pelvic floor
- Symptoms (severity and frequency) of UI

- Overall quality of life

Independent variables

- Exercise program

Experimental protocol: The review is conducted according to the recommendations of the report of the International Continence Society. The women participating in the study underwent various objective and subjective assessments to confirm their continence or to make a diagnosis of SUI. Women reporting urine leakage on exercise had to undergo a clinical examination of the perineum, the data of which were collected on an individual chart. Finally, in order to objectively verify and quantify urine leakage, women had to undergo the modified 60-minute test pad. To do this, the woman had to wear a health protection whose initial weight was known and consume orally 250 ml of water for 20 minutes. Then carry out a series of exercises: walk 30 minutes, go up and down stairs equivalent to one floor, go from sitting to standing 10 times (flexion and extension of the legs) cough 10 times, keep hands under a jet of water for a minute. The presence and severity of incontinence was quantified by increasing the weight of protection after the test. The values of the quantity of urine loss in grams are obtained by subtracting the weight of the layer after testing the weight of the layer before testing using a urine weighing scale. Considering that a high proportion of women demonstrate difficulty in recruiting their pelvic floor musculature correctly, the gloved evaluator performed a digital intra-vaginal assessment to ensure that the subject properly contracted the musculature of his PP before begin the perineometric evaluation. The perineometer was also prepared for the examination by covering the vaginal probe with a condom and lubricating it with a hypoallergenic gel (KY). The examiner subsequently inserted the probe into the vaginal cavity in an anteroposterior axis at a depth of 5 cm. The depth of 5 cm allows evaluation of all the muscles of the PP surrounding the vagina. Then, the subject had to make three contractions to make sure he was comfortable in the execution of the effort. During the evaluation session, the oscillation of forces could be viewed on the screen and recorded when deemed acceptable. The static parameters of the muscular function of the PP studied were:

Passive force: Passive force registration was performed just prior to maximum force measurements. During a 15-second period, the participant had to fully relax her pelvic musculature to allow the recording of passive force. The calculated mean strength was considered as an index of the passive behavior or "tone" of the pelvic floor muscles.

Maximal strength: The woman had to squeeze the muscles of the PP as much as to retain flatulence or leakage of urine. The speed of the contraction was not asked of the participant. The latter was informed that she had 10 seconds to make maximum effort. A rest period of two minutes was respected between each of the three repetitions to avoid the effect of fatigue. The average of the maximum forces calculated during the three tests was considered in the statistical analyzes.

Static endurance: The endurance of a muscle is its ability to maintain the effort required to overcome a given load over time, while its strength can be defined as the maximum load it can overcome at any given moment. Although the strength and endurance of the muscles are obviously related, the measurement of the endurance of the muscles seems more sensitive to detect their dysfunction than the measure of their strength, assimilated in practice to the extent of their capacity to develop a pressure. The subject had to contract quickly and maintain this maximum contraction for a long time. The endurance of the musculature of the PP will be calculated according to the time during which the maximum force of contraction obtained will be maintained.

Dynamic endurance: The participant had to perform a series of maximal contractions followed by a complete relaxation of the PP musculature as quickly as possible. This protocol of repeated rapid contractions had a duration of 15 seconds. The experimental group was subjected to a physical exercise program that involved the pelvis, abdominal and dorsal musculature and pelvic statics of the patient of the pregnant woman suffering from urinary incontinence. On the one hand, prenatal exercise was discussed following a program adapted from Lawani et al. [6] and on the other hand exercises that combine strength and endurance and strength exercises. Women were trained twice a week for 60 minutes with at least 48 hours of rest between the two sessions and for 10 sessions. The heart rate monitor made it possible to follow the evolution of the heart rate. The desirable level of the effort is that which is realized without major shortness of breath. The speech test made it possible to maintain a normal preservation without breathlessness during the practice of the sports activity. Pelvic floor muscle function parameters (strength and endurance), severity and frequency of urinary leakage were assessed before and after the program was performed in two stages (T1: 30 weeks of pregnancy, T2: 37 weeks of Pregnancy). It is the same for the filling of the questionnaire of the Ditrovie scale, for the evaluation of the quality of life of the voiding disorders.

Ethical considerations: From the ethical point of view, the participants, after having imbued themselves with the objectives and the modalities of the course of the study, manifested themselves by a written commitment approved by the sectoral scientific committee of the Sciences and Techniques of the Physical and Sports Activities of the Abomey-Calavi Universityn representing in the sectoriel plan the national committee of Ethics.

Data processing and analysis: The data was collected and then processed with Microsoft Office Excel 2007 and STATISTICA Version 5.5 software and programs from Stat Soft Inc. Descriptive statistics included measures of central tendency and dispersion indices, presented as means and standard deviations. The tests of normality and homogeneity of the variances were not conclusive, we carried out non-parametric tests. The Wilcoxon rank test was adopted for the comparison of variables within a group at the beginning and at the end of the study. The Mann-Whitney test allowed to appreciate the binary variations in case the Kruskal-Wallis test was significant. The threshold of significance was set at $p < 0.05$.

RESULTS

Comparison of mean values of passive forces and maximum forces before and after the execution of the exercise program in trained and sedentary incontinent women: A comparison of the mean maximum force values shows an increase in the maximal strength of the incontinent

Table 1. Mean values of passive force and maximal strength of trained and sedentary incontinent women

	Passive force F_p			Maximal Strength $_{Fm}$		
	Before	After	Δ (%)	Before	After	Δ (%)
FIERP N1=48	3,63 ± 0,56	04,23 ± 0,53	(+16,52)	7,55 ± 0,60	10,79 ± 0,91	(+42,91)
FIS N2=66	3,71 ± 0,48	03,01 ± 0,44	(-18,86)	7,53 ± 0,53	06,80 ± 0,67	(-09,69)

FIERP: Incontinent women practicing physical exercises of perineal reeducation; FIS: sedentary incontinent women; N1: number of incontinent women practicing physical exercises of perineal reeducation; N2: number of sedentary incontinent women

Table 2. Mean values of perineal muscle endurance of trained and sedentary incontinent women

	Static Endurance			Dynamic endurance		
	Before	After	Δ (%)	Before	After	Δ (%)
FIERP N1=48	36,89 ± 3,91	47,03 ± 4,42	(+27,48)	7,93 ± 0,85	10,71 ± 0,78	(+35,05)
FIS N2=66	36,26 ± 1,89	34,18 ± 0,44	(-05,73)	8,34 ± 0,43	7,05 ± 0,67	(-15,46)

FIERP: Incontinent women practicing physical exercises of perineal reeducation; FIS: sedentary incontinent women; N1: number of incontinent women practicing physical exercises of perineal reeducation; N2: number of sedentary incontinent women

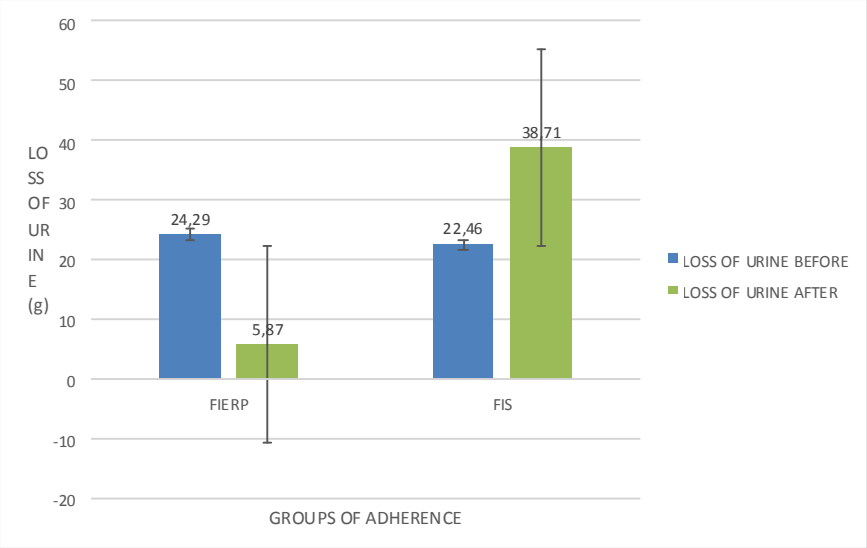

Figure 1. Intra-group comparison of the amount of urinary incontinence

Comparison of mean values of perineal endurance between trained and sedentary incontinent women: A comparison of the mean endurance values of the perineal muscles shows a significant increase of 27.48% and 35.05% respectively for the static endurance and dynamic endurance of incontinent women trained in the rehabilitation exercise program. perineal. In contrast, for sedentary incontinent women, a reduction of 05.73% and 15.46% was observed respectively for static endurance and dynamic endurance (Table II).

Quantitative evaluation of urinary incontinence before and after the execution of the exercise program in trained and sedentary incontinent women: The change in the amount of urine leakage in the group of trained women with incontinence and in that of sedentary incontinent women (Figure 1) reveals that the perineal rehabilitation exercise program significantly reduces the amount of urine loss in the women's group. incontinent trained ($p = 0.0005$). In the group of sedentary incontinent women, there is a significant increase in the amount of urinary leakage.

Frequency of urinary incontinence before and after exercise program exercise in trained and sedentary incontinent women: The change in the incidence of urinary leakage in the group of trained incontinent women and sedentary incontinent women (Figure 2) shows that FIERP who had urinary leakage several times a day before the program was urine one to three times a month after the program. We can therefore say that the perineal rehabilitation exercise program significantly reduces the frequency of urinary losses in the group of trained women with incontinence ($p = 0.0002$). In addition, in the group of sedentary incontinent women, there is a significant increase in the incidence of urinary leakage.

Evaluation of the impact of micturition disorders on the quality of life before and after the execution of the exercise program in trained and sedentary incontinent women: The comparison of daily activity scores, emotional impact, sleep and quality of life shows a significant decrease in the level of discomfort experienced by women with incontinence. However, the results seem to show us the trend that UI in daily activities and sleep is more embarrassing in late pregnancy in sedentary incontinent women, but no significant difference was observed ($p > 0.05$). It is the same for the overall quality of life (Figure 3).

DISCUSSION

Results comparing the average values of passive forces and maximum forces before and after the exercise program show

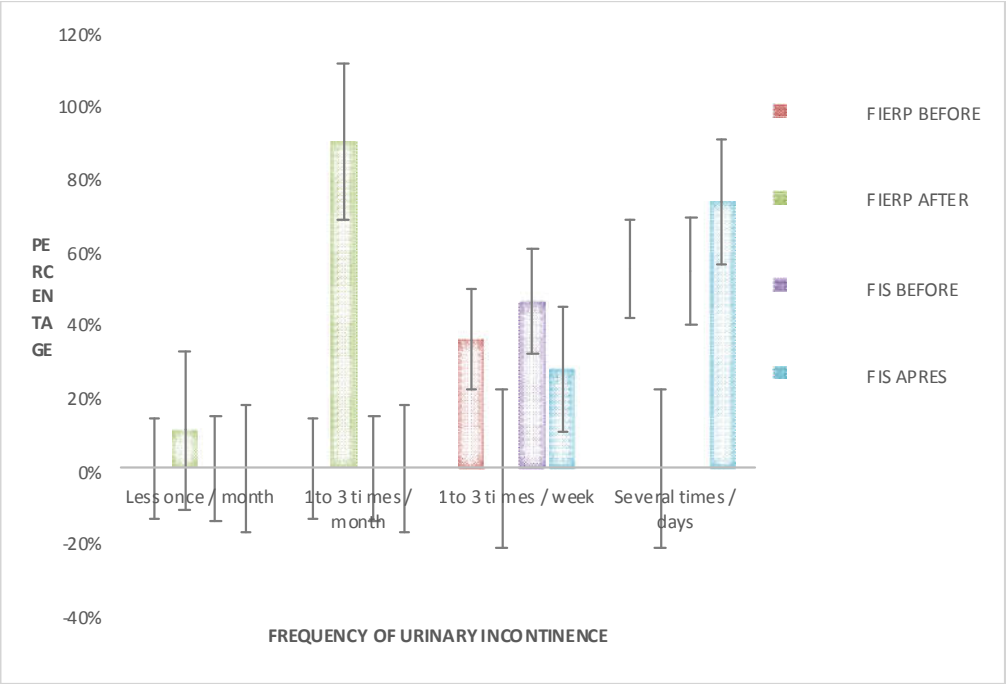

Figure 2. Intra-group comparison of the frequency of urinary incontinence

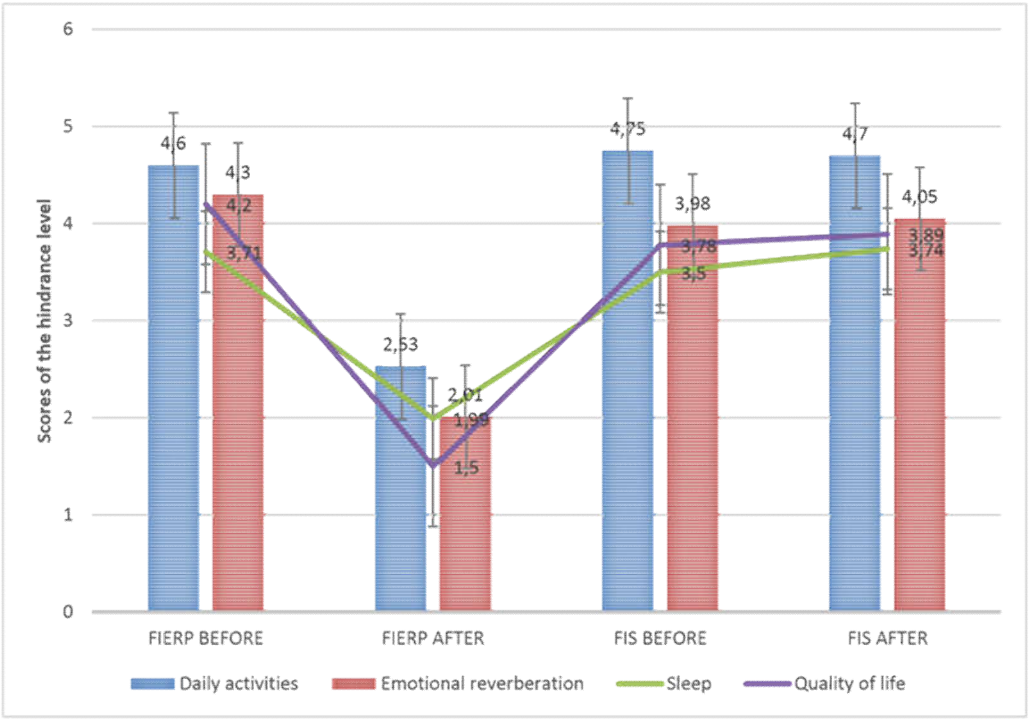

Figure 3. Intra-group comparison of voiding disorders on quality of life

an increase in maximal strength of incontinent women trained in the pelvic floor exercise program, an increase of very significant 42.91%. Our results are consistent with the work of Dinc *et al.* (2009) who found that pregnant women exposed toexercises of the pelvic floor muscles (EPFM) had an increase in perineal muscle strength. Similar results have been tr opened at Sampselle et al. (1998) who studied the effects of EPFM on UI and PFM (pelvic floor muscles) strength during pregnancy and after delivery in 72 primiparous women at 20 weeks gestation. The results revealed a reduction in the incidence of SUI in women trained at 35 weeks of pregnancy, and 6 months postpartum with a significant increase in PFM strength compared to untrained women. In addition, Morkved *et al.* (2003) conducted a study of 301 nulliparous women with IU at 18 weeks of pregnancy. The results reported a reduction of 32% IU at 36 weeks of pregnancy in women in the EPFM program, compared to 48% of women in the control group ($p = 0.007$) with a significant decrease in urinary leakage ($p = 0.014$), a significant 29% increase in MPP strength in late pregnancy in the experimental group ($p = 0.0081$) and 3 months postpartum ($p = 0.048$). The 42.91% increase in maximal strength achieved in our study after the exercise program can be explained by our exercise program which includes not only voluntary and repeated contractions of the perineal muscles, but also also a workout involving exercises of other muscle groups, such as the abdominal, back muscles and gluteal muscles, which according to Hay-Smith *et al.* (2002) facilitates or improves the efficiency of perineal

muscle contraction. This is consistent with Boyle's work which states: a trained muscle may be less prone to injury; a previously trained muscle would find its function more easily after suffering damage; a trained muscle could have a greater reserve of strength, which would prevent lesions from causing functional problems (Boyle *et al.,* 2012). It is also likely that exercises performed during pregnancy help counterbalance the adverse effects of increased intra-abdominal weight on the perineum and increased hormonal laxity (Boyle *et al.,* 2012). Perineal muscle training produces anatomical changes (perineal elevation) that improve the effectiveness of muscle contraction by preventing downward movement during a sudden increase in intraabdominal pressure, preventing leakage of urine(Boyle *et al.,* 2012) . It should also be noted that the significant increase in our strength results can be linked to exercises that combine strength and endurance and strength exercises, since strength training aims at a muscular contraction where the maximum force is generated by the group of muscles. solicited. This type of training is characterized by a low number of contractions with a maximum load. Unlike strength training, endurance training aims at the ability to repeat a contraction or to maintain it over time without deploying a maximum of force (sub-maximal contraction).

This type of training is characterized by a high number of repetitions or by maintaining a contraction in time, with low to moderate loads (Boyle *et al.,* 2012). This is in line with the results of our work, where average values of perineal muscle endurance show a significant increase of 27.48% and 35.05% respectively for the static endurance and dynamic endurance of incontinent women trained. the perineal rehabilitation program. Several studies show statistically significant results regarding perineal reeducation started during the prenatal period for the prevention or treatment (mixed population) of UI in late pregnancy (Boyle *et al.,* 2012). However, two studies used obtained insignificant results in perineal reeducation for the treatment of UI in late pregnancy. This difference in results observed between our study and that of the last two mentioned above may be related to the size of our sample and the inclusion of other muscle groups other than the perineal muscles in our exercise program. In addition, it should be noted that the supervision and supervision of our perineal physiotherapy exercises by professionals could also have a positive impact on the treatment of UI. This corroborates Hay-Smith meta-analysis [10] that attempted to compare the effect of different perineal rehabilitation approaches (coaching supervision, individual or group approach, exercise program) in women which have an IU. The results of this meta-analysis do not provide a single guideline for the optimal approach to perineal muscle exercises. However, the majority of studies included in the meta-analysis showed better treatment efficacy in women who had received regular supervision of their training program. In relation to passive forces, our results corroborate the work of Fernandez (2002), who showed an increase in passive forces measured with a pressure probe in women trained in a program to strengthen the muscles of the PP. The results on the amount of urine leakage in the incontinent women and sedentary incontinent women group reveal that the perineal rehabilitation exercise program significantly reduces the amount of urine loss in the group of trained women with incontinence ($p = 0.0005$). The same is true for the frequency and scores of daily activities, emotional impact, sleep and quality of life. Our results are similar to the work of Sangsawang and Serisathien (2012) who studied the effects of an EMPP program on the severity of SUI in 66 women in the 2nd and 3rd trimesters of pregnancy. After the program was implemented, the women in the experimental group had a significant reduction in the frequency, volume of urinary leakage and UI severity score.

Conclusion

The perineal rehabilitation exercise program significantly increases PFM activity and significantly reduces the amount of urinary loss, frequency of UI, and scores of daily activities, emotional impact, sleep, and quality. of global life. In view of our results, it seems useful to us to make the following suggestions:

- Organize trainings that sensitize health workers to the practice of screening for urinary disorders but also to their prevention during pregnancy
- Screening for urinary continence disorders during pregnancy is widely justified and recommended by several health organizations
- Since UI has many repercussions on the overall health of women (lower self-esteem, limited practice of certain activities, embarrassment, shame, etc.), it is therefore essential that doctors, midwives and nurses working in perinatal care 'recognize the importance of this issue to carry out systematic screening of women to prescribe the various treatments available. - Recognition and certification of the perineal rehabilitation channels in order to ensure better coordination between the prescribing physician and the reeducator and to facilitate the referral of patients to professionals who have received initial and continuous training specific to perineal reeducation techniques. This networking organization should also allow better evaluation of practices and better harmonization of practices.

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