

RESSALVA

Atendendo solicitação do(a)
autor(a), o texto completo desta
dissertação será disponibilizado
somente a partir de 30/09/2023.

UNIVERSIDADE ESTADUAL PAULISTA
“JÚLIO DE MESQUITA FILHO”
FACULDADE DE MEDICINA

Adriely Bittencourt Morgenstern Magyori

**Espessura do reto abdominal como fator preditivo da
incontinência urinária específica da gestação: estudo
ultrassonográfico**

*Rectus abdominis muscles' thickness as predictive factor of pregnancy specific
urinary incontinence: ultrasound study*

Dissertação apresentada à
Faculdade de Medicina,
Universidade Estadual Paulista
“Júlio de Mesquita Filho”, Campus
de Botucatu, para obtenção do título
de Mestre em Tocoginecologia.

Orientadora: Prof.^a Dra. Angélica Mércia Pascon Barbosa
Coorientadora: Profa^a Dra. Natália Miguel Martinho Fogaça

Botucatu
2022

Adriely Bittencourt Morgenstern Magyori

**Espessura do reto abdominal como fator preditivo da
incontinência urinária específica da gestação: estudo
ultrassonográfico**

Dissertação apresentada à
Faculdade de Medicina,
Universidade Estadual Paulista
“Júlio de Mesquita Filho”, Campus
de Botucatu, para obtenção do título
de Mestre em Tocoginecologia.

Orientadora: Prof.^a Dra. Angélica Mércia Pascon Barbosa

Coorientadora: Prof.^a Dra. Natália Miguel Martinho Fogaca

Botucatu
2022

Adriely Bittencourt Morgenstern Magyori

**Espessura do reto abdominal como fator preditivo da
incontinência urinária específica da gestação: estudo
ultrassonográfico**

Dissertação apresentada à
Faculdade de Medicina,
Universidade Estadual Paulista
“Júlio de Mesquita Filho”,
Campus de Botucatu, para
obtenção dotítulo de Mestre em
Tocoginecologia

Orientadora: Prof.^a Dra. Angélica Mércia Pascon Barbosa
Coorientadora: Profa^a Dra. Natália Miguel Martinho Fogaça

Comissão Examinadora:

Prof.^a Dra. Angélica Mércia Pascon Barbosa
Faculdade de Medicina de Botucatu – UNESP

Prof.^a Dra. Flávia Ignácio Antônio
University of Ottawa – uOttawa

Prof.^a Dra. Simone Botelho Pereira
Universidade Federal de Alfenas – UNIFAL-MG

Botucatu, 30 de março de 2022

Dedicatórias

À **Deus**, por sempre me trazer fé, força e esperança em todos os momentos de minha vida. Por sempre me fazer lembrar o quanto sou agraciada e abençoada por tudo que me cerca e por todas as oportunidades concedidas.

Ao meu marido, **Alberto**, que me apoia e incentiva em todas as áreas. Obrigada por ser minha rocha, minha fortaleza, minha paz e o grande amor da minha vida.

À minha mãe, **Vânia**, por todo sacrifício feito em sua vida para que eu pudesse chegar onde cheguei e ser quem eu sou. Desejo ser ao menos parte da grande mulher que você é e da força que você tem. Amo você.

Aos meus avós, **Nabucodonosor (in memoriam)** e **Elza**, por serem meus exemplos de amor. Obrigada pelo apoio e pela mais bela expressão de carinho e cuidado comigo, com minhas irmãs e mamãe. Vovô, saudade eterna do melhor homem que tive a oportunidade de conhecer. Obrigada por ser exemplo.

Às minhas irmãs, **Náthaly e Thayara**, que são minhas melhores amigas, conselheiras e confidentes. Obrigada pela linda união que temos.

À toda **minha família**, sogro, sogra, cunhadas e cunhados por fazerem parte de minha trajetória.

Agradecimentos

À Prof.^a Dra. Angélica Mércia Pascon Barbosa, que se tornou para mim mais do que uma professora e orientadora. Obrigada por todo incentivo, conhecimento, ensinamentos (de vida), por todo carinho e dedicação. Meu desejo é tornar-me uma profissional como você, não apenas em capacidade e experiência, mas também em humanidade.

À Prof.^a Titular Marilza Vieira Cunha Rudge, pela sua sabedoria e profissionalismo ao colaborar com desenvolvimento deste mestrado.

À Profa. Dra. Natália Martinho, por compartilhar toda sua experiência e tempo para que eu pudesse realizar este trabalho. Sem sua paciência, ensinamentos e atenção, nada disso seria possível.

Às amigas e colaboradoras do Diamater **Sthefanie, Michele e Carol Baldini** que foram incondicionais na coleta de dados. Obrigada por toda dedicação e qualidade no trabalho.

Aos funcionários do **Programa de Pós-Graduação da Faculdade de Medicina de Botucatu**, e ao **Departamento de Tocoginecologia**, por toda atenção.

Ao Escritório de Apoio à Pesquisa, nominalmente ao **Prof. Dr. Hélio, Cinthia e Cássia**.

Às **participantes do estudo** pela colaboração e realização dos exames.

À CAPES. O presente trabalho foi realizado com o apoio da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) – Código de financiamento 001.

À Fapesp – Fundação de Amparo à Pesquisa do Estado de São Paulo (Processo nº 2016/01743-5) pelo apoio financeiro essencial para a realização dessa pesquisa.

A todos do **Diamater Study Group**, que fazem a diferença nessa trajetória. Obrigada por todos os ensinamentos e pelo trabalho em equipe.



Epígrafe

“E ainda que tivesse o dom de profecia, e conhecesse todos os mistérios e toda a ciência, e ainda que tivesse toda a fé, de maneira tal que transportasse os montes, e não tivesse amor, nada seria.”

1 Coríntios 13:2

Lista de Figuras

Contextualização

Figura 1 Potenciais confundidores,mediadores e moderadores do Diamater. **26**

Figura 2 Imagem de US-2D do MRA..... **27**

Artigo

Figure 1 Figure 1 – Ultrasound images of RAM. Archive of researchers, 2018..... **39**

Figure 2 Flowchart for cohort derivation showing the number of participants and the reasons for loss to follow-up..... **40**

Lista de Tabelas

Artigo

Table 1	Baseline characteristics of the study population.....	41
Table 2	Rectus abdominis muscle (RAM) thickness during task, Thickness Variation Index and Pelvic floor function.....	42
Table 3	Bivariate linear regression of predictors for a PS-UI.....	43

Lista de abreviações

Português e Inglês

Lista de abreviações em Português

- AP assoalho pélvico
CAAE Certificado de Apresentação de Apreciação Ética
CEP Comitê de Ética em Pesquisa
DMG *diabetes mellitus* gestacional
Dra. doutora
FAMEMA Faculdade de Medicina de Marília
FAPESP Fundação de Amparo à Pesquisa do Estado de São Paulo
FEMA Fundação Educacional do Município de Assis
FMRP Faculdade de Medicina de Ribeirão Preto
IU incontinência urinária
IU-EG incontinência urinária específica da gestação
MAP músculos do assoalho pélvico
MRA músculos reto abdominais
PPG Programa de Pós-graduação
Prof.^a professora
QV qualidade de vida
TT3 treinamento técnico 3
UNESP Universidade Estadual Paulista
US-2D ultrassonografia bidimensional
USC Universidade do Sagrado Coração
USP Universidade de São Paulo

Lista de abreviações em Inglês

- % percentage
- 3D-US three-dimension ultrasound
- BMI body mass index
- CI confidence interval
- Cm centimeter
- GDM Gestational Diabetes Mellitus
- ICI-Q International Consultation on Incontinence Questionnaire
- ISI Incontinence Severity Index
- Kg kilogram
- LAM Levator ani muscle
- PDRC Perinatal Diabetes Research Center
- PFM pelvic floor muscles
- PFMD pelvic floor muscle dysfunction
- PS-UI pregnancy specific-urinary incontinence
- QOL quality of life
- R rest
- RAM Rectus abdominus muscle
- RR Relative risk
- T task
- UI urinary incontinence

Sumário

Seção 1	Trajetória acadêmica	19
Seção 2	Contextualização	22
	Músculos abdominais e do assoalho pélvico e sua relação com a Incontinência Urinária Específica da gestação	23
	Referências	28
Seção 3	Artigo	31
	Funcionalidade do músculo Reto Abdominal avaliada pela ultrassonografia bidimensional como preditora da incontinência urinária específica da gestação	32
	Abstract	33
	Introduction	34
	Method	36
	Results	40
	Discussion	43
	Conclusion	46
	References	48
Seção 4	Perspectivas Acadêmicas e Científicas	53
Seção 5	Diamater Study Group	55
Seção 6	Anexos	58

Referências:

1. Bergmark A. Stability of the lumbar spine: a study in mechanical engineering. *Acta Orthop Scand Suppl.* 1989;230:1–54.
2. Sapsford R. Rehabilitation of pelvic floor muscles utilizing trunk stabilization. *Manual Therapy.* 2004;9(1):3–12.
3. Sapsford R, Hodges PW, Richardson CA, Cooper HD, Markwell SJ, Jull GA. Co-activation of the abdominal and pelvic floor muscles during voluntary exercises. *Neurourol Urodyn* 2001;20(1):31-42.
4. Sapsford RR, Hodges PW. Contraction of the pelvic floor muscles during abdominal maneuvers. *Arch Phys Med Rehabil* 2001;82(8):1081-8.
5. Neumann P, Gill V. Pelvic floor and abdominal muscle interaction: EMG activity and intra-abdominal pressure. *Int Urogynecol J* 2002;13:125-32.
6. Junginger B, Baessler K, Sapsford R, Hodges PW. Effect of abdominal and pelvic floor tasks on muscle activity, abdominal pressure and bladder neck. *Int Urogynecol J* 2010;21(1):69– 77.
7. Pereira LC, Botelho S, Marques J, Amorim CF, Lanza AH, Palma P, Riccetto C. Are transversus abdominis/oblique internal and pelvic floor muscles coactivated during pregnancy and postpartum? *Neurourol Urodyn* 2013;32(5):416-419.
8. Santos AA. Biomecânica do movimento. 2^aed. São Paulo Editora: Sammus, 2002.
9. Bo K, Frawley HC, Haylen BT, Abramov Y, Almeida FG, Berghmans B, et al. An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for the conservative and nonpharmacological management of female pelvic floor dysfunction. *Neurourol Urodyn* 2017;36(2):221-44.
10. Ptaszkowski K, Paprocka-Borowicz M, Slupska L, Bartnicki J, Dymarek R, Rosinczuk J,et al.Assessment of bioelectrical activity of synergistic muscles during pelvic floor muscles activation in postmenopausal women with and without stress urinary incontinence: a preliminary observational study. *Clin Interv Aging [Internet].* 2015 Sep;1521.
11. Vesentini G, El Dib R, Righesso LAR, Piculo F, Marini G, Ferraz GAR et al. Pelvic floor and abdominal muscle cocontraction in women with and without pelvic floor dysfunction: a systematic review and meta-analysis. *Clinics* 2019;25(74):e1319.
12. Ferla L, Darski C, Paiva LL, Sbruzzi G, Vieira A. Synergism between abdominal and pelvic floor muscles in healthy women: a systematic review of observational studies. *Fisioter Mov* 2016;29(2):399- 410.
13. Madill SJ, Harvey MA, McLean L. Women with stress urinary incontinence demonstrate motor control differences during coughing. *Journal of Electromyography and Kinesiology* 2010;20(5):804–812.
14. Arab AM, Chehrehrazi M. The response of the abdominal muscles to pelvic floor muscle contraction in women with and without stress urinary incontinence using ultrasound imaging. *Neurourol Urodyn* 2011;30(1):117-20.
15. Barbic M, Kralj B, Andrej C. Compliance of the bladder neck supporting structures: importance of activity pattern of levator ani muscle and content of elastic fibers of endopelvic fascia. *Neurourol Urodyn* 2003;22:269-76.

16. Thompson JA, O'Sullivan PB, Briffa NK, Neumann P. Altered muscle activation patterns in symptomatic women during pelvic floor muscle contraction and Valsalva manouevre. *Neurourol Urodyn* 2006;25(3):268-76.
17. Bø K, Braekken IH, Majida M, Engh ME. Constriction of the levator hiatus during instruction of pelvic floor or transversus abdominis contraction: a 4D ultrasound study. *Int Urogynecol J Pelvic Floor Dysfunct* 2009;20(1):27-32.
18. Devreese A, Staes F, DeWeerd W, Feys H, Van Assche A, Penninckx F, et al. Clinical evaluation of pelvic floor muscle function in continent and incontinent women. *Neurourol Urodyn* 2004;23(3):190-7.
19. Junginger B, Seibt E, Baessler K. Bladder-neck effective, integrative pelvic floor rehabilitation program: follow-up investigation. *Eur J Obstet Gynecol Reprod Biol* 2014;174:150-3.
20. Smith MD, Coppeters MW, Hodges PW. Postural activity of the pelvic floor muscles is delayed during rapid arm movements in women with stress urinary incontinence. *Int Urogynecol J Pelvic Floor Dysfunct*. 2007;18(8):901-911. DOI: 10.1007/s00192-006-0259-7;
21. Baessler K, Junginger B. Why do women leak urine? Which continence mechanism(s) fail(s)? *Int Urogynecol J* 2013; 24: S90-S91.
22. Vesentini G, El Dib R, Righesso LAR, Piculo F, Marini G, Ferraz GAR, et al. Pelvic floor and abdominal muscle cocontraction in women with and without pelvic floor dysfunction: a systematic review and meta-analysis. *Clinics*. 2019;74:e1319.
23. Boissonnault JS, Blaschak MJ. Incidence of diastasis recti abdominis during the childbearing year. *Phys Ther [Internet]*.1988 Jul [cited 2019 Aug 6];68(7):1082-6.
24. Mesquita LA, Machado AV, Andrade AV. Fisioterapia para redução da diástase dos músculos retos abdominais no pós-parto. *Rev Bras Ginecol e Obs [Internet]*. 1999 Jun;21(5):267-72.
25. Bursch SG. Interrater reliability of diastasis recti abdominis measurement. *Phys Ther [Internet]*.1987 Jul [cited 2019 Aug 6];67(7):1077-9.
26. Landon CR, Crofts CE, Smith ARB, Trowbridge EA. Mechanical properties of fascia during pregnancy: a possible factor in the development of stress incontinence of urine. *Contemp Rev Obstet Gynaecol*. 1990;2:40-6.
27. Van Geelen H, Ostergaard D, Sand P. A review of the impact of pregnancy and childbirth on pelvic floor function as assessed by objective measurement techniques. *Int Urogynecol J [Internet]*. 2018 Mar 13;29(3):327-38.
28. Herbert J. Pregnancy and childbirth: the effects on pelvic floor muscles. *Nurs Times [Internet]*. 105(7):38-41.
29. Moccellin AS, Rett MT, Driusso P. Existe alteração na função dos músculos do assoalho pélvico e abdominais de primigestas no segundo e terceiro trimestre gestacional? *Fisioter e Pesqui [Internet]*.2016Jun;23(2):136-4
30. Kudish BI, Iglesia CB, Sokol RJ, Cochrane B, Richter HE, Larson J, et al. Effect of Weight Change on Natural History of Pelvic Organ Prolapse. *Obstet Gynecol [Internet]*. 2009 Jan;113(1):818.
31. Greer WJ, Richter HE, Bartolucci AA, Burgio KL. Obesity and Pelvic Floor Disorders. *Obstet Gynecol [Internet]*. 2008 Aug;112(2, Part 1):341-9.
32. Stothers L, Friedman B. Risk Factors for the Development of Stress Urinary Incontinence in Women. *Curr Urol Rep [Internet]*. 2011 Oct 22;12(5):363-9.
33. Hvidman L, Foldspang A, Mommsen S, Bugge Nielsen J. Correlates of urinary incontinence in pregnancy. *Int Urogynecol J Pelvic Floor Dysfunct*. 2002;13(5):278-83.
34. Viktrup L, Lose G. Lower urinary tract symptoms 5 years after the first delivery. *Int Urogynecol J Pelvic Floor Dysfunct*. 2000 Dec;11(6):336-40.

35. Barbosa AM, Dias A, Marini G, Calderon IM, Witkin S, Rudge MV. Urinary incontinence and vaginal squeeze pressure two years post cesarean delivery in primiparous women with previous gestational diabetes mellitus. *Clinics (Sao Paulo)*. 2011;66(8):1341-6.
36. Rudge MVC, Souza FP, Abbade JF, Hallur RLS, Marcondes JPC, Piculo F, et al. Study protocol to investigate biomolecular muscle profile as predictors of long-term urinary incontinence in women with gestational diabetes mellitus. *BMC Pregnancy Childbirth* [Internet]. 2020 Dec 19;20(1):117.
37. Piculo F, Marini G, Barbosa AMP, Damasceno DC, Matheus SM, Felisbino SL, et al. Urethral striated muscle and extracellular matrix morphological characteristics among mildly diabetic pregnant rats: translational approach. *Int Urogynecol J Pelvic Floor Dysfunct*. 2014;25:403–415. doi: 10.1007/s00192-013-2218-4.
38. Lambertucci AC, Lambertucci RH, Hirabara SM, Curi R, Moriscot AS, Alba-Loureiro TC, et al. Glutamine supplementation stimulates protein-synthetic and inhibits protein-degradative signaling pathways in skeletal muscle of diabetic rats. *PLoS One* [Internet]. 2012 Jan [cited 2019 Aug 6];7(12):e50390.
39. Messelink B, Benson T, Berghmans B, Bø K, Corcos J, Fowler C, et al. Standardization of terminology of pelvic floor muscle function and dysfunction: Report from the pelvic floor clinical assessment group of the International Continence Society. *Neurourol Urodyn*. 2005
40. Shek KA, Dietz Hans. Pelvic floor ultrasonography: An update. *Minerva ginecologica*. 2013 Feb 01. Vol 65
41. Brækken IH, Majida M, Ellstrøm-Engh M, Dietz HP, Umek W, Bø K. Test-retest and intra-observer repeatability of two-, three- and four-dimensional perineal ultrasound of pelvic floor muscle anatomy and function. *Int Urogynecol J* [Internet]. 2008 Feb 29 [cited 2016 Dec 4];19(2):227–35.
42. DeLancey JOL, Kearney R, Chou Q, Speights S, Binno S. The appearance of levator ani muscle abnormalities in magnetic resonance images after vaginal delivery. *Obstet Gynecol* [Internet]. 2003 Jan [cited 2019 Aug 6];101(1):46–53.
43. Dietz HP, Haylen BT, Broome J. Ultrasound in the quantification of female pelvic organ prolapse. *Ultrasound Obstet Gynecol* [Internet]. 2001 Nov [cited 2019 Aug 6];18(5):511–4.
44. Dietz HP. Levator function before and after childbirth. *Aust N Z J Obstet Gynaecol* [Internet]. 2004 Feb [cited 2019 Aug 6];44(1):19–23.
45. Fielding JR. Practical MR imaging of female pelvic floor weakness. *Radiographics* [Internet]. [cited 2019 Aug 6];22(2):295–304.
46. Margulies RU, Hsu Y, Kearney R, Stein T, Umek WH, DeLancey JOL. Appearance of the levator ani muscle subdivisions in magnetic resonance images. *Obstet Gynecol* [Internet]. 2006 May [cited 2019 Aug 6];107(5):1064–9.
47. Singh K, Reid WMN, Berger LA. Magnetic resonance imaging of normal levator ani anatomy and function. *Obstet Gynecol* [Internet]. 2002 Mar [cited 2019 Aug 6];99(3):433–8.
48. Aukee P, Usenius J-P, Kirkinen P. An evaluation of pelvic floor anatomy and function by MRI. *Eur J Obstet Gynecol Reprod Biol* [Internet]. 2004 Jan 15 [cited 2019 Aug 6];112(1):84–8.

References

1. Dietz HP. Female pelvic floor dysfunction-an imaging perspective [Internet]. Vol. 9, Nature Reviews Gastroenterology and Hepatology. Nat Rev Gastroenterol Hepatol; 2012 [cited 2021 Jan 30]. p. 113–21. Available from: <https://pubmed.ncbi.nlm.nih.gov/22183184/>
2. Sung VW, Hampton BS. Epidemiology of Pelvic Floor Dysfunction [Internet]. Vol. 36, Obstetrics and Gynecology Clinics of North America. Elsevier; 2009 [cited 2021 Jan 30]. p. 421–43. Available from: <http://www.obgyn.theclinics.com/article/S0889854509000679/fulltext>
3. Van Geelen H, Ostergaard D, Sand P. A review of the impact of pregnancy and childbirth on pelvic floor function as assessed by objective measurement techniques [Internet]. Vol. 29, International Urogynecology Journal. Springer London; 2018 [cited 2021 Jan 30]. p. 327–38. Available from: <http://link.springer.com/10.1007/s00192-017-3540-z>
4. Nygaard I, Barber MD, Burgio KL, Kenton K, Meikle S, Schaffer J, et al. Prevalence of symptomatic pelvic floor disorders in US women. JAMA - J Am Med Assoc [Internet]. 2008 Sep 17 [cited 2021 Jan 30];300(11):1311–6. Available from: <https://pubmed.ncbi.nlm.nih.gov/18799443/>
5. Zhu Q, Shu H, Dai Z. Effect of pelvic floor dysfunction on sexual function and quality of life in Chinese women of different ages: An observational study. Geriatr Gerontol Int [Internet]. 2019 Apr 1 [cited 2021 Jan 30];19(4):299–304. Available from: <https://pubmed.ncbi.nlm.nih.gov/30811813/>
6. Anelli SA, Morganti L, Martinello R, Borghi C, Forini E, Greco P, et al. Combined rectal and gynecologic surgery in complex pelvic floor dysfunction: Clinical outcomes and quality of life of patients treated by a multidisciplinary group. Vol. 73, Minerva Chirurgica. Edizioni Minerva Medica; 2018. p. 345–7.
7. Frota IPR, Rocha ABO, Neto JAV, Vasconcelos CTM, De Magalhaes TF, Karbage SAL, et al. Pelvic floor muscle function and quality of life in postmenopausal women with and without pelvic floor dysfunction. Acta Obstet Gynecol Scand [Internet]. 2018 May 1 [cited 2021 Jan 30];97(5):552–9. Available from: <https://pubmed.ncbi.nlm.nih.gov/29352460/>
8. [Symptom distribution of female pelvic floor dysfunction patients with constipation as chief complaint] - PubMed [Internet]. [cited 2021 Jan 30]. Available from: <https://pubmed.ncbi.nlm.nih.gov/30051449/>
9. Ramage L, Georgiou P, Qiu S, McLean P, Khan N, Kontnouonisios C, et al. Can we correlate pelvic floor dysfunction severity on MR defecography with patient-reported symptom severity? Updates Surg [Internet]. 2018 Dec 1 [cited 2021 Jan 30];70(4):467–76. Available from: <https://doi.org/10.1007/s13304-017-0506-0>
10. Bo K, Frawley HC, Haylen BT, Abramov Y, Almeida FG, Berghmans B, et al. An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for the conservative and nonpharmacological management of female pelvic floor dysfunction. Neurourol Urodyn [Internet]. 2017 Feb 1 [cited 2021 Jan 30];36(2):221–44. Available from: <https://pubmed.ncbi.nlm.nih.gov/27918122/>

11. DeLancey JO. The anatomy of the pelvic floor. *Curr Opin Obstet Gynecol* [Internet]. 1994 Aug [cited 2016 Dec 5];6(4):313–6. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/7742491>
12. Piret, Béziers. *Fisiologia da Terapia Manual*: Summus Editorial, 1989.
13. Sapsford RR, Hodges PW. Contraction of the pelvic floor muscles during abdominal maneuvers. *Arch Phys Med Rehabil* 2001;82(8):1081-8.
14. Neumann P, Gill V. Pelvic floor and abdominal muscle interaction: EMG activity and intra-abdominal pressure. *Int Urogynecol J* 2002;13:125-32
15. Pereira LC, Botelho S, Marques J, Amorim CF, Lanza AH, Palma P, Riccetto C. Are transversus abdominis/oblique internal and pelvic floor muscles coactivated during pregnancy and postpartum? *Neurourol Urodyn* 2013;32(5):416-419
16. Bo K, Frawley HC, Haylen BT, Abramov Y, Almeida FG, Berghmans B, et al. An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for the conservative and nonpharmacological management of female pelvic floor dysfunction. *Neurourol Urodyn* 2017;36(2):221-44
17. Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, et al. The standardisation of terminology in lower urinary tract function: report from the standardisation sub-committee of the international continence society. *Urology*. 2003;61:37–49.
18. Madill SJ, Harvey MA, McLean L. Women with stress urinary incontinence demonstrate motor control differences during coughing. *Journal of Electromyography and Kinesiology* 2010;20(5):804–812.
19. Arab AM, Chehrehrazi M. The response of the abdominal muscles to pelvic floor muscle contraction in women with and without stress urinary incontinence using ultrasound imaging. *Neurourol Urodyn* 2011;30(1):117-20.
20. Barbic M, Kralj B, Andrej C. Compliance of the bladder neck supporting structures: importance of activity pattern of levator ani muscle and content of elastic fibers of endopelvic fascia. *Neurourol Urodyn* 2003;22:269-76.
21. Thompson JA, O'Sullivan PB, Briffa NK, Neumann P. Altered muscle activation patterns in symptomatic women during pelvic floor muscle contraction and Valsalva manoeuvre. *Neurourol Urodyn* 2006;25(3):268-76.
22. Bø K, Braekken IH, Majida M, Engh ME. Constriction of the levator hiatus during instruction of pelvic floor or transversus abdominis contraction: a ultrasound study. *Int Urogynecol J Pelvic Floor Dysfunct* 2009;20(1):27-32.
23. Devreese A, Staes F, DeWeerdt W, Feys H, Van Assche A, Penninckx F, et al. Clinical evaluation of pelvic floor muscle function in continent and incontinent women. *Neurourol Urodyn* 2004;23(3):190-7
24. Vesentini G, El Dib R, Righesso LAR, Piculo F, Marini G, Ferraz GAR, et al. Pelvic floor and abdominal muscle cocontraction in women with and without pelvic floor dysfunction: a systematic review and meta-analysis. *Clinics*. 2019;74:e1319.
25. Hvidman L, Foldspang A, Mommsen S, Bugge Nielsen J. Correlates of urinary incontinence in pregnancy. *Int Urogynecol J Pelvic Floor Dysfunct*. 2002;13(5):278-83.

26. Viktrup L, Lose G. Lower urinary tract symptoms 5 years after the first delivery. *Int Urogynecol J Pelvic Floor Dysfunct.* 2000 Dec;11(6):336-40.
27. Bursch SG. Interrater reliability of diastasis recti abdominis measurement. *Phys Ther [Internet].* 1987 Jul [cited2019 Aug 6];67(7):1077–9.
28. Landon CR, Crofts CE, Smith ARB, Trowbridge EA. Mechanical properties of fascia during pregnancy: a possible factor in the development of stress incontinence of urine. *Contemp Rev Obstet Gynaecol.* 1990;2:406.
29. Herbert J. Pregnancy and childbirth: the effects on pelvic floor muscles. *Nurs Times [Internet].* 105(7):38–41.
30. Messelink B, Benson T, Berghmans B, Bø K, Corcos J, Fowler C, et al. Standardization of terminology of pelvic floor muscle function and dysfunction: Report from the pelvic floor clinical assessment group of the International Continence Society. *Neurourol Urodyn.* 2005
31. Brækken IH, Majida M, Ellstrøm-Engh M, Dietz HP, Umek W, Bø K. Test-retest and intra-observer repeatability of two-,three-and four-dimensional perineal ultrasound of pelvic floor muscle anatomy and function. *Int Urogynecol J [Internet].* 2008 Feb 29 [cited 2016 Dec 4];19(2):227–35.
32. Tamanini JT, Dambros M, D'Ancona CA, Palma PC, Rodrigues Netto N Jr. Validation of the “International Consultation on Incontinence Questionnaire -- Short Form” (ICIQ-SF) for Portuguese. *Rev Saude Publica.* 2004;38(3):438–44.
33. Pereira VS, Santos JY, Correia GN, Driusso P. Translation and validation into Portuguese of a questionnaire to evaluate the severity of urinary incontinence. *Rev Bras Ginecol Obstet.* 2011;33(4):182–7.
34. Friedman S, Blomquist JL, Nugent JM, McDermott KC, Muñoz A, Handa VL. Pelvic muscle strength after childbirth. *Obstet Gynecol [Internet].* 2012 Nov [cited 2017 Jan 16];120(5):1021–8. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/23090518>
35. Bø K, Kvarstein B, Hagen RR, Larsen S. Pelvic floor muscle exercise for the treatment of female stress urinary incontinence: II. Validity of vaginal pressure measurements of pelvic floor muscle strength and the necessity of supplementary methods for control of correct contraction. *Neurourol Urodyn [Internet].* 1990 [cited 2021 Jan 28];9(5):479–87. Available from: <http://doi.wiley.com/10.1002/nau.1930090504>
36. Kelly, C. R., Mourtzakis, M., Furberg, H., Tandon, P., & Paris, M. T. (2021). *Rectus Abdominis Muscle Thickness is a Valid Measure of Cross-Sectional Area: Implications for Ultrasound.* Academic Radiology. doi:10.1016/j.acra.2021.06.005
37. Teyhen, D. S., Gill, N. W., Whittaker, J. L., Henry, S. M., Hides, J. A., & Hodges, P. (2007). *Rehabilitative Ultrasound Imaging of the Abdominal Muscles.* Journal of Orthopaedic & Sports Physical Therapy, 37(8), 450–466. doi:10.2519/jospt.2007.2558
38. Rankin G, Stokes M, Newham DJ. Abdominal muscle size and symmetry in normal subjects. *Muscle Nerve.* 2006;34:320-326.
39. Springer BA, Mielcarek BJ, Nesfield TK, Teyhen DS. Relationships among lateral abdominal muscles, gender, body mass index, and hand dominance. *JOrthop Sports Phys Ther.* 2006;36:289-297.

40. Costa, L. O. P., Maher, C. G., Latimer, J., & Smeets, R. J. E. M. (2009). *Reproducibility of Rehabilitative Ultrasound Imaging for the Measurement of Abdominal Muscle Activity: A Systematic Review*. *Physical Therapy*, 89(8), 756–769. doi:10.2522/ptj.20080331
41. Ptaszkowski K, Paprocka-Borowicz M, Slupska L, Bartnicki J, Dymarek R, Rosinczuk J, et al. Assessment of bioelectrical activity of synergistic muscles during pelvic floor muscles activation in postmenopausal women with and without stress urinary incontinence: a preliminary observational study. *ClinInterv Aging* [Internet]. 2015 Sep;15:21.
42. Sapsford RR, Hodges PW. Contraction of the pelvic floor muscles during abdominal maneuvers. *Arch Phys Med Rehabil* 2001;82(8):1081-8.
43. Neumann P, Gill V. Pelvic floor and abdominal muscle interaction: EMG activity and intra-abdominal pressure. *Int Urogynecol J* 2002;13:125-32.
44. Pereira LC, Botelho S, Marques J, Amorim CF, Lanza AH, Palma P, Riccetto C. Are transversus abdominis/oblique internal and pelvic floor muscles coactivated during pregnancy and postpartum? *Neurourol Urodyn* 2013;32(5):416-419.
45. Sapsford R, Hodges PW, Richardson CA, Cooper HD, Markwell SJ, Jull GA. Co-activation of the abdominal and pelvic floor muscles during voluntary exercises. *Neurourol Urodyn* 2001;20(1):31-42.
46. Coldron, Y., Stokes, M. J., Newham, D. J., & Cook, K. (2008). *Postpartum characteristics of rectus abdominis on ultrasound imaging*. *Manual Therapy*, 13(2), 112–121. Doi:10.1016/j.math.2006.10.001
47. Baran, E., Akbayrak, T., Özgül, S., Nakip, G., Çınar, G. N., Üzelpasacı, E., ... Beksaç, M. S. (2021). *Musculoskeletal and anthropometric factors associated with urinary incontinence in pregnancy*. *Physiotherapy Theory and Practice*, 1–10. Doi:10.1080/09593985.2021.1878568
48. Barbosa, L., Boaviagem, A., Moretti, E., & Lemos, A. (2018). *Multiparity, age and overweight/obesity as risk factors for urinary incontinence in pregnancy:a systematic review and meta-analysis*. *International Urogynecology Journal*. Doi:10.1007/s00192-018-3656-9
49. Herbert J. Pregnancy and childbirth: the effects on pelvic floor muscles. *Nurs Times* [Internet]. 105(7):38–41.
50. Kudish BI, Iglesia CB, Sokol RJ, Cochrane B, Richter HE, Larson J, et al. Effect of Weight Change on Natural History of Pelvic Organ Prolapse. *ObstetGynecol* [Internet]. 2009 Jan;113(1):818.
51. Greer WJ, Richter HE, Bartolucci AA, Burgio KL. Obesity and Pelvic Floor Disorders. *Obstet Gynecol* [Internet]. 2008 Aug;112(2, Part 1):341–9
52. Stothers L, Friedman B. Risk Factors for the Development of Stress Urinary Incontinence in Women. *Curr Urol Rep* [Internet]. 2011 Oct 22;12(5):363–9
53. Luber KM. The definition, prevalence, and risk factors for stress urinary Incontinence. *Rev Urol* 2004; 6 Suppl 3: S3-9
54. Hilde, G., & Bo, K. (2015). *The Pelvic Floor During Pregnancy and after Childbirth, and the Effect of Pelvic Floor Muscle Training on Urinary Incontinence - A Literature Review*. *Current Women s Health Reviews*, 11(1), 19–30. doi:10.2174/157340481101150914201
55. Menezes GMD, Pinto FJM, Silva FAA, Castro ME, Medeiros CRB. Queixa de perda urinária: um problema silente pelas mulheres. *Rev Gaúcha Enferm.*, Porto Alegre (RS) 2012 mar;33(1):100-8.

56. Tamanini JTN, Tamanini MMM, Maud LMQ, Auler, AMBAP. Incontinência urinária: prevalência e fatores de risco em mulheres atendidas no programa de prevenção do câncer ginecológico. *Bol Epidemiol Paul.* 2006;3(34):17-23.