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INTRA AND INTER-RATER RELIABILITY STUDY OF THE DYNAMOMETRIC MEASUREMENTS OF THE PELVIC FLOOR MUSCLES

Hypothesis / aims of study

The evaluation of the pelvic floor muscles (PFM) is recommended by the International Continence Society and is considered essential to evaluate the effect of pre and post therapeutic intervention. There are several methods for evaluating the PFM used by researchers. Among them, the vaginal dynamometry has been studied for being an efficient tool for direct investigation of the strength of the female PFM. However, for a tool to be used in clinical research, it is critical to conduct an analysis of its reproduction reliability. Without this, it is impossible to trust the collected data(1). Thus, the aim of this study is to evaluate the intra and inter-rater reliability of maximum strength, average strength and endurance dynamometric measurements of the PFM.

Study design, materials and methods

A convenience sample of 18 female participants, nulliparous and no urogynecological complaints, aged between 19 and 31 participated in the study. All participants signed an informed consent form, and the study was approved by the institutional Research Ethics Committee. Inclusion criteria were: normal body mass index (<25 kg/m^2), nulliparous, nonpregnant and no urogynecological complaints or disease and present PFM strength equal to or greater than 1, according to the Modified Oxford Scale. Exclusion criteria were: pelvic organ prolapse or reconstructive pelvic surgery, symptoms of vaginal infection, intolerance to condoms, allergy to the gel used in the procedure, excessive vaginal scarring preventing the dynamometer insertion, degenerative neurological disorder or any other disease that may interfere with force measurement of the pelvic floor, pre-menstrual and menstrual current period(1). An interviewer (VRS) questioned the participants about their demographic and clinical data. For all women PFM strength was evaluated and repeated in three successive sessions: two at the same day with a rest period between them of 30 minutes, and the last in the successive day. In each session, all participants were evaluated twice. The order was drawn among evaluators (rater 1 - NMM and rater 2 - JM). The interviewer (VRS) remained in the room to ensure that the same procedures were performed by the two examiners and the examiners were blinded to the results obtained by each other. Vaginal dynamometer data were analyzed using three parameters: maximum strength (kgf), average strength (kgf) and endurance (sec); and the intraclass correlation coefficient (ICC) was applied to estimate the reliability of the dynamometric measurements of the PFM, as excellent level to above 0.8.

Results

Most participants were white (94.4%), single (94.4%) and complete / incomplete college (100%). The mean age presented by the participants was 25.4 (±3.9) years and body mass index (BMI) was 22.9 (±2.9) kg/m^2. With regard to personal aspects, most participants reported sexual activity (72.2%), not taking oral contraceptives (77.8%) and no regular physical activity (61.1%). Tables 1 and 2 present the analysis of intra and inter-rater reliability of the evaluated dynamometric measurements, respectively.

Table 1 - Intra-rater reliability of the dynamometric measurements.

	Rater 1					**Rater 2**				
Dynamometric measurements	1ª session M(SD)	2ª session M(SD)	3ª session M(SD)	Intra-rater reliability * (ICC)	Level**	1ª session M(SD)	2ª session M(SD)	3ª session M(SD)	Intra-rater reliability * (ICC)	Level**
Maximum strength	1.01 (0.5)	1.03 (0.6)	1.07 (0.6)	0.96	Excellent	1.06 (0.6)	1.11 (0.6)	1.11 (0.7)	0.95	Excellent
Average strength	0.41 (0.2)	0.42 (0.2)	0.45 (0.3)	0.96	Excellent	0.45 (0.2)	0.46 (0.2)	0.49 (0.3)	0.94	Excellent
Endurance	3.9 (1.7)	3.95 (2.0)	3.99 (2.2)	0.88	Excellent	3.87 (2.1)	4.21 (2.4)	4.58 (2.1)	0.86	Excellent

M=Media SD=Standard Deviation *****ICC = Intraclass Correlation Coeficient **>0.8

Table 2 - Inter-rater reliability of the dynamometric measurements.

Dynamometric measurements	**Rater 1** M(SD)	**Rater 2** M(SD)	**Inter-rater reliability***	**Level****
Maximum strength	1.04 (0.03)	09 (0.03)	0.96	Excellent
Average strength	0.43 (0.02)	0,47 (0.02)	0.97	Excellent
Endurance	3.95 (0.05)	4,22 (0.36)	0.92	Excellent

M=Media SD=Standard Deviation *****ICC = Intraclass Correlation Coeficient **>0.8

Interpretation of results

During the functional evaluation of PFM, it is necessary to use means to investigate not only the muscular response, but also to quantify muscle strength, endurance, speed of contraction, as well as the ability to achieve and repeat fast or sustained contractions(1). Studies using vaginal dynamometer showed good linearity, repeatability and ability to measure PFM strength relying on test-retest and ability to investigate other pathophysiologic parameters such as strength, speed of contraction and muscle tone(1,2,3).

In this study, a vaginal dynamometer equipped with a load cell was used, and three parameters were analyzed: maximum strength (kgf), average strength (kgf) and endurance (seconds). Considering the histological composition of the PFM, with approximately 70% fibers type I and 30% fibers type II, it is believed that the proposed parameters allow fully understanding muscle function. Thus, the reliability of such parameters were proven, which allows its use in clinical research in a reliable way.

Concluding message

The strength of the pelvic floor muscles measured by the vaginal dynamometer equipped with a load cell, showed excellent intra and inter-rater reliability for "maximum strength", "average strength" and "endurance" dynamometric measurements, proving to be a reliable instrument to use in clinical research.

References

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Disclosures

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