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**ANÁLISE DA ATIVIDADE ELETROMIOGRÁFICA DA INTERAÇÃO
DOS MÚSCULOS DO ASSOALHO PÉLVICO E RETO
ABDOMINAL DE GESTANTES COM DIABETES MELLITUS
GESTACIONAL E INCONTINÊNCIA URINÁRIA ESPECÍFICA DA
GESTAÇÃO**

*Electromyographic Analysis of the Interaction of Pelvic Floor and Rectus
Abdominal Muscles in Pregnant Women with Gestational Diabetes Mellitus
and Pregnancy-Specific Urinary Incontinence*

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Músculos do Assoalho Pélvico e Reto Abdominal de Gestantes
com Diabetes Mellitus Gestacional e Incontinência Urinária
Específica da Gestação**

Tese apresentada ao Programa de Pós-Graduação em
Tocoginecologia para obtenção do título de Doutor em Medicina.

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Epígrafe

“Não ter medo de experimentar coisas novas. Por mais que você conheça muito, você ainda não conhece quase nada. O mundo é absurdamente imenso, as possibilidades são infinitas. Ficar preso apenas ao que já se conhece é fechar-se para a maravilhosa imprevisibilidade da vida”.

Fernanda Young

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Português e Inglês

Lista de abreviaturas em português

CEP	Comitê de Ética em Pesquisa
CIDPN	Centro de Investigação do Diabete Perinatal
DM	diabetes mellitus
DMAP	disfunção muscular do assoalho pélvico
DMG	<i>diabetes mellitus</i> gestacional
FAPESP	Fundação de Amparo à Pesquisa do Estado de São Paulo
FFC	Faculdade de Filosofia e Ciências
FMB	Faculdade de Medicina de Botucatu
GJ	glicemia de jejum
IU	incontinência urinária
IUEG	incontinência urinária específica da gestação
MAP	músculos do assoalho pélvico
MGH	miopatia hiperglicêmica gestacional
MLA	músculo levantador do ânus
MRA	músculos reto abdominais
TOTG	teste oral de tolerância à glicose
UNESP	Universidade Estadual Paulista

Lista de abreviações em Inglês

ADA	American Diabetes Association
BMI	body mass index
DM	diabetes mellitus
EMG	eletromyography
GDM	Gestational Diabetes Mellitus
ICS	International Continence Society
IUGA	International Urogynecological Association
OGTT	glucose tolerance test
PDRC	Perinatal Diabetes Research Center
PFM	pelvic floor muscles
PFMD	pelvic floor muscle dysfunction
PSUI	pregnancy-specific urinary incontinence
SUI	stress urinary incontinence
UI	urinary incontinence

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Seção 1

Trajectoria Acadêmica

Em 2012 ingressei como aluna de graduação no curso de fisioterapia na Unesp, no campus de Marília, onde me formei em 2015.

Em 2014 fui bolsista de iniciação científica do trabalho intitulado: "Efetividade da eletroestimulação transcutânea do nervo tibial posterior unilateral e bilateral como propostas de intervenção fisioterapêutica da incontinência urinária por urgência", sob orientação da professora Dra. Angélica Barbosa, que por sua vez tornou-se meu trabalho de conclusão de curso.

Em 2015 comecei a participar das reuniões do grupo de pesquisa e considero que foi essencial para o início da minha jornada acadêmica. Fazer parte de um grupo de estudos com tantos anseios em relação à pesquisa abriu meus horizontes para um olhar na perspectiva científica. Em 2016 me mudei para Botucatu e iniciei como aluna regular no programa de pós-graduação nível mestrado.

Fui orientada pela Prof.^a Emérita Marilza Rudge e coorientada pela Prof.^a Dra. Angélica Barbosa, e em 2018 obtive o título de Mestre em Ginecologia, Obstetrícia e Mastologia, com a dissertação intitulada: "Resposta Sexual entre Gestantes Hiperglicêmicas e Normoglicêmicas". Tal titulação foi obtida junto ao Programa de Pós-Graduação em Ginecologia, Obstetrícia e Mastologia, atualmente denominado Programa de Pós-Graduação em Tocoginecologia (FMB - Unesp).

Nesses anos adquiri muita experiência. Participei de *workshops* e capacitações de Eletromiografia e Ultrassonografia do assoalho pélvico. Integrei-me à rotina de coleta hospitalar nos ambulatórios, enfermarias e laboratórios no Hospital das Clínicas na Faculdade de Medicina de Botucatu. Participei de congressos e obtive grandes conhecimentos científicos. E principalmente aprendi muito sobre trabalhar em uma equipe multidisciplinar com parceiros tão competentes.

Em 2018 iniciei o Doutorado com as atividades de pesquisa financiadas pelo Projeto Temático Fapesp 2016/01743-5 DIAMATER, "*The Diamater Study Group*", nas quais tive o prazer de trabalhar com equipe multidisciplinar e totalmente dedicada a pesquisa. Iniciei o doutorado tendo a Prof.^a Titular Marilza Rudge como orientadora e em 2020 transferimos a orientação para Prof.^a Dra. Angélica Barbosa, que foi credenciada no programa como professora

permanente. Ao longo desses 4 anos tenho dado seguimento ao meu projeto e tive a oportunidade de participar de eventos nacionais e internacionais.

Em meados de 2019 fui convidada pelas Faculdades Integradas de Bauru (FIB) para ser docente no curso de Fisioterapia responsável pela disciplina e estágio curricular de Fisioterapia em Uroginecologia, Obstetrícia e Mastologia. Desde então venho adquirindo muita experiência e obtendo aprendizados na área da fisioterapia e na docência, bem como na orientação de trabalhos de conclusão de curso.

Foi possível colaborar e ser autora de 9 artigos em periódicos (Anexo 3) de alto impacto. Colaborei em 10 resumos apresentados e publicados em anais de congressos (Anexo 4). Orientei 7 Trabalhos de Conclusão de Curso (TCC) no curso de Fisioterapia das Faculdades Integradas de Bauru (Anexo 5) e participei como membro de 12 bancas examinadoras de TCCs (Anexo 6), de graduandas do curso de Fisioterapia da FFC – Unesp / Marília e das Faculdades Integradas de Bauru.

Agradeço imensamente minha querida amiga e orientadora Prof.^a Dra. Angélica Barbosa que contribuiu com a minha trajetória acadêmica até aqui. Os desafios foram muitos, mas o crescimento profissional e pessoal muito maior. Sinto que esta é mais uma etapa concluída de uma longa caminhada, me sinto realizada pelos objetivos alcançados e por todo o amadurecimento pessoal e profissional que obtive até aqui.

Seção 2

Contextualização

Avanços do conhecimento sobre o impacto do *Diabetes Mellitus Gestacional* nos Músculos do Assoalho Pélvico e Abdominais

Investigações sobre a tríade *Diabetes Mellitus Gestacional* (DMG), miopatia diabética e incontinência urinária e seus biomarcadores, são realizadas pelo *Grupo de pesquisa Diabete e Gravidez: Clínico e experimental*, desde 2006. O DMG, definido como hiperglicemia identificada pela primeira vez na gravidez (1), mesmo tratado de acordo com padrões internacionais da *American Diabetes Association* (1) institucionalizado no Centro de Investigação do Diabete Perinatal (CIDPN) não foi suficiente para evitar o efeito deletério da hiperglicemia gestacional controlada sobre a Incontinência Urinária Específica da Gestação (IUEG) e disfunção muscular do assoalho pélvico (DMAP) (2). A procura de marcadores dessa miopatia caracteriza o Projeto Temático (2016/01743-5). O *Conceptual Model* (Figura 1) (3), estabelecido da integração entre DMG, IUEG e miopatia hiperglicêmica tem a funcionalidade dos músculos do assoalho pélvico (MAP) e músculos reto abdominais (MRA) como variáveis moderadoras e precisa ser investigado (Figura 2).

Modelo Conceitual Integrado do Diabater

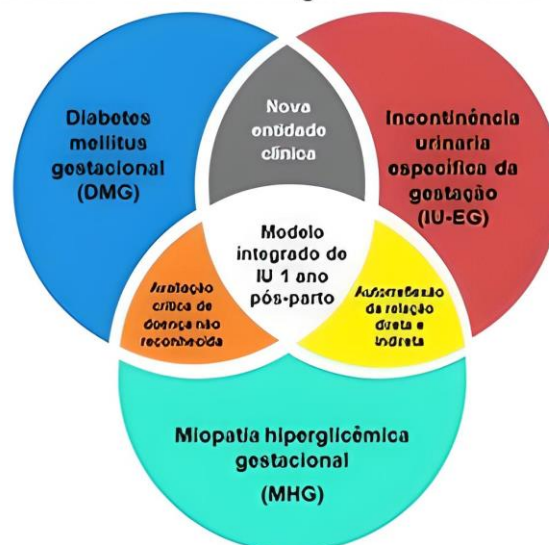


Figure 1 - Modelo conceitual do papel da integração entre DMG, IUEG e MRA-MAP miopatia como nova tríade na determinação da prevalência de IU e DMAP a longo prazo (3).

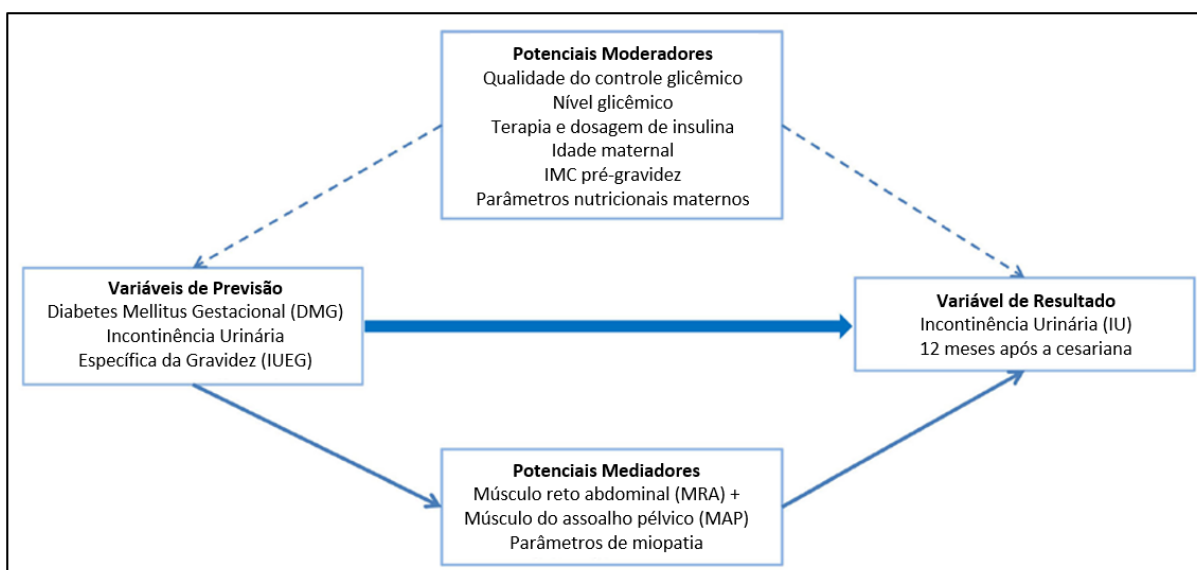


Figura 2 – Variáveis Predictoras, Moderadoras, Mediadoras e de Desfecho (3).

O DMG está associado a repercussões maternas, fetais, neonatais e perinatais negativas com maior frequência, quando comparado à gestação normoglicêmica (4). Sua incidência oscila entre 3 e 7%, e é a complicação médica de maior ocorrência na gestação (5). O DMG mostrou-se relacionado à deterioração da função muscular fisiológica (6), o que denota a existência de conexão entre o metabolismo e a função mecânica dos músculos (7).

Resultados do CIDPN confirmaram prevalência aumentada da DMAP nas gestantes com DMG (8,9) e dois anos após a cesárea, definindo clara associação entre DMG e DMAP (2,10,11). Na mesma linha, a pesquisa translacional, usando modelos de hiperglicemia leve (induzida ao nascimento) e severa (induzida na prenhez) em ratas *Wistar*, evidenciou interação entre hiperglicemia e alterações morfológicas e estruturais da musculatura estriada periuretral e reto abdominal (12–15).

Os estudos com modelo animal reforçam o achado clínico de alterações musculares, demonstrando que ratas prenhes com diabetes moderado (glicemia entre 120 e 300mg/dl) apresentam alterações similares ao diabetes grave (14) na matriz extracelular e no músculo estriado uretral, como: atrofia, adelgaçamento, aumento de colágeno na área de músculo estriado, aumento de vasos, acúmulo de mitocôndrias, além de gotas de lipídios e grânulos de glicogênio presentes em grande quantidade, alteração na distribuição de fibras rápidas e lentas, diminuição de fibras rápidas e a presença de fibrose/deposição de fibras de colágeno, associados com atrofia muscular(13,16). Isto trouxe reflexões sobre potenciais implicações clínicas e respectivas estratégias terapêuticas na atenção à saúde dessas mulheres.

Estes resultados clínicos e experimentais demonstraram relação do binômio DMG e MAP. Os MAP representam elemento crítico de ação na manutenção dos órgãos pélvicos como bexiga, útero e junção uretrovesical no mecanismo de fechamento esfinteriano uretral e anal e na mobilidade do canal vaginal (17–23) e consequente boa qualidade de vida relacionada a estes aspectos (17,19–21).

A contração coordenada e eficaz dos MAP (24) está relacionada à manutenção das funções de micção, evacuação e sexualidade. Por outro lado, MAP disfuncionais podem resultar em sintomas como micção ou defecação prejudicada, dor pélvica e disfunção sexual (25). Além disso, a adequada distensibilidade dos MAP pode favorecer o parto e provavelmente reduzir a incidência de lesões dos músculos elevadores do ânus (26).

A integridade dos MAP pode sofrer alterações tanto anatômicas quanto anatômicas e fisiológicas, nas diferentes fases da vida da mulher, associadas

com obesidade e menopausa, mas especificamente na gestação e parto, sendo mais evidentes na gestação complicada pelo diabetes (2,11,27–29). Mecanicamente, as causas da DMAP tem duas vertentes, alargamento do hiato do levantador e descida do assoalho pélvico abaixo da linha pubococcigeal, sendo a consequência mais comum a incontinência urinária (IU) (30).

Resultados clínicos da avaliação dos MAP provenientes do Diamater demonstraram que na evolução da gestação entre 24-30 e 36-40 semanas, avaliada pela eletromiografia, que houve diminuição do recrutamento dos MAP no grupo DMG com diminuição da atividade elétrica em repouso ($p=0,042$) e na contração tônica ($p=0,044$), quando comparadas com o grupo não-DMG (8). Estudos que avaliaram a morfologia e a funcionalidade dos MAP pela ultrassonografia tridimensional (US-3D) (31) demonstraram, em avaliação realizada no mesmo intervalo gestacional, que as medidas biométricas da morfologia foram diferentes em repouso para o grupo com DMG em relação ao grupo sem DMG, e também que havia alteração na funcionalidade, com menor contratilidade, distensibilidade e mobilidade (32).

Com base nesses fatos, a avaliação da funcionalidade dos MAP é recomendada pela *International Continence Society* (ICS) e *International Urogynecological Association* (IUGA) (33), e pode ser realizada por diversos métodos, incluindo a eletromiografia superficial (EMG) perineal (34). O mais importante é que a avaliação dos MAP deve incluir a avaliação da função dos MAP tanto em repouso quanto durante atividades dinâmicas como na contração (35).

A relação funcional entre os MAP e músculos abdominais foi primeiramente descrita por Sapsford e colaboradores (36), que justificaram a

relação funcional entre estes músculos devido o posicionamento das fibras. Assim, visando o melhor desempenho destes músculos frente às funções uroginecológicas, parece ser necessário que sua atuação ocorra de forma conjunta e coordenada de modo que, durante a contração dos MAP, ocorra também a contração dos músculos abdominais (37) e vice-versa. Esta atuação conjunta denomina-se co-contração sinérgica (33), uma vez que a contração simultânea desses músculos parece potencializar a atividade motora de ambos resultando na manutenção, coordenação, suporte e força dos MAP (36–39), reiterando que a importância da musculatura abdominal para a continência urinária (40).

De forma semelhante, durante situações de aumento da pressão intra-abdominal, faz-se necessário que ocorra interação entre os músculos abdominais e os MAP, dissipando a pressão dentro do recinto abdominal. Os MAP, por sua vez, também devem contrair sinergicamente com a musculatura do tronco. Com a incoordenação destes músculos, ocorre aumento da atividade muscular dos músculos da parede abdominal superior, o que faz com que as vísceras sejam empurradas contra o assoalho pélvico. Assim, durante o aumento da pressão intra-abdominal, a insuficiência dos MAP somada à hiperativação da parede abdominal superior, predispõe às disfunções pélvicas (41).

A contração sinérgica tem sido observada em mulheres assintomáticas (42,43). Em contrapartida, ainda não existe consenso na literatura se mulheres com Incontinência Urinária (IU) apresentam ou não resposta sincrônica dos MAP e dos músculos abdominais.

O artigo *“Negative impact of gestational diabetes mellitus on progress of pelvic floor muscle electromyography activity: Cohort study.”* avaliou os músculos

do assoalho pélvico por meio da eletromiografia dos MAP. Este estudo demonstra que houve diminuição progressiva do recrutamento muscular entre o segundo e terceiro trimestre relacionados as contrações sustentadas por 10 segundos e que o nível de atividade basal dos MAP também diminuíram entre momentos no grupo com DMG (8).

A partir dos conhecimentos prévios experimentais e clínicos, que indicam o comprometimento dos MAP durante a gestação complicada pelo DMG, os resultados que serão apresentados direcionarão o entendimento do processo de comprometimento funcional dos MAP do segundo e terceiro trimestre gestacional até 18-24 meses pós-parto. É amplamente difundido que o treino muscular do assoalho pélvico é efetivo para tratamento e prevenção da IUEG, no entanto, faltam estudos básicos de fisiopatologia que empreguem métodos objetivos que possam delinear o comportamento dos MAP ao longo da gestação e seu processo de recuperação no pós-parto, uma vez que sua função tem ligação com a presença ou ausência de disfunções, como a IU (2,11,44). Na literatura há lacuna no conhecimento em relação a gestação sem comorbidades em relação a função dos MAP ao longo da gestação e no seguimento após o parto. Nos grupos com DMG o assunto é inédito considerando a análise dos MAP por EMG ao longo da gestação e no seguimento após o parto.

Até o momento, nenhum estudo foi encontrado que demonstram proposta para avaliar o desempenho dos MAP de gestantes com DMG. Nesse contexto, analisar o desempenho dos MAP com resultados eletromiográficos confiáveis, objetivos e visíveis é um método eficaz para orientar a prática clínica e científica na avaliação e nos cuidados preventivos e terapêuticos.

Esta tese de doutorado é um dos subprojetos da coorte DIAMATER que

está em desenvolvimento desde 2016, na busca da consolidação da tríade DMG-IUEG-MHG e sua potencial associação com a IU pós-parto. Como outros subprojetos, tem como base o “*Integrated Diamater Conceptual Model*”

Portanto, o objetivo deste trabalho foi avaliar a interação dos músculos do assoalho pélvico e reto abdominal com a eletromiografia de gestantes com diabetes mellitus gestacional e incontinência urinária específica da gestação.

A partir dos resultados deste estudo pretende-se estabelecer ações de rotina de diagnóstico, prevenção e de tratamento das alterações do mecanismo de ação dos MAP e MRA de gestantes com IUEG. Embasado na literatura e em dados de pesquisas prévias, acredita-se encontrar alterações funcionais entre MAP e MRA nos grupos com DMG e com IUEG.

Espera-se que os resultados obtidos nesta pesquisa auxiliem a prática clínica, ampliando as áreas de investigação e de intervenção, contribuindo na saúde da gestante com DMG e com IUEG. Será possível divulgar os resultados deste estudo com apresentação de trabalhos em eventos e periódicos de relevância científica, destacando, nacional e internacionalmente, a UNESP.

Diante de todos os impactos e circunstâncias que a IU pode ocasionar na vida da mulher, os estudos comprovam a necessidade de a qualidade de vida ser considerada como parâmetro primordial da avaliação, no qual as ações dos profissionais de saúde durante o planejamento e orientação do tratamento serão centralizadas, revelando-se essenciais para o processo de recuperação. Logo, esses profissionais devem priorizar desenvolver uma assistência focada na promoção da saúde e em processos terapêuticos, com intuito de interferir na redução das repercussões negativas e suas complicações, bem como melhor direcionar a prática clínica nos serviços de saúde.

Os resultados obtidos nesta Tese estão apresentados em 2 artigos de acordo o respectivo objetivo:

1 - *Development and Validation of the Pregnancy-Specific Urinary Incontinence Questionnaire (PSUI-Q) in Brazilian population*

2- *Pelvic Floor and Abdominal Muscles Electromyographic Characteristics of Co-activation in Women with Gestational Diabetes Mellitus and Pregnancy-specific Urinary Incontinence*

Referências

1. ADA. Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes—2020. *Diabetes Care*. 2020 Jan;43(Supplement 1):S14–31.
2. Barbosa AMP, Dias A, Marini G, Calderon IMP, Witkin S, Rudge MVC. Urinary incontinence and vaginal squeeze pressure two years post-cesarean delivery in primiparous women with previous gestational diabetes mellitus. *Clinics (Sao Paulo) [Internet]*. 2011;66(8):1341–6. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/21915481>
3. 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. Available from: <https://bmcpregnancychildbirth.biomedcentral.com/articles/10.1186/s12884-020-2749-x>
4. Montenegro Jr RM, Paccola GMFG, Faria CM, Sales APM, Montenegro APDR, Jorge SM, et al. Evolução materno-fetal de gestantes diabéticas seguidas no HC-FMRP-USP no período de 1992-1999. *Arq Bras Endocrinol Metabol [Internet]*. 2001 Oct;45(5):467–74. Available from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0004-27302001000500010&lng=pt&tlng=pt
5. Katz L, Amorim M, Coutinho I, Santos LC. Análise Comparativa de Testes Diagnósticos para Diabete Gestacional. *Rev Bras Ginecol e Obs [Internet]*. 2002 Sep;24(8). Available from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0100-72032002000800005&lng=pt&nrm=iso&tlng=pt
6. Sayer AA, Dennison EM, Syddall HE, Gilbody HJ, Phillips DIW, Cooper C. Type 2 diabetes, muscle strength, and impaired physical function: The tip of the iceberg? *Diabetes Care*. 2005 Oct;28(10):2541–2.
7. Helander I, Westerblad H, Katz A. Effects of glucose on contractile function, $[Ca^{2+}]_i$, and glycogen in isolated mouse skeletal muscle. *Am J Physiol Physiol [Internet]*. 2002 Jun 1;282(6):C1306–12. Available from: <https://www.physiology.org/doi/10.1152/ajpcell.00490.2001>
8. Prudencio CB, Rudge MVC, Pinheiro FA, Sartorão Filho CI, Nunes SK, Pedroni CR, et al. Negative impact of gestational diabetes mellitus on progress of pelvic floor muscle electromyography activity: Cohort study. Palatnik A, editor. *PLoS One*. 2019 Nov;14(11):e0223261.
9. Sartorão Filho CI, Pinheiro FA, Prudencio CB, Nunes SK, Takano L, Enriquez EMA, et al. Impact of gestational diabetes on pelvic floor: A prospective cohort study with three-dimensional ultrasound during two-time points in pregnancy. *Neurourol Urodyn*. 2020 Aug;nau.24491.
10. Barbosa AMP, Carvalho LR de, Martins AMV de C, Calderon I de MP, Rudge MVC. Efeito da via de parto sobre a força muscular do assoalho pélvico. *Rev Bras Ginecol e Obs*. 2005 Nov;27(11).
11. Barbosa AMP. Prevalência e fator de risco para incontinência urinária e disfunção do assoalho pélvico dois anos após Diabete Melito gestacional. *Rev Bras Ginecol e Obs*. 2007 Apr;29(4):220–220.
12. Marini G, Pascon Barbosa AM, Damasceno DC, Michelin Matheus SM, De Aquino Castro R, Castello Girão MJB, et al. Morphological changes in the

- fast vs slow fiber profiles of the urethras of diabetic pregnant rats. *Urogynaecologia*. 2011 Nov;25(1):9.
13. Piculo F, Marini G, Barbosa AMP, Damasceno DC, Matheus SMM, Felisbino SL, et al. Urethral striated muscle and extracellular matrix morphological characteristics among mildly diabetic pregnant rats: translational approach. *Int Urogynecol J* [Internet]. 2014 Mar 17;25(3):403–15. Available from: <http://link.springer.com/10.1007/s00192-013-2218-4>
 14. Marini G, Piculo F, Vesentini G, Barbosa AMP, Damasceno DC, Matheus SMM, et al. Effects of short-term severe and long-term mild STZ-induced diabetes in urethral tissue of female rats. *Neurourol Urodyn* [Internet]. 2017 Mar;36(3):574–9. Available from: <http://doi.wiley.com/10.1002/nau.22974>
 15. Marini G, Piculo F, Vesentini G, Damasceno DC, Delella FK, Calderon IMP, et al. The influence of hyperglycemia on the remodeling of urethral connective tissue in pregnant rats. *Eur J Obstet Gynecol Reprod Biol*. 2018 Feb;221:81–8.
 16. Vieira M, Rudge C, Piculo F, Marini G, Damasceno DC, Mattos I, et al. Pesquisa translacional em diabetes melito gestacional e hiperglicemia gestacional leve: conhecimento atual e nossa experiência. *Arq Bras Endocrinol Metab*. 2013;57(7).
 17. DeLancey JO, Starr RA. Histology of the connection between the vagina and levator ani muscles. Implications for urinary tract function. *J Reprod Med*. 1990 Aug;35(8):765–71.
 18. HANDA V, HARRIS T, OSTERGARD D. Protecting the pelvic floor: obstetric management to prevent incontinence and pelvic organ prolapse. *Obstet Gynecol*. 1996 Sep;88(3):470–8.
 19. Sarkar PK, Ritch AES. Management of urinary incontinence. Vol. 25, *Journal of Clinical Pharmacy and Therapeutics*. J Clin Pharm Ther; 2000. p. 251–63.
 20. Martins G, Soler ZASG, Cordeiro JA, Amaro JL, Moore KN. Prevalence and risk factors for urinary incontinence in healthy pregnant Brazilian women. *Int Urogynecol J*. 2010 Oct;21(10):1271–7.
 21. Henscher. *Fisioterapia em ginecologia*. 2007;
 22. Auge AFP, Carramão S. Prolapso de órgãos pélvicos. In: Piatto S. In: *Ginecologia diagnóstico e tratamento*. 2008. p. 81–90.
 23. Lopes MHBM HR. Restrições causadas pela incontinência urinária à vida da mulher. *Rev Esc Enferm*. 2006;
 24. 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*. 1990;9(5):479–87.
 25. Betschart C, Kim J, Miller JM, Ashton-Miller JA, DeLancey JOL. Comparison of muscle fiber directions between different levator ani muscle subdivisions: In vivo MRI measurements in women. *Int Urogynecol J Pelvic Floor Dysfunct*. 2014 Sep;25(9):1263–8.
 26. Guzmán Rojas R, Wong V, Shek KL, Dietz HP. Impact of levator trauma on pelvic floor muscle function. *Int Urogynecol J*. 2014 Mar;25(3):375–80.
 27. Nygaard IE, Thompson FL, Svengaus SL, Albright JP. Urinary incontinence in elite nulliparous athletes. *Obstet Gynecol*. 1994 Apr;84(2):183–7.
 28. Bø K, Borgen JS. Prevalence of stress and urge urinary incontinence in

- elite athletes and controls. *Med Sci Sports Exerc.* 2001 Nov;33(11):1797–802.
29. de Oliveira FP, Bosi MLM, dos Santos Vigário P, da Silva Vieira R. Comportamento alimentar e imagem corporal em atletas. *Rev Bras Med do Esporte.* 2003 Nov;9(6):357–64.
 30. Boyadzhyan L, Raman SS, Raz S. Role of static and dynamic MR imaging in surgical pelvic floor dysfunction. *Radiographics.* 2008 Mar;28(4):949–67.
 31. Sartorão Filho CI, Pinheiro FA, Prudencio CB, Nunes SK, Takano L, Enriquez EMA, et al. Impact of gestational diabetes on pelvic floor: A prospective cohort study with three-dimensional ultrasound during two-time points in pregnancy. *Neurourol Urodyn.* 2020 Nov;39(8):2329–37.
 32. Pinheiro F. Ultrassonografia tridimensional da funcionalidade dos músculos do assoalho pélvico de gestantes com diabete melito gestacional. Diss - Univ Estadual Paul Júlio Mesquita Filho, Fac Med Botucatu. 2017;
 33. 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 Feb;36(2):221–44.
 34. Vassimon FIA, Ferreira CHJ, Martins WP, Ferriani RA, de Andrade Batista RL, Bo K. Surface electromyography and ultrasound evaluation of pelvic floor muscles in hyperandrogenic women. *Int Urogynecol J* [Internet]. 2016 Apr 17;27(4):587–91. Available from: <http://link.springer.com/10.1007/s00192-015-2865-8>
 35. Baessler K, Metz M, Junginger B. Valsalva versus straining: There is a distinct difference in resulting bladder neck and puborectalis muscle position. *Neurourol Urodyn.* 2017 Sep;36(7):1860–6.
 36. Sapsford RR, Hodges PW, Richardson CA, Cooper DH, Markwell SJ, Jull GA. Co-activation of the abdominal and pelvic floor muscles during voluntary exercises. *Neurourol Urodyn* [Internet]. 2001;20(1):31–42. Available from: [https://onlinelibrary.wiley.com/doi/10.1002/1520-6777\(2001\)20:1%3C31::AID-NAU5%3E3.0.CO;2-P](https://onlinelibrary.wiley.com/doi/10.1002/1520-6777(2001)20:1%3C31::AID-NAU5%3E3.0.CO;2-P)
 37. Neumann P, Gill V. Pelvic Floor and Abdominal Muscle Interaction: EMG Activity and Intra-abdominal Pressure. *Int Urogynecol J* [Internet]. 2002 Apr 18;13(2):125–32. Available from: <http://link.springer.com/10.1007/s001920200027>
 38. Pauleta JR, Pereira NM GL. Sexuality during pregnancy. *J Sex Med.* 2010;
 39. Pereira LC, Botelho S, Marques J, Amorim CF, Lanza AH, Palma P, et al. Are transversus abdominis/oblique internal and pelvic floor muscles coactivated during pregnancy and postpartum? *Neurourol Urodyn* [Internet]. 2013 Jun;32(5):416–9. Available from: <https://onlinelibrary.wiley.com/doi/10.1002/nau.22315>
 40. Ptazkowski 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. Available from: <https://www.dovepress.com/assessment-of-bioelectrical-activity-of-synergistic-muscles-during-pel-peer-reviewed-article-CIA>

41. Sapsford R. Rehabilitation of pelvic floor muscles utilizing trunk stabilization. *Man Ther* [Internet]. 2004 Feb;9(1):3–12. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S1356689X03001310>
42. 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* [Internet]. 2019 Nov 19;74. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6862713/>
43. 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 em Mov* [Internet]. 2016 Jun;29(2):399–410. Available from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-51502016000200399&lng=en&tlng=en
44. Van Geelen H, Ostergard D, Sand P. A review of the impact of pregnancy and childbirth on pelvic floor function as assessed by objective measurement techniques. Vol. 29, *International Urogynecology Journal*. Springer London; 2018. p. 327–38.



Seção 3

Resumos Expandidos

Exame Geral de Qualificação

Resumo da Tese

Nunes, S. K. Análise da Atividade Eletromiográfica da Interação dos Músculos do Assoalho Pélvico e Reto Abdominal de Gestantes com Diabetes Mellitus Gestacional e Incontinência Urinária Específica da Gestação. 2022. Defesa para obtenção de título (Doutorado) – Faculdade de Medicina de Botucatu, Universidade Estadual Paulista, Brasil.

Introdução: Pesquisas clínicas identificaram que mulheres diabéticas gestacionais apresentam inter-relação entre a Incontinência Urinária (IU) gestacional e Disfunção Muscular do Assoalho Pélvico (DMAP). Os músculos do assoalho pélvico (MAP) representam elemento crítico na sustentação dos órgãos pélvicos, fornecendo suporte ativo tanto em repouso quanto durante a atividade. Os resultados das pesquisas experimentais originadas desse resultado clínico evidenciaram alterações nos músculos estriados uretrais e músculo reto abdominal (MRA) de ratas diabéticas prenhes que mostrou atrofia muscular com desorganização e rompimento de fibras, alteração na organização dos tipos de fibras *slow* e *fast* (Tipo I e II), com aumento das fibras *fast*, fibrose e aumento do colágeno I/III que caracterizam matriz extracelular rígida. Estes achados corroboram os da literatura sobre o fato da integridade da estrutura dos músculos abdominais e do assoalho pélvico sofrer alterações nas diferentes fases da vida da mulher, particularmente na gestação e parto, sendo que a gestação complicada pelo diabetes pode ter alterações ainda mais evidentes, causando impacto negativo na qualidade de vida. A contração coordenada e eficaz dos MAP está relacionada à manutenção das funções de micção, evacuação e sexualidade. A DMAP é distúrbio que afeta a capacidade de controlar e coordenar os MAP, está associada à incontinência urinária de esforço, síndrome da bexiga hiperativa, prolapso de órgão pélvico, incontinência anal, dor pélvica, disfunção sexual e constipação, resultando em impacto negativo na qualidade de vida. A IU também está associada a um padrão de ativação alterado dos MAP em relação aos músculos abdominais durante as atividades funcionais incluindo as atividades que geram aumento da pressão intra-abdominal (PIAb). Achados provenientes de nossas pesquisas associam o *Diabetes Mellitus Gestacional* (DMG) com a DMAP. O DMG é definido como distúrbio de tolerância à glicose com início durante a gravidez, relacionado com a deterioração da função

muscular fisiológica e associado ao termo "miopatia diabética", que se refere a alterações funcionais, metabólicas e estruturais que são induzidas pelo *diabetes mellitus* (DM) no músculo esquelético. Tendo em vista a importante repercussão negativa da incontinência urinária específica da gestação (IUEG) e este seja um distúrbio amplamente investigado, não existe na literatura nacional e internacional instrumento construído e validado para identificar e avaliar especificamente a IUEG, demonstrando ser necessária a construção e validação de um questionário inédito para identificar e avaliar a IUEG na população brasileira. Estudos clínicos demonstraram que o DMG impacta negativamente na atividade eletromiográfica dos MAP ao longo da gestação. Lesão que acomete o músculo reto abdominal durante a gestação também foi relacionada ao DMG. Estudos translacionais mostraram impactos prejudiciais tanto de hiperglicemia leve de longo prazo quanto de hiperglicemia severa de curto prazo no músculo uretral de ratas prenhes, como: atrofia, adelgaçamento, desorganização, ruptura das fibras musculares e perda de tipos específicos de fibras de localizações anatômicas normais, denotando conexão entre os níveis de glicemia e estrutura do MAP. Recentemente, protocolo de estudo clínico estabeleceu pesquisa de biomarcador bem desenvolvida em novo modelo conceitual do papel da integração da tríade DMG, IUEG e miopatia hiperglicêmica como preditora de IU de longo prazo e DMAP. A avaliação do desempenho dos MAP por meio da Eletromiografia de superfície (EMG) é capaz de, além de analisar sua funcionalidade, também identifica o exato momento em que determinado músculo entra em ação, e assim verificar se há co-contração entre os músculos. A avaliação deve incluir o desempenho dos MAP em repouso e em atividades dinâmicas. O emprego da EMG, que é utilizada como forma de avaliação em trabalhos que analisaram a função dos MAP durante a gestação, é pertinente para analisar o *status* muscular, pois é possível obter dados como o recrutamento de unidades motoras, velocidade de condução das fibras musculares e a fadiga muscular, variáveis importantes para identificar com eficácia diversos aspectos do desempenho muscular da gestante. A técnica é de acesso fácil, sem radiação, com desconforto mínimo, tem boa confiabilidade inter-observador e interdisciplinar, além de permitir avaliação dinâmica.

Justificativa: Aprofundar e preencher lacunas do conhecimento sobre a repercussão do DMG e da miopatia hiperglicêmica a longo prazo torna-se

imprescindível. Nesse contexto, analisar o desempenho dos MAP com avaliações eletromiográficas confiáveis, objetivas, visíveis e em tempo real é método alternativo para orientar a prática clínica e científica nos cuidados preventivos e terapêuticos.

Objetivos: 1) Construção e validação de um instrumento para avaliação da incontinência urinária específica da gestação em mulheres brasileiras.

2) Analisar o efeito do DMG na funcionalidade dos MAP durante a gestação pela avaliação eletromiográfica.

Métodos: 1) Trata-se de estudo transversal realizado no Centro de Pesquisas em Diabetes Perinatal (CPDP) da Universidade Estadual Paulista (UNESP), Faculdade de Medicina de Botucatu, Brasil. A ferramenta de guia STROBE foi usada como guia para relatar este estudo. Os dados foram coletados entre março/2018 a dezembro/2021. Este estudo foi aprovado pelo Comitê de Ética em Pesquisa (CAAE 31976620.1.0000.5411). As gestantes foram recrutadas para participar do estudo durante a rotina de rastreio do DMG no CPDP. Os critérios de inclusão foram gestantes entre 18-40 anos de idade, normoglicêmicas e com DMG em tratamento não medicamentoso. Foram excluídas as participantes com DM tipo I ou II, uso de hipoglicemiantes, triagem ou diagnóstico inadequado de DMG, tratamento farmacológico após falha no controle da glicose com modificação do estilo de vida e dieta, doença do tecido conjuntivo, distúrbios neurológicos, prolapso de órgão pélvico ou cirurgia de incontinência, distúrbio hipertensivo gestacional ou pré-existente e incapacidade de realizar a sequência de contração dos MAP. O diagnóstico do DMG foi realizado de acordo com os critérios da *American Diabetes Association* (ADA) e quando confirmado estas participantes foram alocadas no grupo DMG. As participantes com resultado negativo foram alocadas no grupo normoglicêmico (NG). As participantes foram submetidas a aplicação do questionário e avaliação dos MAP pela EMG considerando a área dos levantadores do ânus. Todas as participantes forneceram consentimento informado previamente ao início da coleta de dados.

2) Este estudo foi aprovado pelo Comitê de Ética em Pesquisa (CAAE 82225617.0.0000.5411). O modelo foi proposto para avaliar o desempenho dos MAP em suas diferentes atividades por meio da EMG e desenhado com base na importância de incluir, além da medida de repouso inicial, as medidas de repouso

antes e depois de cada atividade realizada. Este conceito permitirá análise ampliada e detalhada do desempenho dos MAP e MRA entre os repousos, entre as atividades e repousos, bem como entre atividades semelhantes e/ou opostas.

Resultados: 1) Na primeira etapa foi feita uma revisão bibliográfica e análise de entrevistas qualitativas. Após a retirada de detalhes sugeridos pelos especialistas, obtiveram-se 14 itens como versão final do questionário.

A avaliação das propriedades psicométricas do instrumento foi feita em segundo lugar. Foram relatadas a análise das propriedades psicométricas do instrumento, incluindo validade de conteúdo, validade formal, validade de construto e confiabilidade (consistência interna).

2) Durante as contrações rápidas não houve diferenças na atividade eletromiográfica dos MAP entre os grupos. A ativação dos MAP superficiais das mulheres com DMG independente do status da continência urinária foram semelhantes, mas separadamente eles diferiram da ativação das mulheres do grupo normoglicêmico-incontinente (NG-IU) sendo assim, as mulheres do grupo diabético-continente (DMG-C) e diabético-incontinente (DMG-IU) ativaram 56,3% ($p=,000$) e 28,7% ($p=,047$) menos os MAP superficiais comparado com as NG-IU, respectivamente. Em relação a ativação sinérgica do MRA durante a tarefa de contração rápida do AP, a ativação do RA das mulheres com DMG independente do status da continência urinária foi semelhante, mas separadamente eles diferiram da ativação das mulheres do grupo NG-IU sendo assim, as mulheres DMG-C e as mulheres DMG-IU ativaram 39,1% ($p=,001$) e 34,8% ($p=,005$) menos o MRA comparado com as NG-IU, respectivamente.

Conclusão: 1) O PSUI-Q é uma escala baseada em conteúdo, que permite que clínicos ou pesquisadores não apenas caracterizem os níveis de sobrecarga emocional, social, financeiro, profissional e sexual experimentados por mulheres grávidas, mas também oferece uma compreensão mais personalizada da sua angústia durante esse período específico. Portanto, o PSUI-Q é uma medida valiosa que pode ser usada como base para os profissionais de saúde desenvolverem cuidados adequados para atender às necessidades individuais das mulheres. Compreender a sobrecarga da gestante deve ser um componente fundamental para o desenvolvimento de um pré-natal adequado para auxiliar a mulher no enfrentamento de sua situação, evitando as consequências adversas da carga emocional materna. O PSUI-Q desenvolvido com 14 itens foi

confirmado como tendo validade e confiabilidade satisfatórias.

2) Os resultados preliminares deste estudo indicam que mulheres que são DMG-C e DMG-IU ativam menos os MAP e RA quando comparadas com mulheres NG-C e NG-IU.

Palavras-Chaves: Assoalho pélvico; eletromiografia; *diabetes mellitus* gestacional; músculo do assoalho pélvico; gravidez; incontinência urinária; questionário.

Summary of Abstract

Nunes, S. K. Electromyographic Analysis of the Interaction of Pelvic Floor and Rectus Abdominal Muscles in Pregnant Women with Gestational Diabetes Mellitus and Pregnancy-Specific Urinary Incontinence. 2022. Doctorate - Botucatu Medical School (FMB), São Paulo State University (UNESP), Brazil.

Introduction: Clinical research has identified that women with gestational diabetes have an interrelationship between gestational urinary incontinence (UI) and pelvic floor muscular dysfunction (PFMD). The pelvic floor muscles (PFM) are critical to supporting the pelvic organs, providing active support both at rest and during activity. The experimental research from this clinical result showed altered striated urethral muscles and rectus abdominis muscle (RAM) in pregnant diabetic rats. Those had muscle atrophy with fiber disorganization and disruption, altered organization of slow and fast fiber types (type I and II), increased fast fibers and fibrosis as well collagen I/III, leading to a rigid extracellular matrix. These findings corroborate the literature on the integrity of the structure of the abdominal muscles and the pelvic floor changes throughout women's lives, particularly during pregnancy and childbirth. Besides, diabetes-complicated pregnancies may have even more evident changes, hurting the quality of life. The coordinated and effective contraction of PFM is related to the maintenance of urination, evacuation, and sexual functioning. PFMD is a disorder that affects the ability to control and coordinate PFM associated with stress urinary incontinence, overactive bladder syndrome, pelvic organ prolapses, anal incontinence, pelvic pain, and sexual dysfunction and constipation, thus negatively impacting the quality of life. UI is also associated with altered PFM activation patterns in abdominal muscles during functional activities, including those that increase intra-abdominal pressure (PIAb). Findings from our research associate gestational diabetes mellitus (GDM) with DMAP. GDM is defined as a glucose tolerance disorder with onset during pregnancy. It is related to physiological muscle function deterioration and associated with the term "diabetic myopathy," which refers to functional, metabolic, and structural changes that diabetes mellitus (DM) induces in the skeletal muscles. Given the strong negative impact of pregnancy-specific urinary incontinence (PSUI) and how it is a widely investigated disorder, no built, validated instruments exist in the national and

international literature to specifically identify and evaluate PSUI. That shows the need to develop and validate an unprecedented questionnaire to identify and assess the SUI in the Brazilian population. Clinical studies have shown that DMG negatively impacts the electromyographic activity of PFM throughout pregnancy. An injury affecting the rectus abdominis muscle during pregnancy was also related to GDM. Translational studies have shown harmful impacts of both mild long-term hyperglycemia and severe short-term hyperglycemia on the urethral muscle of pregnant rats. These include atrophy, thinning, disorganization, muscle fiber rupture, and loss of specific types of fibers from normal anatomical locations, denoting a connection between blood glucose levels and PFM structure. Recently, a clinical trial protocol established well-developed biomarker research in a new conceptual model of the role of integrating the triad GDM, PSUI, and hyperglycemic myopathy as a predictor of long-term UI and PFMD.

In addition to analyzing muscle functionality, PFM performance evaluation via electromyography (EMG) can identify the exact moment when a particular muscle acts and thus checks for co-contraction between the muscles. The assessment should include PFM performance at rest and in dynamic activities. Studies that analyze PFM function during pregnancy use EMG as an assessment. It is relevant to analyze muscle status as it can obtain data such as the recruitment of motor units, the conduction velocity of muscle fibers, and muscle fatigue, which are essential variables to efficiently identify different aspects of pregnant women's muscle performance. In addition, the technique is easily accessible, does not require radiation, has minimal discomfort and good inter-observer and interdisciplinary reliability, and allows dynamic evaluation.

Justification: Deepening and filling knowledge gaps about the long-term repercussion of GDM and hyperglycemic myopathy becomes essential. In this context, analyzing PFM performance with reliable, objective, visible, and real-time electromyographic assessments is an alternative method to guide clinical and scientific practice in preventive and therapeutic care.

Objectives: 1) To build and validate an instrument to assess pregnancy-specific urinary incontinence in Brazilian women.

2) To analyze the effect of DMG on PFM functionality during pregnancy via electromyographic assessment.

Methods: 1) This is a cross-sectional study performed at São Paulo State University's Botucatu Medical School's Research Center on Perinatal Diabetes (RCPD UNESP), Brazil. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guide tool was used as a guide to report this study. Data were collected between March 2018 and December 2021. This study was approved by the Research Ethics Committee (CAAE 31976620.1.0000.5411). The study recruited pregnant women to participate in the routine GDM screening at the RCPD. Inclusion criteria were pregnant women between 18-40 years of age who were normoglycemic and had GDM on a non-drug treatment. Participants with type I or II DM, using hypoglycemic agents, with inadequate screening or diagnosis of GDM, pharmacological treatment after failure of glucose control with lifestyle and diet modification, connective tissue disease, neurological disorders, and organ prolapse were excluded. GDM was diagnosed according to the American Diabetes Association (ADA) criteria, and when confirmed, these participants were allocated to the GDM group. Participants with a negative result were assigned to the normoglycemic (NG) group. The participants were submitted to filling out a questionnaire and were assessed for PFM by the EMG considering the levator ani area. All participants provided informed consent before data collection.

2) This study was approved by the Research Ethics Committee (CAAE 82225617.0.0000.5411). The model proposed to evaluate the performance of PFMs in their different activities through EMG was designed based on the importance of including rest measures before and after each activity performed besides the initial rest measure. This concept will allow for an extended, detailed PFM and RAM performance analysis between rests, between activities and rests, and between similar or opposite activities.

Results: 1) The first stage included a bibliographic review and analysis of qualitative interviews. After removing details suggested by the experts, 14 items were included in the final version of the questionnaire.

The assessment of the instrument's psychometric properties was performed afterward. Finally, the analysis of the instrument's psychometric properties, including content validity, formal validity, construct validity, and reliability (internal consistency), were reported.

2) There were no differences in PFM electromyographic activity between groups

during rapid contractions. Superficial PFM activation in women with GDM regardless of urinary continence status was similar, but separately they differed from activation of women in the normoglycemic-incontinent (NG-UI) group. Thus, women in the diabetic-continent (GDM-C) and diabetic-incontinent (DMG-UI) groups activated 56.3% ($p=.000$) and 28.7% ($p=.047$) less superficial PFM compared to NG-UI, respectively. Regarding the synergistic activation of the RAM during the rapid contraction task of the PF, the activation of the RAM of the women with GDM regardless of their urinary continence status was similar, but separately they differed from the activation of the women in the NG-UI group. GDM-C and GDM-UI women activated 39.1% ($p=.001$) and 34.8% ($p=.005$) fewer MRA than NG-UI, respectively.

Conclusion: 1) The PSUI-Q is a content-based scale clinicians and researchers use to define emotional, social, financial, professional, and sexual burden levels pregnant women experience, as well as provide a more tailored understanding of their distress during that period. Therefore, the PSUI-Q is a valuable measure health care professionals can use to develop appropriate care to meet women's individual needs. Understanding the burden of pregnant women should be fundamental to developing proper prenatal care to help women cope with their situation and avoid the adverse consequences of the maternal emotional burden. The 14-item PSUI-Q had satisfactory validity and reliability.

2) The preliminary results in this study indicate that women who are GDM-C and GDM-UI activate less PFM and RAM when compared to NG-C and NG-UI women.

Key words: Pelvic floor; electromyography; gestational diabetes mellitus; pelvic floor muscle; pregnancy; urinary incontinence; questionnaire.

Seção 4

Artigos

Artigo 1

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Development and Validation of the Pregnancy-Specific Urinary Incontinence Questionnaire (PSUI-Q) in a Brazilian population

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Abstract

Aim: This study aimed to develop and validate the pregnancy-specific urinary incontinence questionnaire (PSUI-Q) for the first time. We used a qualitative study design to develop the scale and a cross-sectional study to establish its validity.

Methods: This is a descriptive and analytical cross-sectional study to develop and validate an instrument to assess pregnancy-specific urinary incontinence conducted in two stages: (1) Development of an item pool; (2) Item reduction and development of the PSUI-Q.

Results: 10 gynecology and obstetrics experts contributed to developing the scale. There is a positive evaluation for at least 80% of the judges for each item, which validates the questionnaire regarding the construct. Considering the data from 22 patients, as the responses had a slight variation, the alpha value was low ($\alpha=0.44$). Psychometric property evaluation of the instrument was performed afterward. Changes were made according to the experts' suggestions on item wording and arrangement. The alpha value is close to 0.7, which is considered suitable for the questionnaire's consistency and coherence.

Conclusions: The PSUI-Q is a content-based scale clinicians and researchers use to define the burden levels pregnant women experience. Additionally, it is a valuable measure health care providers can use as a foundation to provide the appropriate care and meet women's individual needs. Item 14 item confirmed these needs had confirmed validity and reliability.

Keywords: questionnaire, specific urinary incontinence, pregnancy, development, validation.

Introduction

Pregnancy and delivery may cause disorders in the pelvic floor, including urinary incontinence (UI), whose rates during pregnancy range from 25% to 75% (1). Pelvic floor disorders significantly decrease pelvic floor muscle (PFM) strength (2). UI or involuntary urine leakage is a distressing and severe health problem with a significant psychosocial and economic burden that leads to significant quality of life issues (3). This involuntary passing of urine is a common health condition experienced by 10-20% of women; however, only 25% seek or receive treatment (4).

Whether resulting from conscious planning, pregnancy and childbirth is women's most meaningful change of a lifetime (5). Women's physiological states change multiple times during pregnancy. These alterations could be of particular importance in the medical care of pregnant women (6). Understanding the anatomic relationship between the pelvic floor muscles and the pelvic girdle, spine, and hips aids the rehabilitation provider in diagnosing, managing, and providing the appropriate referrals (7).

Stress urinary incontinence (SUI) is the most common and prevalent type of UI during pregnancy (8). This type of UI is defined as the involuntary passing of urine during physical activity due to a sudden increase in intra-abdominal pressure without detrusor contraction or underactivity (9). Injuries to the pelvic floor during pregnancy and childbirth are considered significant risk factors (8). Although the SUI is the most prevalent UI type during pregnancy, women also complain about urinary incontinence and its combination, which is named mixed urinary incontinence (10). In addition, women who experience UI for the first time during pregnancy are termed "pregnancy-specific UI (PSUI)" (11).

Most clinicians have encountered situations where a woman struggled physically and psychologically to understand her voiding dysfunction. The International Continence Society (ICS) recommends including quality of life as an outcome in clinical trials (12). Guidelines for diagnosis and treatment of urinary incontinence were published in 2012 by the American Urological Association (13), and several questionnaires are available to determine which type of chronic urinary incontinence is present (14). However, instruments are insufficient to assess and diagnose PSUI explicitly.

Quality of life is a multidimensional concept that refers to the subjective impact health and illnesses have on a person's physical, social, emotional, and cognitive functioning (15) and can be assessed using disease-specific or generic outcome measures (16). The National Institute for Health and Care Excellence guidelines recommend validated questionnaires to evaluate UI treatment interventions (17). However, there is a considerable variation in the quality-of-life instruments used in studies on women with UI, and there is no consensus on which instruments have the highest psychometric quality (18).

The World Health Organization Consultation on Incontinence proposed the International Consultation on Incontinence Questionnaire Short Form (ICIQ-SF) (19) to provide a clinically easy-to-use set of modules covering all aspects of the assessment of urinary incontinence severity and its impact on quality of life. A preliminary study showed a high degree of reliability and validity in that questionnaire (20), but there was a moderate level of evidence for insufficient criterion validity (21); besides, reliability and hypothesis testing for construct validity were uncertain (22).

King's Health Questionnaire (KHQ) is also designed to assess urinary

incontinence's impact on quality of life. However, there was a high level of evidence for insufficient internal consistency (Cronbach's α : 0.52–0.89) and very low-level evidence for sufficient test-retest reliability due to inadequate methodological quality as test conditions were not similar at follow-up in a study on that property (23).

PSUI assessment criteria are unclear and have been measured using tools from other types of UI. Therefore, there is a need to develop a unique questionnaire to measure PSUI as the tools used in the individual studies were too diverse and unspecific. Besides, such a variety of instruments makes it difficult to compare the results of assessments and integrate the evidence that may interfere with the clinical application of the results.

Measuring the emotional, social, financial, professional, and sexual dimensions of PSUI involves complex and interrelated problems that need to be considered. Most research has only studied the assessment of and intervention in general areas of UI (18), not including pregnancy as the main factor. However, these approaches can mask complex problems experienced by pregnant women. The complex issues experienced by those women and the multiple interventions required for their prenatal emphasize the need to develop a specific tool for measuring the burden of PSUI.

Therefore, our study aimed to develop and validate the Pregnancy-specific Urinary Incontinence Questionnaire (PSUI-Q). We used a qualitative study design to develop the scale and a cross-sectional study to establish its validity.

Methods

Study Population

This is a qualitative and cross-sectional study on developing and validating an instrument to assess the Pregnancy-Specific Urinary Incontinence Questionnaire.

The Medical School (FMB) of São Paulo State University (UNESP)'s Research Ethics Committee approved this study under No. 31976620.1.0000.5411. Furthermore, participants received written information about this study's aim and procedures and learned their right to withdraw at any time.

Initial PSUI-Q development

We conducted this study in two stages:

- 1- Development of an item pool;
- 2- Item reduction and development of the PSUI-Q.

The first stage aimed to manage a qualitative study to create a pool of the questionnaire's primary items. This stage focused on literature review findings and qualitative conventional content analysis. The International Consultation on Incontinence Questionnaire (ICIQ-SF) (20) is a simple questionnaire that provides a quick assessment of the impact urinary incontinence has on quality of life and classifies unintentional passing of urine experienced by patients. However, there are not enough instruments in the literature to measure the impact of pregnancy-specific urinary incontinence on pregnant women at the assessment time.

Content validity of the initial PSUI-Q

We mailed an item-review document with a cover letter explaining the

PSUI-Q's purpose and an item-scoring form with instructions to the expert panel. The panel includes ten professionals who are experts in maternal health, research, and questionnaire development. They were asked to evaluate the behavior, objectivity, simplicity, plainness, relevance, precision, variety, modality, typicality, and credibility of the PSUI-Q items with a dichotomous scale ranging from 0 (not appropriate) to 1 (very appropriate). The experts provided item revision suggestions.

PSUI-Q psychometric property examination

The instrument's psychometric properties were assessed, including face, content, construct validity, and reliability (internal consistency).

The content validity index (CVI) for each item and the content validity index for all scales (CVIS) were estimated. The CVI is calculated as the percentage of experts giving 1 on a scale, while the CVIS is the average of the total CVI on the scale. CVI and CVIS values equal to or greater than 0.7 are considered appropriate when at least six experts rate the items (23).

CVI relevance, correctness, and comprehensibility ranges for each item on the PSUI-Q were 0.67–1.0, 0.67– 1.0, 0.5–1.0, respectively, and four items (4, 5, and 11–14) had unacceptable CVI due to unclear and redundant content commanded by the experts. Therefore, after the four items were changed, the remaining 14 were processed for further psychometric properties testing.

Instruments

Pregnancy-Specific Urinary Incontinence Questionnaire (PSUI-Q)

The PSUI-Q is a self-reported scale designed to detect four domains of

specific distresses of activity restriction, including (1) role function changes; (2) fetal safety and health; (3) physical and psychological care issues; and (4) socioeconomic and medical issues (24). The initial PSUI-Q had 16 questions, which were decreased to 14 after an expert's review. Furthermore, to account for variations in each woman's situation, we included four filter questions (items 5, 6, 8, and 9) that attempted to explore the issues of frequency and amount of urinary incontinence. Respondents could skip the question if they did not experience what the filter question described.

The ICIQ-SF Portuguese version with appropriate reliability and validity (24) was used to build the PSUI-Q by offering support and guiding its elaboration.

QUESTIONÁRIO PARA IDENTIFICAÇÃO DA INCONTINÊNCIA URINÁRIA ESPECÍFICA DA GESTAÇÃO		
"Muitas gestantes PERDEM URINA sem querer e chegam a molhar a calcinha ou a roupa de xixi"		
1- Isto já aconteceu com você nessa gestação? <i>*se a resposta for "não": Obrigada pela participação! A pesquisa avança somente com gestantes que perdem urina na atual gestação</i>	sim ()	não ()*
2- Essa perda de urina já acontecia antes desta gestação ? <i>*se a resposta for "sim": Obrigada pela participação! A pesquisa avança somente com gestantes que perdem urina na atual gestação</i>	sim ()*	não ()
3- Em que momento da gestação você estava quando aconteceu a primeira perda de urina? <input type="checkbox"/> Três primeiros meses (entre 0-13 semanas) <input type="checkbox"/> Entre quatro e seis meses (entre 14-26 semanas) <input type="checkbox"/> Entre sete e nove meses (entre 27-41 semanas)		
4- Você já perdeu urina em alguma das situações abaixo? Assinale quantas alternativas forem necessárias. <input type="checkbox"/> Quando tusso <input type="checkbox"/> Quando espirro <input type="checkbox"/> Quando pego peso		
CASO NÃO PERCA EM NENHUMA DESSAS SITUAÇÕES, PASSE PARA A QUESTÃO 7		
5- Com que frequência você perde urina nessas situações? <input type="checkbox"/> Uma vez por mês <input type="checkbox"/> Uma ou mais vezes na semana <input type="checkbox"/> Todo dia		
6- Qual a quantidade de urina que geralmente você perde nessas situações? <input type="checkbox"/> Gotas – Pequena Quantidade <input type="checkbox"/> Colher – Média Quantidade <input type="checkbox"/> Copo – Grande Quantidade		
7- Já aconteceu de você perder urina em alguma dessas situações? <input type="checkbox"/> Quando sinto vontade e não consigo controlar <input type="checkbox"/> Quando sinto vontade e estou próxima ao banheiro <input type="checkbox"/> Quando estou mexendo com água		
CASO NÃO PERCA EM NENHUMA DESSAS SITUAÇÕES, PASSE PARA A QUESTÃO 10		
8- Com que frequência você perde urina nessas situações? <input type="checkbox"/> Uma vez por mês <input type="checkbox"/> Uma ou mais vezes na semana <input type="checkbox"/> Todo dia		
9- Qual a quantidade de urina que geralmente você perde nessas situações? <input type="checkbox"/> Gotas – Pequena Quantidade <input type="checkbox"/> Colher – Média Quantidade <input type="checkbox"/> Copo – Grande Quantidade		
Pense em todos os motivos que você PERDE URINA e responda se isso causa algum problema:		
10- Na sua saúde emocional? (sentir-se triste, irritada ou frustrada...) () sim () não		
11- Na sua vida social? (deixar de frequentar eventos, cultos, reuniões...) () sim () não		
12- Na sua vida financeira? (maior gasto com protetor diário ou absorventes...) () sim () não		
13- Na sua vida profissional? (causa algum problema ou vergonha no trabalho...) () sim () não		
14- Na sua vida sexual? (deixar de ter relações sexuais ou tem relações sexuais insatisfatórias...) () sim () não		
Agradecemos sua participação!		

Data Analyses

The data obtained with the judges' scale were descriptively analyzed for each attribute assessed to the items (behavior, objectivity, simplicity, plainness, relevance, precision, variety, modality, typicality, and credibility). A total of 80% of concordant answers among the judges were considered satisfactory, thus considering the evaluation of the questionnaire construct.

After that evaluation, a group of patients (n=22) answered the questionnaire to calculate psychometric measures, such as Cronbach's alpha, item-item ratio, and correlation between items to assess internal consistency. Values above 0.9 had very good consistency; 0.8-0.9 good consistency; 0.7-0.8 reasonable consistency; 0.6-0.7 weak consistency; and below 0.6 unacceptable consistency. All analyzes were performed using SAS v. 9.4 for Windows.

Results

A literature review and qualitative interview analysis were performed in this first stage, and item 15 was removed. Then, after eliminating details suggested by experts, 14 items were included in the questionnaire's final version.

The instrument's psychometric properties were then assessed. Finally, the instrument's psychometric properties analysis was reported, including content validity, formal validity, construct validity, and reliability (internal consistency).

Validity assessment

At this stage, after obtaining experts' comments, CVR and CVI values were calculated to evaluate the questionnaire's content validity; 14 items achieved acceptable CVR and CVI values and were approved. Changes were made

according to the experts' suggestions on item wording and arrangement. We interviewed 22 patients to assess questionnaire item comprehensibility and added examples to some items according to their comments to improve fluency and comprehension.

Table 1. Judges' assessment result regarding the PSUI-Q for the considered items.

Item	Questions																												
	cat	1	%	2	%	3	%	4	%	5	%	6	%	7	%	8	%	9	%	10	%	11	%	12	%	13	%	14	%
Behavior	0	1	10	2	20	0	0	1	10	0	0	0	0	1	10	0	0	0	0	1	10	1	10	1	10	1	10	1	10
	1	9	90	8	80	10	100	9	90	10	100	10	100	9	90	10	100	10	100	9	90	9	90	9	90	9	90	9	90
Objectivity	0	1	10	3	30	0	0	1	10	0	0	0	0	1	10	0	0	0	0	2	20	1	10	1	10	1	10	1	10
	1	9	90	7	70	10	100	9	90	10	100	10	100	9	90	10	100	10	100	8	80	9	90	9	90	9	90	9	90
Simplicity	0	0	0	0	0	2	20	0	0	0	0	0	0	0	0	0	0	0	0	1	10	1	10	1	10	1	10	1	10
	1	10	100	10	100	8	80	10	100	10	100	10	100	10	100	10	100	10	100	9	90	9	90	9	90	9	90	9	90
Clarity	0	1	10	1	10	2	20	1	10	2	20	0	0	1	10	2	20	0	0	1	10	1	10	1	10	1	10	1	10
	1	9	90	9	90	8	80	9	90	8	80	10	100	9	90	8	80	10	100	9	90	9	90	9	90	9	90	9	90
Relevance	0	0	0	1	11.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	9	100	8	88.9	9	100	9	100	9	100	9	100	9	100	9	100	9	100	9	100	9	100	9	100	9	100	9	100
Precision	0	0	0	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	10	100	9	90	10	100	10	100	10	100	10	100	10	100	10	100	10	100	10	100	10	100	10	100	10	100	10	100
Variety	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	10	100	10	100	10	100	10	100	10	100	10	100	10	100	10	100	10	100	10	100	10	100	10	100	10	100	10	100
Modality	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	10	1	10	1	10	1	10	1	10
	1	10	100	10	100	10	100	10	100	10	100	10	100	10	100	10	100	10	100	9	90	9	90	9	90	9	90	9	90
Typicality	0	0	0	0	0	0	0	0	0	0	0	1	10	0	0	0	0	1	10	0	0	0	0	0	0	0	0	0	0
	1	10	100	10	100	10	100	10	100	10	100	9	90	10	100	10	100	9	90	10	100	10	100	10	100	10	100	10	100
Credibility	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	10	0	0	0	0	0	0	0	0	0	0
	1	10	100	10	100	10	100	10	100	10	100	10	100	10	100	10	100	9	90	10	100	10	100	10	100	10	100	10	100

*Results for internal consistency using Cronbach's alpha and test-retest reliability.

Table 1 shows a positive evaluation [1] for at least 80% of the judges for each item, validating the questionnaire regarding its construct.

Characteristics of participants

A total of 10 gynecology and obstetrics experts contributed to developing the scale. We used a Pasquali (25) method, which is a valid scale development method starting with experts' contributions. We initially gathered a panel of four experts to contribute to the scale's topics and types of questions.

Table 2. Descriptive demographic characteristics of pregnant women.

Variable	Mean	SD
1 - Maternal age (years)	29.9	5.4
2 - Gestational age (weeks)	27.7	5.4
	Frequency (N=21)	%
3- Partnership status		
(1) (1) married/living together	2	9.52
(2) (2) single	19	90.48
4 - Education level		
(1) (1) basic level	3	14.29
(2) (2) high school	15	71.43
(3) (3) college/university	3	14.29
5 - Religion		
(1) (1) catholic	6	28.57
(2) (2) evangelical	12	57.14
(3) (3) others	3	14.29

*The Chi-square test compared the result of differences in demographic and personal characteristics of pregnant women.

Questions in the psychometric assessment were renumbered according to their items. Patients could answer more than one item in each question. Thus, we increased the items and assessed consistency and coherence with Cronbach's alpha coefficient calculation and the item-item evaluation for the questions.

Considering the 22 patients' data, as the responses had a slight variation,

the alpha value was low ($\alpha=0.44$). Therefore, an item-by-item analysis was performed to avoid an increased sample size, which influences the alpha value. Thus, we removed items 4.3, 4.5, 5.3, 5.4, 7.2, 7.4, 7.5, 8.3, and 8.4 (when I laugh, when I walk, two or three times a week, several times a day, when I feel cold, when I finished urinating and am getting dressed, without knowing why, two or three times a week, several times a day) and turned questions 10, 11, 12, 13 and 14 into dichotomous alternatives. Consequently, the alpha value approached 0.7, which is considered suitable for questionnaire consistency and coherence.

Discussion

To the authors' knowledge, this is the first study to develop and execute a detailed validation of a questionnaire to assess the factors influencing urinary incontinence among pregnant women.

We conducted this study to design and assess a questionnaire's psychometric properties and factor structure that assesses urinary incontinence during pregnancy.

Some reasons include individual perceptions, attitudes toward UI, changes in social and professional life, financial impact, sexual dysfunction, and fear and anxiety about the consequences of a UI diagnosis. These can be included as related reasons and relevant factors this instrument can assess.

The items reflected pregnant women's perspectives and were verified by the published specialized literature. Such an approach ensured tool content validity during early research (26).

The questionnaire in this study measures both treatment areas (medicine and physiotherapy), while most previous instruments (27) could not significantly

assess pregnancy-specific urinary incontinence.

One limitation of this study may be related to the sample size. However, previous studies that aimed to build and validate a questionnaire to assess urinary incontinence during pregnancy included few participants in their validation process (28). Moreover, sample size studies have rarely been justified in validation studies (29). However, due to being a recent questionnaire, its usefulness has not yet been thoroughly analyzed in clinical practice, and we need further research to evaluate its feasibility and accessibility (30). Future studies should also investigate the responsiveness of the questionnaire to assess PSUI.

The main limitation of this study should be noted: All pregnant women who had experienced one or more pregnancies were included. Even though some studies revealed women in their first pregnancy have different PSUI experiences than those in their second or later pregnancies, we still cannot ignore the impact of multiparity on the PSQUI-Q psychometric properties.

This study results indicate that the assessment questionnaire for pregnancy-specific urinary incontinence and its respective development during pregnancy is reproducible and valid for Brazilian pregnant women. Furthermore, the questionnaire's Brazilian Portuguese version will contribute to health care professionals' clinical practice and scientific research by optimizing PSUI-related assessments in Brazilian pregnant women. This will allow objective measurements through the questionnaire sub-items, facilitating clinical decision-making, follow-up, and reassessment.

Further research encompassing structural validity and confirmatory analyses is required.

Conclusion

The PSUI-Q is a content-based scale clinicians and researchers use to define the burden pregnant women experience and offer a more tailored understanding of their distress during this specific period. Additionally, it is a valuable measure health care providers can use as a foundation to provide the appropriate care and meet women's individual needs.

Understanding the burden of pregnant women should be a key component of developing appropriate prenatal care and assist women in coping with their situation, avoiding the adverse consequences of the emotional burden of motherhood. The developed 14-item PSUI-Q was confirmed to have satisfied validity and reliability.

References

1. Kumtepe Y. 2009. Pelvic floor, pregnancy and delivery. In: Yalcin O editor., € Basic Urogynecology. Istanbul: p 61–5.
2. Kahyaoglu Sut H, Balkanli Kaplan P. Effect of pelvic floor muscle exercise on pelvic floor muscle activity and voiding functions during pregnancy and the postpartum period. *NeurourolUrodyn*. 2016 Mar;35(3):417-22. doi: 10.1002/nau.22728. Epub 2015 Feb 3. PMID: 25648223.
3. Padmanabhan P, Dmochowski R. Urinary incontinence in women: a comprehensive review of the pathophysiology, diagnosis and treatment. *Minerva Ginecol*. 2014 Oct;66(5):469-78. Epub 2014 Jul 31. PMID: 25078140.
4. Lukacz ES, Santiago-Lastra Y, Albo ME, Brubaker L. Urinary Incontinence in Women: A Review. *JAMA*. 2017 Oct 24;318(16):1592-1604. doi: 10.1001/jama.2017.12137. PMID: 29067433.
5. Oates M. Normal emotional changes in pregnancy and the puerperium. *BaillieresClinObstetGynaecol*. 1989 Dec;3(4):791-804. doi: 10.1016/s0950-3552(89)80065-3. PMID: 2700143.
6. Kohlhepp LM, Hollerich G, Vo L, Hofmann-Kiefer K, Rehm M, Louwen F, Zacharowski K, Weber CF. Physiologische Veränderungen in der Schwangerschaft [Physiological changes during pregnancy]. *Anaesthesist*. 2018 May;67(5):383-396. German. doi: 10.1007/s00101-018-0437-2. PMID: 29654495.
7. Eickmeyer SM. Anatomy and Physiology of the Pelvic Floor. *Phys Med Rehabil Clin N Am*. 2017 Aug;28(3):455-460. doi: 10.1016/j.pmr.2017.03.003. Epub 2017 May 27. PMID: 28676358.
8. Santos PC, Mendonca D, Alves O, Barbosa AM. [Prevalence and impact of stress urinary incontinence before and during pregnancy]. *Acta Med Port*. 2006; 19(5):349–56. PMID: 17376320.
9. 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 Jan; 61(1):37–49. [https://doi.org/10.1016/s0090-4295\(02\)02243-4](https://doi.org/10.1016/s0090-4295(02)02243-4) PMID: 12559262.
10. Woodley SJ, Lawrenson P, Boyle R, Cody JD, Mørkved S, Kernohan A, et al. Pelvic floor muscle training for preventing and treating urinary and faecal incontinence in antenatal and postnatal women. *Cochrane Database Syst Rev* [Internet]. 2020 May 6; Available from: <http://doi.wiley.com/10.1002/14651858.CD007471.pub4> PMID: 32378735
11. Hvidman L, Foldspang A, Mommsen S, Bugge Nielsen J. Correlates of urinary incontinence in pregnancy. *IntUrogynecol J PelvicFloorDysfunct* 2002;13:278–83.
12. Mattiasson A, Djurhuus JC, Fonda D, Lose G, Nordling J, Stöhrer M. Standardization of outcome studies in patients with lower urinary tract

- dysfunction: a report on general principles from the Standardisation Committee of the International Continence Society. *Neurourol Urodyn*. 1998;17(3): 249-253.
13. Khandelwal C, Kistler C. Diagnosis of urinary incontinence. *Am Fam Physician*. 2013 Apr 15;87(8):543-50. PMID: 23668444.
 14. Holroyd-Leduc JM, Tannenbaum C, Thorpe KE, Straus SE. What type of urinary incontinence does this woman have? *JAMA*. 2008;299(12): 1446-1456.
 15. Saxena S, Orley J. Quality of life assessment: the world health organization perspective. *Eur Psychiatry*. 1997;12(Suppl 3): 263s-266s.
 16. Donovan JL, Badia X, Corcos J, et al: Symptom and quality of life assessment in incontinence, in Abrams, Cardozo, Khoury, et al, (Eds): 2nd Consultation on Incontinence, 1999.
 17. Dugan E, Cohen SJ, Robinson D, et al. The quality of life of older adults with urinary incontinence: determining generic and condition-specific predictors. *Qual Life Res*. 1998;7(4): 337-344.
 18. Wuytack F, Moran P, Daly D, Panda S, Hannon K, Cusack C, O'Donovan M. A systematic review of utility-based and disease-specific quality of life measurement instruments for women with urinary incontinence. *Neurourol Urodyn*. 2021 Aug;40(6):1275-1303. doi: 10.1002/nau.24678. Epub 2021 Jun 3. PMID: 34082483.
 19. Avery K, Donovan J, and Abrams P: Validation of a new questionnaire for incontinence: the International Consultation on Incontinence Questionnaire (ICI-Q). *NeurourolUrodyn* 20: 510–512, 2001
 20. Nyström E, Sjöström M, Stenlund H, Samuelsson E. ICIQ symptom and quality of life instruments measure clinically relevant improvements in women with stress urinary incontinence. *Neurourol Urodyn*. 2015;34(8):747-751.
 21. Hajebrahimi S, Nourizadeh D, Hamedani R, Pezeshki MZ. Validity and reliability of the International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form and its correlation with urodynamic findings. *Urol J*. 2012; 9(4):685-690.
 22. Brusaca LA, Rocha APR, Cardozo L, Oliveira AB, Driusso P. Brazilian version of the King's Health Questionnaire: assessment of the structural validity and internal consistency in female urinary incontinence. *Int Urogynecol J*. 2022 Apr 12. doi: 10.1007/s00192-022-05189-3. Epub ahead of print. PMID: 35412068.
 23. Tamanini, José Tadeu Nunes et al. Validação para o português do "International Consultation on Incontinence Questionnaire - Short Form" (ICIQ-SF). *Revista de Saúde Pública* [online]. 2004, v. 38, n. 3 [Acessado 5 Fevereiro 2022] , pp. 438-444. Disponível em: <<https://doi.org/10.1590/S0034-89102004000300015>>. Epub 08 Jul 2004. ISSN 1518-8787. <https://doi.org/10.1590/S0034-89102004000300015>.

24. Hung, HY., Hung, SP. & Chang, YJ. Development and validation of the prenatal activity restriction stress questionnaire: a Rasch rating scale analysis. *BMC PregnancyChildbirth* 20, 659 (2020). <https://doi.org/10.1186/s12884-020-03347-3>
25. Pasquali L. Princípios de elaboração de escalas psicológicas. *Rev Psiq Clín.* 1998;25(5):206-13. Disponível em: <http://www.hcnet.usp.br/ipq/revista/r255/conc255a.htm>.
26. Boynton PM, Greenhalgh T. Selecting, designing, and developing your questionnaire. *BMJ.* 2004 May 29;328(7451):1312-5. doi: 10.1136/bmj.328.7451.1312. PMID: 15166072; PMCID: PMC420179.
27. Nelson HD, Cantor A, Pappas M, Miller L. Screening for Urinary Incontinence in Women: A Systematic Review for the Women's Preventive Services Initiative. *Ann Intern Med.* 2018 Sep 4;169(5):311-319. doi: 10.7326/M18-0225. Epub 2018 Aug 14. PMID: 30105353.
28. Palmieri S, Cola A, Ceccherelli A, et al. Italian validation of the German pelvic floor questionnaire for pregnant and postpartum women. *Eur J Obstet Gynecol Reprod Biol.* 2020;248:133–6. <https://doi.org/10.1016/j.ejogrb.2020.03.032>
29. Anthoine E, Moret L, Regnault A, et al. Sample size used to validate a scale: a review of publications on newly-developed patient reported outcomes measures. *Health Qual Life Outcomes.* 2014;12:176. <https://doi.org/10.1186/s12955-014-0176-2>.
30. Zuchelo LTS, Bezerra IMP, Da Silva ATM, et al. Questionnaires to evaluate pelvic floor dysfunction in the postpartum period: a systematic review. *Int J Womens Health.* 2018;10:409–24. <https://doi.org/10.2147/IJWH.S164266>.

Artigo 2

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Pelvic Floor and Abdominal Muscles Electromyographic Characteristics of Co-activation in Women with Gestational Diabetes Mellitus and Pregnancy-Specific Urinary Incontinence

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Abstract

Aim: This study aimed to determine whether EMG activity from PFM and RAM differs between women with and without GDM.

Methods: This is a cross-sectional study to investigate whether EMG activity from PFM and RAM differs between women with and without GDM conducted in three steps: (1) a 60-second preliminary resting baseline was defined as the rest-activity to assess PFM lower basal activity; (2) five fast contractions or “flicks,” each preceded by a 10-second rest period, were defined as fast contractions; and (3) five repetitions of 10-second contractions, each contraction preceded by a 10 second rest period, were defined as hold contractions.

Results: There were differences in the electromyographic activity of the deep PFM layer between the groups during fast and hold contractions. The GDM-PSUI group's deep PFM muscle activation was 35,2% smaller than the non-DMG-C group during 1-sec phasic contraction and 39,4% smaller during 10-sec hold contractions. Both groups had similar activation of superficial PFM layer, RAM, and TrA/Oi during 1-sec phasic and 10-sec hold contractions task of the PFM.

Conclusions: The results of this study show that the GDM group presents progressive decreased EMG-PFM activity contractions. On the other hand, RAM and TrA/Oi seem to remain in a state of rest.

Keywords: pelvic floor muscles, electromiography, gestational diabetes mellitus, urinary incontinence.

Introduction

The pelvic floor (PF) comprises muscles, ligaments, and fascia that act as a sling to support the bladder, reproductive organs, and rectum. This soft tissue sling is enclosed by the bony scaffolding of the pelvis, formed by two innominate bones made from the ilium, ischium, and pubis, which articulate with the sacrum posteriorly and each other anteriorly. The stability of the articulating surfaces of the pelvis is thought to arise through mechanisms termed “force closure” and “form closure.” Force closure is achieved through the interlocking of the pelvis's ridges and grooves of the bony joint surfaces. In contrast, form closure is achieved through the compressive forces of the muscles, ligaments, and fascia, providing passive stability (1,2).

The strength of the pelvic floor muscles (PFM) can decrease during pregnancy (3) and after delivery due to physiological processes, altered anatomical position of the pelvis, and the shape of the pelvic floor muscles. Such decreased muscle strength may lead to musculoskeletal alterations, leading to urinary incontinence, perineal laceration, and dyspareunia (4).

Its anatomic structures prevent incontinence and pelvic organ prolapse during abdominal pressure elevation and physical activity. Yet, they are responsible for the waste being discarded through urination and defecation (5).

The classic rectus abdominis muscle (RAM) anatomical description is influenced by considerable interindividual variation. The current tendency toward an increased incidence of obesity and accompanying morphological changes have modified that typical anatomy, thus the importance of analyzing the influence of such variations on the RAM anatomy (6).

For a long time, health care providers believed and emphasized that the

PFM should be exercised in isolation without any abdominal or hip muscle activity. That means that in the case of abdominal muscle activity, there is concern that this may result in straining or an increased bladder pressure, thus aggravating the initial condition (7,8). However, studies on women with no symptoms of PFM dysfunctions showed preliminary evidence that RAM activation is associated with PFM contraction (9). In addition, there is co-activation of the abdominal and PFM in functional activities such as head and shoulder raising (10). Furthermore, palpable tightening of the abdominal muscles has been identified clinically in association with a PFM contraction (11). This co-activation is necessary to develop intra-abdominal pressure (IAP) and is thought to contribute to spinal stability (12).

At the same time, diabetes mellitus (DM) is a global health concern, and gestational diabetes mellitus (GDM) is defined as the onset or first recognition of glucose intolerance in pregnancy. As its incidence has rapidly increased globally in recent decades (13), it is an increasingly common condition affecting approximately 8.3% of pregnancies worldwide (14). In addition to the increased risk of adverse neonatal outcomes, GDM has substantial implications for maternal health, including an increased risk of developing type 2 diabetes mellitus (15), traumatic delivery complications (16), and PFM disorders (17,18). Such disorders, including pregnancy-specific urinary incontinence (PSUI), are commonly found and have a prevalence of 49% among women with a recent history of GDM (19). Although a causal link between GDM and UI is still being investigated, DM is currently correlated with impaired function and reduced skeletal muscle mass (20), a condition called diabetic myopathy (21, 22).

Urinary incontinence, defined as involuntary urination (23), is a distressing,

socially restricting condition that affects about one in every three women. UI has three subcategories: stress urinary incontinence, which is the most common type and concerns urine leakage associated with physical activity, coughing, and sneezing; urgency urinary incontinence, which involves a sudden need to pass urine and is preceded or accompanied by urine leakage; and mixed urinary incontinence, which involves both stress and urgency urinary incontinence (24). PSUI can significantly impact women's quality of life and considerable economic burden (25).

Surface electromyography (EMG) is the technique of recording and analyzing the electrical signals from individual muscle fibers of motor units at rest and during voluntary contraction using a recording electrode inserted into the muscle. It is considered an acceptable tool for real-time PFM contraction assessment (26, 27) and PFM function assessment (28) via PFM motor unit action potential identification (29). The recruitment of motor units generates electrical signals from the muscles during contraction, and a correlation has been observed between muscle strength and the activation of motor units (30). The bioelectrical activity of a muscle can be monitored as a representation of muscle function (31).

Therefore, to understand the correlation between co-activation of PFM and RAM activity and the consequences of GDM on the skeletal muscle, we tested the hypothesis that an EMG of pregnant women with GDM would show impaired PFM and RAM activity compared to controls. In addition, this study aimed to determine whether EMG activity from PFM and RAM differs between women with and without GDM.

Methods

Study Population

Pregnant women were screened for GDM between 24-40 weeks of gestation and were diagnosed according to the ADA criteria using a 75 g-OGTT test (32, 33). Women with known type 1 or type 2 DM and urinary incontinence before pregnancy or known fetal anomaly were excluded. All women with GDM underwent the same treatment at the Perinatal Diabetes Research Center (PDRC).

The study was approved by the São Paulo State University's Botucatu Medical School (FMB)'s Research Ethics Committee (CAAE 82225617.0.0000.5411). In addition, participants received written information on the study's aim and procedures and learned about their right to withdraw at any time.

Instruments

Procedure

Pregnant women who agreed to participate were scheduled for a single-day evaluation. The patient confirmed data was collected from hospital records, and body mass index (BMI) was measured at both time points (calculated as weight [kg]/height² [m]). Bladder emptying was requested. Participants were examined in the supine position with their lower limbs flexed with feet on the stretcher, and information about the anatomical position and possible movement of the PFM was obtained to avoid using adductor or gluteus and hip or expulsive movements. For PFM contraction correctness, vaginal palpation was performed. A PFM contraction was requested via verbal instructions: "Please squeeze the

vaginal muscle and hold as if you were holding urine.” The contraction was correct if the examiner felt an inward pressure or upward traction in palpation. Participants who could not perform a correct contraction were excluded.

The participants had three chances to perform maximal voluntary contraction (1 second to contract and relax afterward) and three chances to perform hold contractions (1 to 10 seconds holding and relaxing), respectively, simulating the steps of the EMG test performed later. Contraction of the adductor, gluteus, hip movements, and expulsion movements was discouraged and rectified (34,35). Participants were allowed five minutes of resting before EMG to prevent PFM basal tone muscle fatigue.

EMG was measured using an eight-channel device (New Miotool Uro 8 canais, Porto Alegre, Brazil) with a gain of 1000, 16-bit A/D converter, 10^{10} Ohm/2 pF input impedance, 126 dB common mode rejection ratio (CMRR), 20-500 Hz band-pass filter, and 2000 Hz signals sample. The EMG signal was collected from 4 sensors in 4 different muscles:

- a. Deep PFM: EMG was recorded using a vaginal probe sensor with two opposite stainless-steel electrodes (85x25 mm) positioned on both vaginal sidewalls coupled to an active differential sensor with ring connection. The probed was introduced into the vaginal canal using a water-soluble gel (36).
- b. Superficial PFM: EMG was recorded by surface electrodes: One pair of external electrodes was placed on each side immediately below the labia majora (36).

- c. Rectus abdominis: One pair of electrodes was placed on the RA – 2 cm lateral to the midline at the level of the anterior superior iliac spines (37).
- d. TRA/IO: To test for correct TRA/IO contraction, electrical activity generated with contraction was evaluated using sensors placed on the lateral abdominal wall at the level of the umbilicus and by palpating the inward movement of the abdominal wall without movement of the pelvis or lower lumbar spine (37,38).

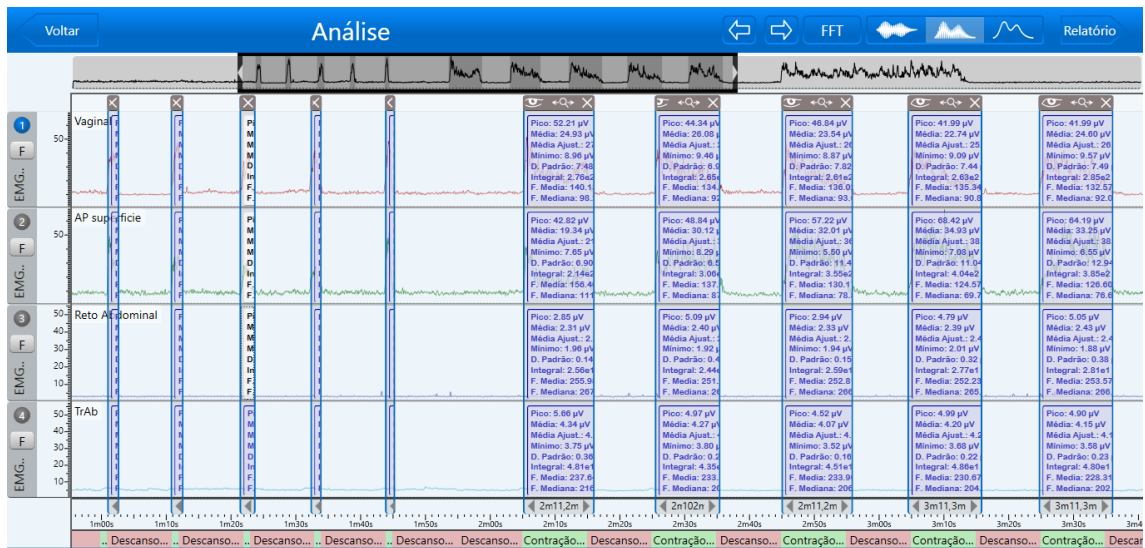
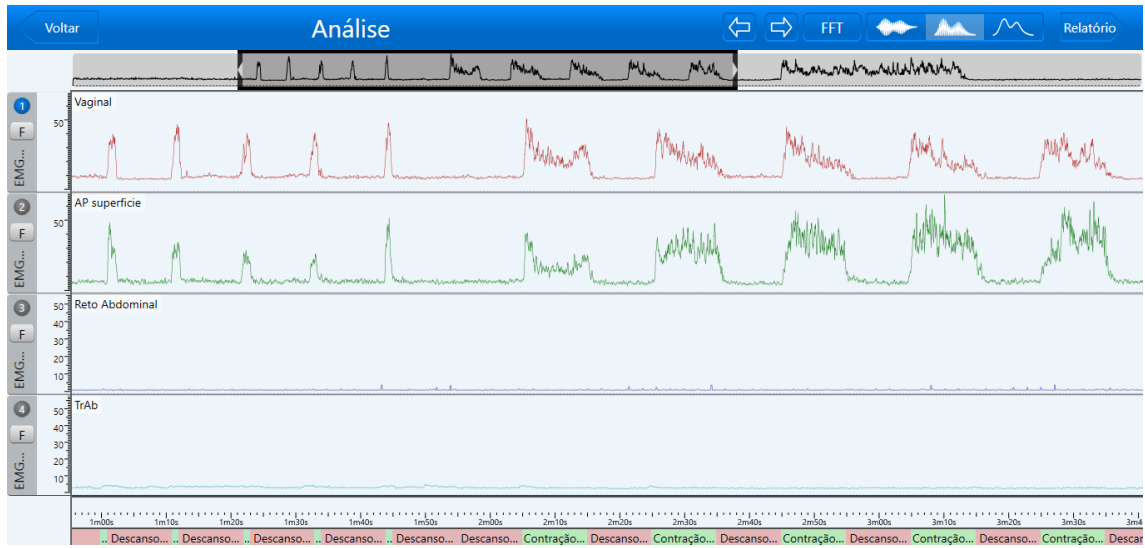
Their skin was prepared with a 70% ethanol solution, and the reference electrode was fixed on the ulna's styloid process.

A modified Glazer (29,39,40) protocol was used for the EMG recordings to verify muscle activity during rest-activity and fast and hold contractions (29,40). The sequence had three segments: 1) a 60-second preliminary resting baseline was defined as the rest-activity to assess PFM lower basal activity; 2) five fast contractions or "flicks," each preceded by a 10-second rest period, were defined as fast contractions; and 3) five repetitions of 10-second contractions, each contraction preceded by a 10 second rest period, were defined as hold contractions (Fig 1) (29,40). The participants were instructed about the sequence and their need to contract the PFM immediately when verbally instructed by the researcher. All participants performed the same evaluation sequence.

EMG processing

An examiner blinded to the women's clinical data processed the EMG recording data signal using the MiotecSuite® software. The first channel (deep

PFM) determined the EMG selection process. The five fast and five slow contractions, separately, were selected during the most stable period (early contraction), identified visually as the point where the EMG activity deviated from the baseline, and at the end of the contraction, where the EMG activity returned to baseline. (Figure 1)



Data Analyses

Statistical analysis was performed using IBM SPSS Statistics for Windows, version 20.0 (IBM Corp., Armonk, NY, USA). The categorical characteristics of the study population were expressed in absolute and relative frequency, and the continuous variables were expressed as median, minimum, and maximum, provided that the Kolmogorov-Smirnov test showed non-parametric data distribution. The chi-square or Fisher's exact test was applied to compare categorical data between groups, and the z-test (Bonferroni method) was applied to check for intergroup differences. Comparisons between the four groups were performed using the Kruskal-Wallis H test and the post hoc (pairwise) test for Dunn-Bonferroni multiple comparisons. Differences were statistically significant at $p < 0.05$.

Results

Participants Characteristics

Table 1 shows the groups had similar ethnicity, marital status, parity, gestational week at the time of collection, and weight gain. In addition, the GDM-C and GDM-PSUI group participants were older than non-GDM-PSUI. The GDM-PSUI had significant measures of previous and at the time of collection BMI compared to both non-GDM groups. As expected, the glycemic levels were different between non-GDM and GDM groups.

Table 2 shows the raw values of the average electromyographic activity during the five fast contractions and the five slow contractions (10-seconds) of the Glazer protocol (29, 39, 40) for each muscle evaluated. There were differences in the electromyographic activity of the deep PFM layer between the

groups during fast and hold contractions. The GDM-PSUI group's deep PFM muscle activation was 35,2% smaller than the non-DMG-C group during 1-sec phasic contraction and 39,4% smaller during 10-sec hold contractions.

Both groups had similar activation of superficial PFM layer, RAM, and TrA/Oi during 1-sec phasic and 10-sec hold contractions task of the PFM.

Table 1. Demographic, anthropometric, and obstetric characteristics of normoglycemic-continent (NG-C), normoglycemic-incontinent (NG-IUEG), diabetic-continent (GDM-C), diabetic-incontinent (GDM-IUEG) groups.

	Non-GDM-C (n= 40)	Non-GDM-PSUI (n= 44)	GDM-C (n= 40)	GDM-PSUI (n= 42)	p-value
Caucasian	31 (77.5%)	38 (86.4%)	27 (67.5%)	33 (78.6%)	.213
Marital Status (marriage)	17 (42.5%)	15 (34.1%)	22 (55%)	24 (57.1%)	.073
Prior cesarean delivery	9 (22.5%)	11 (25%)	10 (25%)	13 (31%)	.841
Age (years)	24.0 (18.0-43.0)	23.5 (18.0-43.0) ab	29.5 (19.0-43.0) a	27.0 (18.0-43.0) b	.017
Gestational age	28.0 (19.0-37.0)	27.0 (23.0-41.0)	29.5 (18.0-38.0)	30.5 (20.0-38.0)	.077
Pre-pregnancy BMI	24.2 (15.1-33.5) ab	25.1 (16.1-50.5) c	29.2 (19.1-33.5) a	29.4 (18.3-48.4) bc	.001
BMI gestational	27.2 (17.0-40.7) ab	28.8 (19.0-49.7) c	32.0 (21.1-41.6) a	33.2 (22.9-49.5) bc	.002
Weight gain (kg)	7.0 (2.0-29.0)	8.0 (0.0-20.0)	6 (0.0-21.0)	7.5 (0.0-22.0)	.519
Fasting (mg/dl)	74.5 (52.0-90.0) ab	73.0 (45.0-91.0) cd	94.0 (80.0-146.0) bd	91.5 (70.0-131.0) ac	.000
OGTT-75g fasting (mg/dl)	69.0 (48.0-89.0) ab	72.0 (52.0-82.0) cd	90.0 (60.0-109.0) bd	89.5 (62.0-127.0) ac	.000
OGTT-75g 1 h (mg/dl)	96.0 (50.0-158.0) ab	113.5 (77.0-147.0) cd	124.0 (19.0-158.0) bd	164.5 (72.0-258.0) ac	.000
OGTT-75g 2 h (mg/dl)	89.0 (38.0-137.0) ab	98.0 (49.0-139.0) cd	120.0 (19.0-137.0) bd	146.0 (87.0-252.0) ac	.000

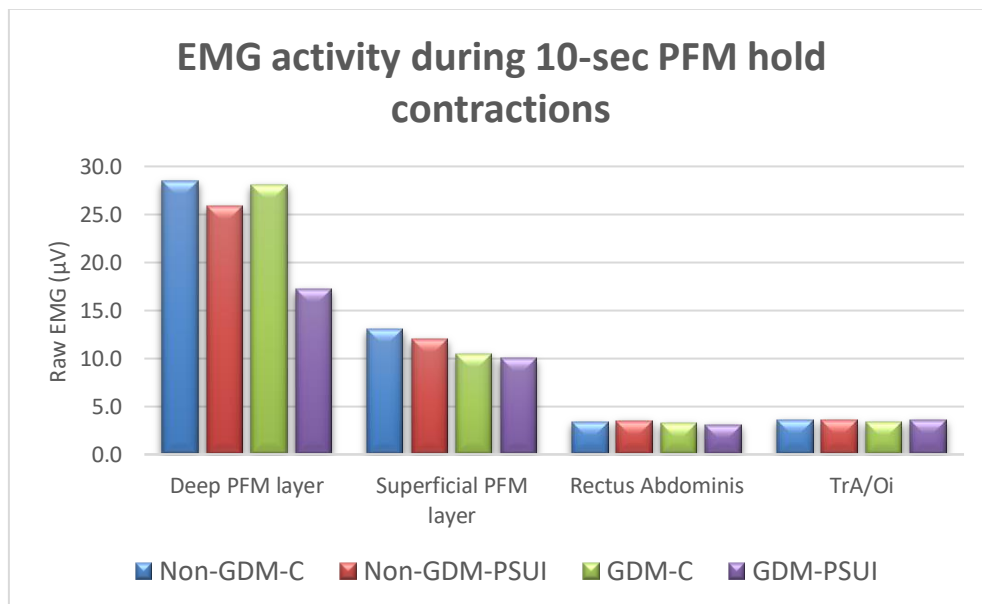
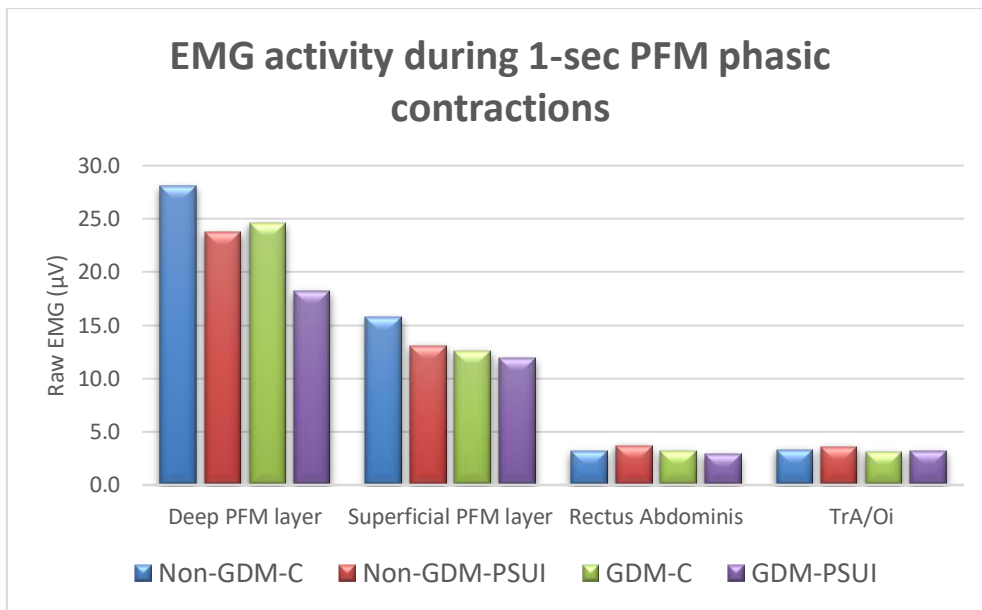
n: Sample; BMI: Body mass index; kg: Kilograms; OGTT-75g: Oral glucose tolerance test of 75 g; same letters represent post hoc differences; Kruskal-Wallis test, followed by Dunn's multiple comparisons and chi-square test. Non-GDM-C: Non-gestational diabetes mellitus continent group; Non-GDM-PSUI: Non-gestational diabetes mellitus incontinent group; GDM-C: Gestational diabetes mellitus continent group; GDM-PSUI: Gestational diabetes mellitus incontinent group; $p < 0.05$ indicates significant difference among the four groups.

Table 2. Raw values of the mean electromyographic activity of the deep and superficial PFM, rectus, and transversus abdominis muscles during the five fast contractions and the five slow contractions (10 seconds) of the Glazer protocol.

	Non-GDM-C (n= 40)	Non-GDM-PSUI (n= 44)	GDM-C (n= 40)	GDM-PSUI (n= 42)	p-value
Activation during 1-sec phasic PFM contraction					
Deep PFM layer	28.1 (13.4-91.9) a	23.8 (10.4-72.9)	24.6 (10.8-63.4)	18.2 (9.3-105.4) a	.024
Superficial PFM layer	15.7 (2.7-43.3)	13.1 (2.7-31.3)	12.6 (2.6-35.1)	11.9 (2.7-37.0)	.061
Rectus Abdominis	3.2 (2.3-9.6)	3.7 (2.3-19.6)	3.2 (1.7-8.5)	2.9 (2.2-10.1)	.402
TrA/Oi	3.3 (2.2-13.1)	3.6 (2.2-16.1)	3.1 (1.9-8.4)	3.2 (1.8-8.8)	.363
Activation during 10-sec hold PFM contraction					
Deep PFM layer	28.4 (12.5-100.0) a	25.9 (9.5-79.0)	28.1 (10.4-64.7)	17.2 (9.0-136.5) a	.039
Superficial PFM layer	13.0 (2.6-57.6)	12.0 (2.6-38.6)	10.5 (2.7-27.2)	10.0 (3.0-37.2)	.069
Rectus Abdominis	3.4 (2.2-9.7)	3.5 (2.2-20.7)	3.2 (1.8-8.6)	3.1 (2.3-9.8)	.569
TrA/Oi	3.6 (2.0-12.9)	3.6 (2.0-16.9)	3.4 (1.9-7.6)	3.6 (1.9-16.0)	.380

n: Sample; Non-GDM-C: Non-gestational diabetes mellitus continent group; Non-GDM-PSUI: Non-gestational diabetes mellitus incontinent group; GDM-C: Gestational diabetes mellitus continent group; GDM-PSUI: Gestational diabetes mellitus incontinent group; PFM: Pelvic floor muscles; sec: Seconds; TrA/Oi: Transversus abdominis/obliquus internus abdominis; same letters and symbols indicate differences detected by post hoc (Bonferroni) contrasts test; Kruskal-Wallis test, followed by Dunn's multiple comparisons and chi-square test $p < 0.05$ indicates significant difference among the four groups.

Figure 2 represents each analyzed muscle's average activity during fast and slow PFM contractions. From the highest to the lowest level of electromyographic activity, the deep PFM are more recruited, followed by the superficial ones. RAM and TRA/O present activity levels compatible with values close to the resting state.



Discussion

The results in this study suggest that the deep PFM muscles in the GDM-PSUI group activated less compared to the non-DMG-C group during 1-sec phasic contraction and 10-sec hold contractions. Furthermore, we found those significant changes in PFM recruitment during fast and hold contraction in the GDM-PSUI group, which had decreased function during pregnancy. This recruitment behavior may suggest that GDM contributes to changes in PFM activity during contractions. PFM hold contractions are essential as those muscles are involved in postural stability, intra-abdominal pressure maintenance, and pelvic organ mechanical support (41).

As demonstrated in previous clinical and experimental studies, hyperglycemia has been associated with muscle injury and impaired PFM function during and after pregnancy (42-45). Skeletal muscle insulin resistance is a critical feature in pregnancies complicated by preexisting maternal obesity or GDM (46, 47). Pregnancy is also associated with a progressive rise in intra-abdominal pressure, and GDM pregnancies complicated by fetal macrosomia contribute to an intense increase in maternal intra-abdominal pressure (48). A previous study showed that PFM electromyography activity in GDM pregnant decreased compared to the control group, which is consistent with our results (49).

Decreased PFM activity in GDM could predispose pregnant women to develop PFMD, consistent with a clinical study showing that women diagnosed with GDM presented higher urinary incontinence rates and PFMD even two years postpartum (18). In addition, the decrement of PFM activity can be difficult to

adjust recruitment for challenging functions because women with symptoms of PFMD show delayed PFM contractions in response to increased intra-abdominal pressure. That suggests such delay is possibly influenced by insufficient preparatory recruitment transitioning from rest-activity to functional PFM activity (50).

Our findings showed a statistically significant, substantial difference in functionality evaluated by EMG between women during pregnancy. PFM activity depends on body positions, and the level of background muscle activity increases in standing (51, 52). This study examined PFM activity in the supine position with a bent knee and hip joints. A previous study evaluated pelvic floor muscle training performed in the supine, standing, and sitting positions, and the supine position provided the most excellent training benefits (53).

The muscle activation degree estimation is one of the most common applications of EMG recordings. The interpretation of PFM's EMG is usually limited to raw signal inspection and timing of activation based on normal electromyographic patterns (54). It enables the identification of out-of-phase or absence of contraction, such as co-contraction and spasticity (55-57). The EMG profile during contraction must consider both the timing and relative amplitude of the EMG signal representation (58). EMG signal amplitude could improve the interpretation by adding an additional dimension related to muscle strength to the activation timing (59).

The purpose of EMG amplitude normalization is to enable comparisons between participants, muscles, measurement sessions, or electrode positions by accounting for features that would influence the EMG signal amplitude and thus

alter the nature of its relationship to muscle activation (60). Unfortunately, for any recording situation, it is generally not possible to quantify the contribution of each of these factors to variation in EMG amplitude. This makes it difficult to interpret the absolute value of the EMG signal amplitude (61).

The normalized EMG amplitude value provides information on the degree of muscle activation in a specific task context, expressed relative to a reference value used for normalization. Various normalization methods have been described (60, 62), such as the reference to a maximal voluntary contraction (MVC), sub-maximal voluntary contraction, or peak/mean during a task. Normalization to an MVC is commonly used because it is generally repeatable and provides a reference value that can be interpreted easily – that is, relative to the maximum possible activation of the muscle (60, 63). However, this is not always possible and may not be the best method for some of the required analyses (64). Although some methods have been reported as reliable (65-67) and give similar values between sessions, this does not ensure that the normalized EMG amplitude value enables a valid comparison of the level of muscle activation for a specific application or research question (61).

We performed the EMG analysis with the raw signal without normalization. Our purpose was to verify how much the PFM deep, superficial, RAM and TrA/Oi activated, and we asked for demand only for PFM activity. PFM normalization without the abdominal muscles would result in inconsistent data, leading us to miss the possibility of analyzing the coactivation between all musculature for which we aimed.

Oleksy et al. (2020) examined the bioelectrical activity of the PFM of 96 healthy, young, nulliparous women and obtained normative values among a large

group. This study was the first to report normative values for all Glazer Protocol phases with raw EMG values. Therefore, those EMG values may be considered typical for healthy pelvic floor muscles and are a reference for any PFM dysfunctions (68).

A previous study by Silva et al. (2016) analyzed the co-activation of PFM and TrA/OI and discovered significantly increased PFM electrical activity following training when MVC of TrA/OI was required. On the other hand, the same study did not find any significant co-activation of TrA during the MVC of PFM (69). Equivalent results were presented by Perschers et al. (2001) (70). Some factors could influence muscle synergy, such as assessment positioning, which is typically different than the adopted position of daily activities, as well as the influence of posture in the order of muscular activation, also cited by Madill (2009) (71), and that corroborates of our findings. One of the hypotheses to explain that fact is the TrA contraction maintenance solicitation during exercise execution, not unlike what we did in our protocol, which favors co-activation of PFM.

Additionally, the women evaluated in those studies were nulliparous (68). Especially in nulliparous young women, Pereira et al. (2013) (72) found significant co-activation of both TrA/OI and PFM when MVC was solicited to both. However, there was no co-activation in pregnant and puerperal women, suggesting the existence of pregnancy-related factors that influence the behavior of those muscles.

Conclusion

We found the same methodological limitation to our conclusions, so the subsequent studies must provide more information on its data. In conclusion, the results of this study show that the GDM group presents progressive decreased EMG-PFM activity contractions. On the other hand, RAM and TrA/Oi seem to remain in a state of rest.

This study was the first to directly show changes in PFM, RAM, and TrA/Oi during GDM-complicated pregnancy. This investigation contributes to understanding PFM and abdominal muscle recruitment in GDM women with PSUI. In addition, it may serve clinicians as a reference point allowing for a quick and specific interpretation of PFM, RAM, and TrA/Oi assessments.

References

1. Pool-Goudzwaard AL, Vleeming A, Stoeckart R, et al. Insufficient lumbopelvic stability: a clinical, anatomical and biomechanical approach to 'a-specific' low back pain. *Man Ther* 1998;3:12–20.
2. Vleeming A, Stoeckart R, Volkers AC, et al. Relation between form and function in the sacroiliac joint. Part I: clinical anatomical aspects. *Spine* 1990;15:130–2.
3. Barbosa AMP, Enriquez EMA, Rodrigues MRK, Prudencio CB, Atallah ÁN, Reyes DRA, Hallur RLS, Nunes SK, Pinheiro FA, Filho CIS, Andrade GLP, Berghmans B, Bie R, Lima SAM, Rudge MVC; Diamater Study Group. Effectiveness of the pelvic floor muscle training on muscular dysfunction and pregnancy specific urinary incontinence in pregnant women with gestational diabetes mellitus: A systematic review protocol. *PLoS One*. 2020 Dec 7;15(12):e0241962. doi: 10.1371/journal.pone.0241962. PMID: 33284811; PMCID: PMC7721159.
4. Assis LC, Barbosa AMP, Santini ACM, Vianna LS, Bernardes JM, Dias A. Effectiveness of an illustrated home exercise guide on promoting urinary continence during pregnancy: a pragmatic randomized clinical trial. *Rev Bras Ginecol Obstet*. 2015 ;37:460–466.
5. Ashton-Miller JA, DeLancey JO. Functional anatomy of the female pelvic floor. *Ann N Y Acad Sci*. 2007 Apr;1101:266-96. doi: 10.1196/annals.1389.034. Epub 2007 Apr 7. PMID: 17416924.
6. Fredon F, Hardy J, Germain M, Vincent-Viry E, Taïbi A, Monteil J, Mabit C, Valleix D, Durand-Fontanier S. Correlations of the rectus abdominis muscle anatomy with anthropometric measurements. *Surg Radiol Anat*. 2021 Apr;43(4):589-593. doi: 10.1007/s00276-020-02655-9. Epub 2021 Jan 5. PMID: 33399920.
7. Bump RC, Mattiasson A, Bø K, Brubaker LP, DeLancey JOL, Klarskov P, Shull BL, Smith ARB. 1996. The standardization of terminology of female pelvic organ prolapse and pelvic floor dysfunction. *Am J Obstet Gynecol* 175:10–7.
8. Burgio KL, Robinson JC, Engel BT. 1986. The role of biofeedback in Kegel exercise training for stress urinary incontinence. *Am J Obstet Gynecol* 154:58–64.
9. Bø K, Kvarstein B, Hagen RR, Larsen S. 1990. Pelvic floor muscle exercise for the treatment of female stress urinary incontinence. 2. Validity of vaginal pressure measurements of pelvic floor muscle strength and the necessity of supplemental methods for control of correct contraction. *Neurourol Urodynam* 9:479–87.

10. Bø K. Techniques. In: Schussler B, Laycock J, Norton P, Stanton S, editors. *Pelvic floor re-education: principles and practice*. London: Springer-Verlag; 1994. p 134–9.
11. Richardson C, Jull G, Hodges P, Hides J. 1999. Therapeutic exercise for spinal segmental stabilization in low back pain. Edinburgh: Churchill-Livingstone.
12. Hemborg B, Moritz M, Lowing H. 1985. Intra-abdominal pressure and trunk activity during lifting. *Scand J Rehabil Med* 17:25–38.
13. American Diabetes A. 2. Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes-2020. *Diab Care* 2020;43(Suppl 1):S14–S31.
14. Whiting DR, Guariguata L, Weil C, Shaw J. IDF diabetes atlas: global estimates of the prevalence of diabetes for 2011 and 2030. *Diabetes Res Clin Pract* 2011;94(3):311–21.
15. Varner MW, Rice MM, Landon MB, Casey BM, Reddy UM, Wapner RJ, et al. Pregnancies After the Diagnosis of Mild Gestational Diabetes Mellitus and Risk of Cardiometabolic Disorders. *Obstet Gynecol* 2017;129(2):273–80.
16. Sacks DA, Black MH, Li X, Montoro MN, Lawrence JM. Adverse Pregnancy Outcomes Using The International Association of the Diabetes and Pregnancy Study Groups Criteria: Glycemic Thresholds and Associated Risks. *Obstet Gynecol* 2015;126 (1):67–73.
17. Chuang CM, Lin IF, Horng HC, Hsiao YH, Shyu IL, Chou P. The impact of gestational diabetes mellitus on postpartum urinary incontinence: a longitudinal cohort study on singleton pregnancies. *BJOG Int J Obstet Gynaecol* 2012;119 (11):1334–43.
18. 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* 2011;66 (8):1341–6.
19. Kim C, McEwen LN, Sarma AV, Piette JD, Herman WH. Stress urinary incontinence in women with a history of gestational diabetes mellitus. *J Women's Health* 2008;17(5):783–92.
20. Park SW, Goodpaster BH, Strotmeyer ES, de Rekeneire N, Harris TB, Schwartz AV, et al. Decreased muscle strength and quality in older adults with type 2 diabetes: the health, aging, and body composition study. *Diabetes* 2006;55(6):1813–8.
21. Hernandez-Ochoa EO, Vanegas C. Diabetic Myopathy and Mechanisms of Disease. *Biochem Pharmacol Open Access* 2015;4(5). 10 diabetes research and clinical practice 166 (2020) 108315.

22. Krause MP, Riddell MC, Gordon CS, Imam SA, Cafarelli E, Hawke TJ. Diabetic myopathy differs between Ins2Akita+/- and streptozotocin-induced Type 1 diabetic models. *J Appl Physiol* 2009;106(5):1650–9.
23. Abrams P, Cardozo L, Fall M, et al, Standardisation Sub-committee of the International Continence Society. The standardisation of terminology of lower urinary tract function: report from the Standardisation Sub-committee of the International Continence Society. *Neurourol Urodyn* 2002;21:167-78. doi:10.1002/nau.10052
24. Hagen S, Elders A, Stratton S, Sergenson N, Bugge C, Dean S, Hay-Smith J, Kilonzo M, Dimitrova M, Abdel-Fattah M, Agur W, Booth J, Glazener C, Guerrero K, McDonald A, Norrie J, Williams LR, McClurg D. Effectiveness of pelvic floor muscle training with and without electromyographic biofeedback for urinary incontinence in women: multicentre randomised controlled trial. *BMJ*. 2020 Oct 14;371:m3719. doi: 10.1136/bmj.m3719. PMID: 33055247; PMCID: PMC7555069.
25. Subak LL, Goode PS, Brubaker L, Kusek JW, Schembri M, Lukacz ES, et al. Urinary incontinence management costs are reduced following Burch or sling surgery for stress incontinence. *Am J Obstet Gynecol* 2014;211(2):e1–7.
26. Pullman SL, Goodin DS, Marquinez AI, Tabbal S, Rubin M. Clinical utility of surface EMG: report of the therapeutics and technology assessment subcommittee of the American Academy of Neurology. *Neurology*. 2000;25, 55:171–177. <https://doi.org/10.1212/wnl.55.2.171> PMID: 10908886.
27. Resende AP, Petricelli CD, Bernardes BT, Alexandre SM, Nakamura MU, Zanetti MR. Electromyographic evaluation of pelvic floor muscles in pregnant and nonpregnant women. *Int Urogynecol J*. 2012; 23(8):1041–1045. <https://doi.org/10.1007/s00192-012-1702-6> PMID: 22415702.
28. Zhang Q, Wang L, Zheng W. Surface electromyography of pelvic floor muscles in stress urinary incontinence. *Int J Gynaecol Obstet*. 2006; 95(2):177–178. <https://doi.org/10.1016/j.ijgo.2006.07.006> PMID: 16920119.
29. Hacad CR, Glazer HI, Zambon JP, Burti JS, Almeida FG. Is there any change in pelvic floor electromyography during the first 6 months after radical retropubic prostatectomy? *Appl Psychophysiol Biofeedback*. 2015; 40(1):9–15. <https://doi.org/10.1007/s10484-015-9271-3> PMID: 25735504.
30. Vodusek DB. The role of electrophysiology in the evaluation of incontinence and prolapse. *Curr Opin Obstet Gynecol*. 2002; 14(5):509–514. <https://doi.org/10.1097/00001703-200210000-00012> PMID: 12401980.
31. Haslam J. (2008). “Biofeedback” in therapeutic management of incontinence and pelvic pain: pelvic organ disorders (2nd ed.). eds Haslam J. & Laycock J. (London: Springer-Verlag Ltd), 105–110.

32. American Diabetes A. Diagnosis and classification of diabetes mellitus. *Diabetes care*. 2011; 34 Suppl 1:S62–9. <https://doi.org/10.2337/dc11-S062> PMID: 21193628.
33. International Association of D, Pregnancy Study Groups Consensus P, Metzger E, Gabbe SG, Persson B, Buchanan TA, et al. International association of diabetes and pregnancy study groups recommendations on the diagnosis and classification of hyperglycemia in pregnancy. *Diabetes care*. 2010; 33 (3):676–82. <https://doi.org/10.2337/dc09-1848> PMID: 20190296.
34. Henderson JW, Wang S, Egger MJ, Masters M, Nygaard I. Can Women Correctly Contract Their Pelvic Floor Muscles Without Formal Instruction? *Female Pelvic Med Reconstr Surg*. 2013;19: 8–12. PMID:23321652.
35. Friedman S, Blomquist JL, Nugent JM, McDermott KC, Muñoz A, Handa VL. Pelvic muscle strength after childbirth. *Obstet Gynecol*. 2012;120: 1021–8. PMID:23090518
36. Moretti E, de Moura Filho AG, de Almeida JC, Araujo CM, Lemos A. Electromyographic assessment of women's pelvic floor: What is the best place for a superficial sensor? *Neurourol Urodyn*. 2017 Sep;36(7):1917-1923. doi: 10.1002/nau.23212. Epub 2017 Feb 21. PMID: 28220534.
37. Sapsford RR, Hodges PW, Richardson CA, Cooper DH, Markwell SJ, Jull GA. Co-activation of the abdominal and pelvic floor muscles during voluntary exercises. *Neurourol Urodyn*. 2001;20(1):31-42. doi: 10.1002/1520-6777(2001)20:1<31::aid-nau5>3.0.co;2-p. PMID: 11135380.
38. Neumann P, Gill V. Pelvic floor and abdominal muscle interaction: EMG activity and intra-abdominal pressure. *Int Urogynecol J Pelvic Floor Dysfunct* 2002;13:125–32.
39. Glazer HI, Rodke G, Swencionis C, et al. Treatment of vulvar vestibulitis syndrome with electromyographic biofeedback of pelvic floor musculature. *J Reprod Med* 1995;40:283–90.
40. Glazer HI, Hacad CR. The Glazer Protocol: evidence-based medicine pelvic floor muscle (PFM) surface electromyography (SEMG). *Biofeedback* 2012;40:75–9.
41. Haylen BT, Maher CF, Barber MD, Camargo S, Dandolu V, Digesu A, et al. Erratum to: An International Urogynecological Association (IUGA) / International Continence Society (ICS) joint report on the terminology for female pelvic organ prolapse (POP). *Int Urogynecol J*. 2016; 27: 655–684. <https://doi.org/10.1007/s00192-016-3003-y> PMID: 26984443
42. Vesentini G, Marini G, Piculo F, et al. Morphological changes in rat rectus abdominis muscle induced by diabetes and pregnancy. *Brazilian J Med Biol Res*. 2018;51(4):e7035. <https://doi.org/10.1590/1414-431x20177035>

43. Piculo F, Marini G, Barbosa AMP, et al. Urethral striated muscle and extracellular matrix morphological characteristics among mildly diabetic pregnant rats: translational approach. *Int Urogynecol J*. 2014;25(3):403-415. <https://doi.org/10.1007/s00192-013-2218-4>
44. Marini G, Pascon Barbosa AM, Damasceno DC, et al. Morphological changes in the fast vs slow fiber profiles of the urethras of diabetic pregnant rats. *Urogynaecologia*. 2011;25(1): 31. <https://doi.org/10.4081/uij.2011.e9>
45. Marini G, Piculo F, Vesentini G, et al. Effects of short-term severe and long-term mild STZ-induced diabetes in urethral tissue of female rats. *Neurourol Urodyn*. 2016;36(3):574-579. <https://doi.org/10.1002/nau.22974>
46. Friedman JE, Ishizuka T, Shao J, Huston L, Highman T, Catalano P. Impaired glucose transport and insulin receptor tyrosine phosphorylation in skeletal muscle from obese women with gestational diabetes. *Diabetes*. 1999;48(9):1807-1814. <https://doi.org/10.2337/diabetes.48.9.1807>
47. Colomiere M, Permezel M, Lappas M. Diabetes and obesity during pregnancy alter insulin signalling and glucose transporter expression in maternal skeletal muscle subcutaneous adipose tissue. *J Mol Endocrinol*. 2010;44(4): 213-223. <https://doi.org/10.1677/JME-09-0091>
48. Hoffman B, Schorge J, Schaffer J. *Obstetricia de Williams*. 23rd ed. Hill M, editor. Artmed; 2013.
49. Prudencio CB, Rudge MVC, Pinheiro FA, Sartorão Filho CI, Nunes SK, Pedroni CR, Junginger B, Barbosa AMP. Negative impact of gestational diabetes mellitus on progress of pelvic floor muscle electromyography activity: Cohort study. *PLoS One*. 2019 Nov 7;14(11):e0223261. doi: 10.1371/journal.pone.0223261. PMID: 31697712; PMCID: PMC6857854.
50. Smith MD, Coppieters 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*. 2007; 18: 901–911. <https://doi.org/10.1007/s00192-006-0259-7> PMID: 17139463
51. Chmielewska D, Stania M, Sobota G, Kwaśna K, Błaszczak E, Taradaj J, et al. Impact of different body positions on bioelectrical activity of the pelvic floor muscles in nulliparous continent women. *Biomed Res Int*. 2015;2015:905897. pmid:25793212
52. Lee K. Investigation of Electromyographic Activity of Pelvic Floor Muscles in Different Body Positions to Prevent Urinary Incontinence. *Med Sci Monit*. 2019; 25: 9357–63. pmid:31813929
53. Liu YJ, Wu WY, Hsiao SM, Ting SW, Hsu HP, Huang CM. Efficacy of pelvic floor training with surface electromyography feedback for female stress urinary incontinence. *Int J Nurs Pract*. 2018 Dec;24(6):e12698. doi: 10.1111/ijn.12698. Epub 2018 Sep 14. PMID: 30215876.

54. V. Agostini, A. Nascimbeni, A. Gaffuri, P. Imazio, M.G. Benedetti, M. Knaflitz, Normative EMG activation patterns of school-age children during gait, *Gait Posture* 32 (2010) 285–289.
55. H.Y. Chen, S.C. Chen, J.J. Chen, L.L. Fu, Y.L. Wang, Kinesiological and kinematical analysis for stroke subjects with asymmetrical cycling movement patterns, *J. Electromyogr. Kinesiol.* 15 (2005) 587–595.
56. R.T. Lauer, C.A. Stackhouse, P.A. Shewokis, B.T. Smith, C.A. Tucker, J. McCarthy, A time-frequency based electromyographic analysis technique for use in cerebral palsy, *Gait Posture* 26 (2007) 420–427.
57. A. Lamontagne, F. Malouin, C.L. Richards, F. Dumas, Mechanisms of disturbed motor control in ankle weakness during gait after stroke, *Gait Posture* 15 (2002) 244–255.
58. R.A. Bogey, L.A. Barnes, J. Perry, Computer algorithms to characterize individual subject EMG profiles during gait, *Arch. Phys. Med. Rehabil.* 73 (1992) 835–841.
59. E.P. Ravera, P.A. Catalfamo, M.J. Crespo, A.A.A. Braidot, Electromyography as an important parameter for a proper assessment of dynamic muscles strength in gait analysis, *Am. J. Biomed. Eng.* 2 (2012) 269–277.
60. Burden, A. How should we normalize electromyograms obtained from healthy participants? What we have learned from over 25 years of research. *J Electromyogr Kinesiol.*, 20(6) (2010), pp.1023-35.
61. Besomi M, Hodges PW, Clancy EA, Van Dieën J, Hug F, Lowery M, Merletti R, Søgaard K, Wrigley T, Besier T, Carson RG, Disselhorst-Klug C, Enoka RM, Falla D, Farina D, Gandevia S, Holobar A, Kiernan MC, McGill K, Perreault E, Rothwell JC, Tucker K. Consensus for experimental design in electromyography (CEDE) project: Amplitude normalization matrix. *J Electromyogr Kinesiol.* 2020 Aug;53:102438. doi: 10.1016/j.jelekin.2020.102438. Epub 2020 Jun 10. PMID: 32569878.
62. Merlo, A., Campanini, I. Applications in Movement and Gait Analysis. In: Merletti, R., Farina, D., editors. *Surface Electromyography: Physiology, Engineering, and Applications.* (2016), Chapter 16: p.440-59.
63. Bolgla, L. A., & Uhl, T. L. Reliability of electromyographic normalization methods for evaluating the hip musculature. *J Electromyogr Kinesiol.*, 17(1) (2007), pp.102-11.
64. Hug, F., & Tucker, K. Surface Electromyography to Study Muscle Coordination. In B. Müller, S. I. Wolf, G.-P. Brueggemann, Z. Deng, A. McIntosh, F. Miller, & W. S. Selbie (Eds.). *Handbook of Human Motion* (2017), pp. 1-21. Cham: Springer International Publishing.
65. Albertus-Kajee, Y., Tucker, R., Derman, W., Lamberts, R. P., & Lambert, M. I. Alternative methods of normalising EMG during running. *J Electromyogr Kinesiol.*, 21(4) (2011), pp.579-86.

66. Murley, G. S., Menz, H. B., Landorf, K. B., & Bird, A. R. Reliability of lower limb electromyography during overground walking: a comparison of maximal- and submaximal normalisation techniques. *J Biomech.*, 43(4) (2010), pp.749-56.
67. Tabard-Fougere, A., Rose-Dulcina, K., Pittet, V., Dayer, R., Vuillerme, N., & Armand, S. EMG normalization method based on grade 3 of manual muscle testing: Within- and between-day reliability of normalization tasks and application to gait analysis. *Gait Posture.*, 60 (2018), pp.6-12.
68. Oleksy Ł, Wojciechowska M, Mika A, Antos E, Bylina D, Kielnar R, Pruszczyński B, Stolarczyk A. Normative values for Glazer Protocol in the evaluation of pelvic floor muscle bioelectrical activity. *Medicine (Baltimore)*. 2020 Jan;99(5):e19060. doi: 10.1097/MD.00000000000019060. PMID: 32000454; PMCID: PMC7004594.
69. Silva VR, Riccetto CL, Martinho NM, Marques J, Carvalho LC, Botelho S. Training through gametherapy promotes coactivation of the pelvic floor and abdominal muscles in young women, nulliparous and continents. *Int Braz J Urol.* 2016 Jul-Aug;42(4):779-86. doi: 10.1590/S1677-5538.IBJU.2014.0580. PMID: 27564290; PMCID: PMC5006775.
70. Peschers UM, Gingelmaier A, Jundt K, Leib B, Dimpfl T. Evaluation of pelvic floor muscle strength using four different techniques. *Int Urogynecol J Pelvic Floor Dysfunct.* 2001;12:27-30.
71. Madill SJ, Harvey MA, McLean L. Women with SUI demonstrate motor control differences during voluntary pelvic floor muscle contractions. *Int Urogynecol J Pelvic Floor Dysfunct.* 2009;20:447-59.
72. Pereira LC, Botelho S, Marques J, Amorim CF, Lanza AH, Palma P, et al. Are transversus abdominis/oblique internal and pelvic floor muscles coactivated during pregnancy and postpartum? *Neurourol Urodyn.* 2013;32:416-9.

Seção 5

Perspectivas Acadêmicas e Científicas

O cumprimento desta etapa, que exigiu extenso trabalho e dura dedicação, me fortaleceu e ampliou a perspectiva de iniciar e progredir ainda mais na carreira da docência e pesquisa. Hoje, não seria capaz de performar em sala de aula com qualidade sem toda a bagagem que a pós-graduação me acrescentou, e claro, sem todo o ensinamento que obtive com a professora Angélica sobre como ser uma professora que repassa todo o seu conhecimento técnico com muita ética, carinho e atenção. Essa é a experiência mais rica que o desenvolvimento do mestrado e do doutorado me trouxeram, e honestamente, a que levo com mais carinho dentro do meu coração.

Para a continuidade da busca do conhecimento e na colaboração para melhorar a assistência à saúde da mulher, a proposta é permanecer como colaboradora do *Diamater Study Group* e desenvolver o Pós-Doutorado na mesma linha de pesquisa desta trajetória e continuar colaborando no desenvolvimento dos artigos para a publicação de todas as respostas que obtivemos ao longo desses anos.

Dar continuidade a carreira docente na instituição que leciono atualmente, é meu principal objetivo, mas tenho participado de editais de seleção de concursos em instituições públicas para que futuramente consiga ingressar em um corpo docente como professora titular.

Espero poder levar o conhecimento e principalmente beneficiar todos os alunos e mulheres que cruzarem o meu caminho ao longo desta nova etapa da minha vida.

Seção 6

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Ms. Raissa Escandiusi Avramidis
Ms. Guilherme Thomaz de Aquino Nava
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Ms. Luiz Takano
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Seção 7

Anexos

Anexo 1 - Eventos Internacionais



CERTIFICATE



The **American Chemical Society (ACS)** - through the **ACS Publications Division**, and the **State University of Campinas** - through the **Unicamp Libraries (SBU)**, certify that **Sthefanie Kenickel Nunes** participated in the event “*Latin American Seminar on Open Science and Open Access*”, held in March 2nd and 3rd, 2021, with 04 (four) hours of total duration.




Regiane Bracchi
ACS Publications Manager
Brazil



Certificate of Attendance

17 February 2022

To Whom It May Concern

Certificate of Attendance

This is to certify that Sthefanie Kenickel Nunes, São Paulo State University, Brazil attended the following webinars which were part of the ‘Diabetes and Obesity in Pregnancy: From Patients to Molecular Mechanisms’ webinar series:

- Obesity Inflammasome as a Risk for Developing Gestational Diabetes – 27 April 2021
- Placental Adaptation in Gestational Diabetes and Obesity – 25 May 2021

Yours faithfully

Dr Catherine Hall
Chair, Conferences Committee
The Physiological Society, UK

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CERTIFICADO

O Diretor Geral, no uso de suas atribuições, confere o presente certificado a

STHEFANIE KENICKEL NUNES

Por ter participado como congressista do 4º CONGRESSO INTERNACIONAL / INSPIRAR DE FISIOTERAPIA PÉLVICA realizado em Belo Horizonte/MG, no dia 22 à 24 de abril de 2016, com carga horária total de 16 horas.

Curitiba, 24 de abril de 2016.

Prof. MSC Marcelo Marcio Xavier
 Prof. MSC Marcelo Marcio Xavier
 Diretor Geral

Dra. Maura Regina Setemo
 Dra. Maura Regina Setemo
 Presidente do Congresso




44th Annual Meeting of the International Continence Society
 20-24 October 2014, Rio de Janeiro, Brazil

CME/CPD Certificate

This is to certify that

Sthefanie Kenickel Nunes
(first, last name, degree)

participated in the

44th Annual Meeting of the International Continence Society
 Rio de Janeiro, Brazil
 October 20-24, 2014

and received 24 credits
(credits obtained)

Carlos D'Ancoia
 Carlos D'Ancoia
 Annual Meeting Chair
 ICS 2014 Rio de Janeiro

Nicolas Lemos
 Nicolas Lemos
 Scientific Chair
 ICS 2014 Rio de Janeiro

European Accreditation Council for Continuing Medical Education (EACCME)
 The 44th Annual Meeting of the International Continence Society is accredited by the European Accreditation Council for Continuing Medical Education (EACCME) to provide the following CME activity for medical specialists. The EACCME is an institution of the European Union of Medical Specialists (UEMS). www.uems.net

The 44th Annual Meeting of the International Continence Society is designated for a maximum of, or up to, 27 European external CME credits. Each medical specialist should claim only those hours of credit that he/she actually spent in the educational activity.

American Medical Association (AMA)
 Through an agreement between the European Union of Medical Specialists and the American Medical Association, physicians may convert EACCME credits to an equivalent number of AMA PRA Category 1 Credits™. Information on the process to convert EACCME credit to AMA credit can be found at www.ama-assn.org/go/continuingeducation.

Royal College of Physicians and Surgeons of Canada
 Live educational activities, occurring outside of Canada, recognized by the UEMS-EACCME, for ECMEC credits are deemed to be Accredited (Class Learning Activities (Section 1)) as defined by the Maintenance of Certification Program of The Royal College of Physicians and Surgeons of Canada. For more information, visit www.royalcollege.ca.

www.ics.org/2014

Anexo 2 - Cursos complementares



DISQUE
SAÚDE
136



CERTIFICADO


Certificamos que *Sthefanie Kenickel Nunes* concluiu o curso

"Prática Clínica Baseada em Evidências e o contexto da pesquisa clínica"

do Projeto Pesquisa Clínica, produzido pelo Hospital Moinhos de Vento

O curso foi disponibilizado no formato de ensino a distância com carga horária de 4 horas.

Porto Alegre, 18 de Maio de 2021.


Dr. Regis Goulart Rosa
Responsável Técnico
Projeto Pesquisa Clínica


Luis Eduardo Ramos Mariath
Superintendente de Responsabilidade Social
do Hospital Moinhos de Vento

CERTIFICADO

Sthefanie Kenickel Nunes

Participou do **I - MINI CURSO ON-LINE DE ULTRASSONOGRRAFIA NA REABILITAÇÃO DA DIÁSTASE ABDOMINAL**, ministrado pela professora **NATÁLIA MARTINHO**, realizado no dia 6 de junho de 2020, com carga horária de 3 horas/aula.

Brasil, 6 de junho de 2020.





Organização UROFISIO – Registro 003002
Fernanda Pacheco CREFITO2: 109096F





Anexo 3 - Artigos publicados em periódicos

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CLINICAL ARTICLE

Urology Dynamics | ICS | WILEY

Pelvic floor muscle dysfunction at 3D transperineal ultrasound in maternal exposure to gestational diabetes mellitus: A prospective cohort study during pregnancy

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01743-5, 2021/10665-6

Abstract

Aim: This study aimed to assess, for the first time, the dynamic morphometry of pelvic floor muscles (PFM) using three-dimensional transperineal ultrasound (3D-TPUS) and its progression at two-time points of gestation between women with and without gestational diabetes mellitus (GDM), and whether the PFM dysfunction is connected to GDM.

Methods: The study comprised 83 consecutive pregnant women with ($n = 38$) and without ($n = 45$) GDM screened at 24–30 and 38–40 weeks of gestation. 3D-TPUS and a mobility test were used to quantify PFM dynamic morphometry during maximum contraction and the Valsalva maneuver.

Results: When compared to the control group, GDM women had no significant variations in all levator hiatus dimensions at 24–30 weeks of gestation. Meanwhile, women with GDM experienced an increase in levator hiatus area (LHa) ($p < 0.000$) during PFM contraction and enlargement in LHa ($p < 0.001$) during Valsalva maneuver ($p = 0.010$) at 38–40 weeks of gestation.

RESEARCH ARTICLE

Alterations in the structural characteristics of rectus abdominis muscles caused by diabetes and pregnancy: A comparative study of the rat model and women

Giovana Vesentini^{1,2*}, Angélica M. P. Barbosa^{1,3}, Débora C. Damasceno², Gabriela Marini^{1,2,4}, Fernanda Piculo^{1,2}, Selma M. M. Matheus^{1,2}, Raghavendra L. S. Hallur^{1,2}, Sthefanie K. Nunes^{1,2}, Bruna B. Catinelli^{1,2}, Claudia G. Magalhães^{1,2}, Roberto Costa^{1,2}, Joelcio F. Abbade^{1,2}, José E. Corrente^{1,4}, Iracema M. P. Calderon^{1,2}, Marilza V. C. Rudge^{1,2}, The DIAMATER Study Group⁵

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† Membership of the Termita Genome Working Group is listed in the Acknowledgments.
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Data Availability Statement: All data is available at <http://hdl.handle.net/11449/150666>.

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Abstract

Background and objective

In the present study, we compared the effect of diabetic pregnancy on the rectus abdominis muscle (RAM) in humans and rats. We hypothesized that our animal model could provide valuable information about alterations in the RAM of women with Gestational Diabetes (GDM).

Method

Newborns female rats ($n = 10$ /group) were administered streptozotocin (100 mg/kg body weight) subcutaneously and were mated on reaching adulthood, to develop the mild hyperglycemic pregnant (MHP) rat model. At the end of pregnancy, the mothers were sacrificed, and the RAM tissue was collected. Pregnant women without GDM (non-GDM group; $n = 10$) and those diagnosed with GDM (GDM group; $n = 8$) and undergoing treatment were recruited, and RAM samples were obtained at C-section. The RAM architecture and the distribution of the fast and slow fibers and collagen were studied by immunohistochemistry.

Results

No statistically significant differences in the maternal and fetal characters were observed between the groups in both rats and women. However, significant changes in RAM



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Diabetes
Federation



Deleterious effects of gestational diabetes mellitus on the characteristics of the rectus abdominis muscle associated with pregnancy-specific urinary incontinence

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ABSTRACT

Aims: To evaluate the effects of gestational diabetes mellitus (GDM) on the structural characteristics of the rectus abdominis muscle (RAM) and its indirect effects on pregnancy-specific urinary incontinence (PSUI).

Methods: A total of 52 pregnant women were divided into four groups, according to their clinical conditions: non-GDM continent, non-GDM associated PSUI, GDM continent and GDM associated PSUI. The muscle morphometry (histochemistry and immunohistochemistry) for the fiber types and collagen fiber distribution, the ultrastructural analysis (transmission electron microscopy), the protein expression of fiber types and calcium signaling (Western blotting), and the content of types I and III collagen fiber (ELISA) in RAM collected at delivery were assessed.

Results: The GDM groups presented a significantly increased number of slow fibers and slow-twitch oxidative fiber expression; decreased fiber area, number of fast fibers, and area of collagen; an increase in central nuclei; ultrastructural alterations with focal lesion areas such as myeloid structures, sarcomere disorganization, and mitochondrial alteration. The

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REGISTERED REPORT PROTOCOL

Effectiveness of the pelvic floor muscle training on muscular dysfunction and pregnancy specific urinary incontinence in pregnant women with gestational diabetes mellitus: A systematic review protocol

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* These authors contributed equally to this work.

† AMPB and EMAE are first authors on this work. SAML and MVCR are last authors on this work.

§ Membership of The Diamater Study Group is listed in the Acknowledgments.

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Abstract

Background

There is ample evidence that gestational diabetes mellitus has a direct influence on urinary incontinence and pelvic floor muscles. There are no standardized pelvic floor muscle exercise programs in the literature for the physiotherapy and differ in the type of exercise, intensity, type and duration of application, and the frequency and duration of treatment sessions. The aim of this systematic review will be to investigate that Pelvic Floor Muscle Training can prevent and/or decrease the pregnancy specific urinary incontinence in women with gestational diabetes mellitus or gestational hyperglycemia.

Methods

We will perform a systematic review according to the Cochrane methodology of Randomized Controlled Trials. An overall search strategy will be developed and adapted for Embase, MEDLINE, LILACS, and CENTRAL databases, with the date of consultation until

Impact of Gestational Diabetes Mellitus on Sexual Function: A Case–Control Study

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Raghavendra L. Hallur, PhD,¹ Caroline B. Prudencio, MSc,¹ Fabiane A. Pinheiro, MSc,¹
Carlos I. Sartorão Filho, MSc, MD,¹ Jon Odland, PhD,² Iracema M.P. Calderon, PhD,¹
Angélica M.P. Barbosa, PhD,^{1,3,*} and Marilza V.C. Rudge, PhD¹

Abstract

Background: The prevalence of gestational diabetes mellitus (GDM) is increasing worldwide, and this condition may be compromising female sexual function. However, there are controversial findings regarding the impact of GDM diagnosis and proposed treatments on sexual function during pregnancy. Therefore, this study seeks to elucidate the impact of GDM on sexual function in pregnant women by making a comparison between GDM and non-GDM groups using pregnancy sexual response inventory (PSRI).

Materials and Methods: A case–control study involved 303 [168 women without GDM (control group) and 108 women diagnosed with GDM (case group)] Brazilian pregnant women at the Perinatal Diabetes Research Centre-Universidade Estadual Paulista, Brazil. PSRI was used to collect the data. The sexual function was scored in 10 domains as composite and specific scores by domains, categorized into quartiles (0 < 25 “very low,” 25 < 50 “low,” 50 < 75 “high,” and 75–100 “very high”), for “before pregnancy” and “during pregnancy.” The obtained data were subjected to statistical analysis using Student’s *t*-, *F*-, and chi-square tests.

Results: GDM women (PSRI composite score < 50) are at risk of decreased sexual function during pregnancy, while non-GDM women are not at risk (PSRI composite score > 50). There were no significant differences in the sexual functions between the two groups before pregnancy ($p > 0.0001$). After GDM diagnosis and proposed treatment, the differences were significant ($p < 0.0001$), notably in the frequency, arousal, orgasm, satisfaction, and dyspareunia score.

Conclusions: This study showed that GDM diagnosis and proposed treatment resulted in decreased sexual functions during pregnancy.

Keywords: gestational diabetes mellitus, pregnancy, pregnancy sexual response inventory

Introduction



SEXUAL FUNCTION IN PREGNANT WOMEN has been attributed to several factors such as religious, sociocultural, relationships, physical, and psychological changes. Multiple studies have reported that pregnant women may experience impaired sexual function across all phases of the female sexual response cycle.^{1,2}

Gestational diabetes mellitus (GDM), defined as impaired glucose tolerance during pregnancy, has long been suspected of causing sexual dysfunction in pregnant women³ caused by

the sudden transformation of a normal pregnancy to a high-risk pregnancy without maternal clinical symptoms.

GDM is associated with maternal and fetal risks related to diagnosis, including strict glycemic control, altered well-being and fetal growth, timely decision-making and route of delivery, and increased short- and long-term complications for mother and newborn.⁴ To reduce this risk, women with GDM should change their habits and undergo rigorous medical follow-up. It is recommended to maintain adequate and controlled diet to ensure control of weight gain, active lifestyle, continuous monitoring of glucose level, and sometimes

Impact of gestational diabetes on pelvic floor: A prospective cohort study with three-dimensional ultrasound during two-time points in pregnancy

Carlos I. Sartorão Filho^{1,2}  | Fabiane A. Pinheiro¹ | Caroline B. Prudencio¹ | Sthefanie K. Nunes¹ | Luiz Takano¹ | Eusebio M. A. Enriquez¹ | Maiara I. G. Orlandi¹ | Baerbel Junginger³ | Raghavendra L. S. Hallur¹ | Marilza V. C. Rudge¹ | Angélica M. P. Barbosa PT, PhD^{1,4} 

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²Department of Medicine, Assis Municipality Educational Foundation (FEMA), Medical School, Fundação Educacional do Município de Assis (FEMA), Assis, São Paulo, Brazil

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Correspondence

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Funding information

Fundação de Amparo à Pesquisa do Estado de São Paulo, Grant/Award Number: 2016/01743-5

Abstract

Aim: To evaluate the pelvic floor (PF) biometry using three-dimensional ultrasound (US) at two-time points of gestational in pregnant women with gestational diabetes mellitus (GDM).

Methods: A prospective cohort study conducted at the Perinatal Diabetes Research Center including 44 pregnant women with GDM and 66 pregnant women without GDM at 24 to 28 weeks of gestation. Three-dimensional transperineal US was performed at 24 to 28 and 34 to 38 weeks of gestation in the lithotomy position at rest. The axial plane of the minimal Levator hiatus dimensions was used to determine Levator ani muscle and Hiatal area (HA) biometry at 24 to 28 and 34 to 38 weeks of gestation.

Results: Of the 110 pregnant women, 100 (90.9%) completed the follow-up at 34 to 38 weeks of gestation. The evaluation by US showed a negative biometric change between the two-time points, during pregnancy in women with GDM; in the HA (β coefficient: estimative of effect in biometric progression according to GDM diagnosis, using the non-GDM group as reference = -6.76 ; $P = .020$), anteroposterior diameter ($\beta = -5.07$; $P = .019$), and Levator ani thickness ($\beta = -12.34$; $P = .005$).

Conclusions: Pregnant women with GDM had a significantly lower than expected percentage of changes in biometry of Levator ani thickness and HA from 24 to 28 to 34 to 38 weeks of gestation when compared with the group of pregnant women without GDM. GDM alters the morphology of PF structures assessed by three-

RESEARCH ARTICLE

Negative impact of gestational diabetes mellitus on progress of pelvic floor muscle electromyography activity: Cohort study

Caroline B. Prudencio^{1*}, Marilza V. C. Rudge^{1*}, Fabiane A. Pinheiro^{1‡}, Carlos I. Sartório Filho^{1‡}, Stefanie K. Nunes^{1‡}, Cristiane R. Pedroni^{2‡}, Baerbel Junginger^{3‡}, Angélica M. P. Barbosa^{1,2,3}

1 Department of Gynecology and Obstetrics, Botucatu Medical School, São Paulo State University (Unesp), Universidade Estadual Paulista (UNESP), Botucatu, São Paulo, Brazil, **2** Department of Physiotherapy and Occupational Therapy, School of Philosophy and Sciences, São Paulo State University (Unesp), Universidade Estadual Paulista (UNESP), Marília, São Paulo, Brazil, **3** Gynecology Department, Charité University Hospital, Berlin, Germany

* These authors contributed equally to this work.

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OPEN ACCESS

Citation: Prudencio CB, Rudge MVC, Pinheiro FA, Sartório Filho CI, Nunes SK, Pedroni CR, et al. (2019) Negative impact of gestational diabetes mellitus on progress of pelvic floor muscle electromyography activity: Cohort study. PLOS ONE 14(11): e0223261. <https://doi.org/10.1371/journal.pone.0223261>

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Data Availability Statement: All relevant data are within the manuscript and its Supporting Information files.

Funding: This work received a scholarship from Brazilian Federal Agency for Support and Evaluation of graduate Education/SD (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, CAPES/OS to CBP. MVCRC received financial assistance to develop the project from Sao Paulo Research Foundation protocol number 2016/

Abstract

Background and objective

Pelvic floor muscles are involved in postural stability, in maintenance intra-abdominal pressure, and on mechanical support for pelvic organ. Gestational Diabetes Mellitus' (GDM) pregnancies complicated by fetal macrosomia, large placenta and polyhydramnios contribute for abrupt and intense increase in maternal intra-abdominal pressure. Our objective was analyze the impact of GDM on pelvic floor muscle (PFM) electromyography (EMG) activity progress from 24–30 to 36–38 weeks of gestation. We conducted a prospective cohort study. PFM EMG was performed in nulliparous or primiparous women with one previous elective cesarean delivery and with or not GDM diagnosed by the American Diabetes Association criteria. A careful explanation of the muscle anatomy and functionality of the PFM was given before EMG assessment. The outcome measures were PFM recruitment and progress from 24–30 to 36–38 weeks of gestation analyzed by the normalized root mean square (RMS) during rest-activity, fast and hold pelvic floor muscle contraction.

Results

Fifty-two pregnant women were assigned to 2 groups: the GDM (n = 26) and normoglycemic (NG) (n = 26). The demographic and obstetric data showed homogeneity between the groups. PFM activity progress was decreased in rest-activity (P = 0.042) and hold contraction (P = 0.044) at 36–38 weeks of gestation in the GDM group relative to that in the NG group.

STUDY PROTOCOL

Open Access

Study protocol to investigate biomolecular muscle profile as predictors of long-term urinary incontinence in women with gestational diabetes mellitus



Marilza V. C. Rudge^{1*}, Fátima P. Souza², Joekcio F. Abbade¹, Raghavendra L. S. Hallur¹, João Paulo C. Marcondes¹, Fernanda Piculo^{1,3}, Gabriela Marini^{1,4}, Giovana Vesentini¹, Lehana Thabane^{5,6}, Steven S. Witkin^{7,8}, Iracema M. P. Calderon¹, Angélica M. P. Barbosa^{1,9}, and [The Diamater Study Group](#)

Abstract

Background: Pelvic floor muscles (PFM) and rectus abdominis muscles (RAM) of pregnant diabetic rats exhibit atrophy, co-localization of fast and slow fibers and an increased collagen type I/III ratio. However, the role of similar PFM or RAM hyperglycemic-related myopathy in women with gestational diabetes mellitus (GDM) remains poorly investigated. This study aims to assess the frequency of pelvic floor muscle disorders and pregnancy-specific urinary incontinence (PS-UI) 12 months after the Cesarean (C) section in women with GDM. Specifically, differences in PFM/RAM hyperglycemic myopathy will be evaluated.

Methods: The Diamater is an ongoing cohort study of four groups of 59 pregnant women each from the Perinatal Diabetes Research Centre (PDRC), Botucatu Medical School (FMB)-UNESP (São Paulo State University), Brazil. Diagnosis of GDM and PS-UI will be made at 24–26 weeks, with a follow-up at 34–38 weeks of gestation. Inclusion in the study will occur at the time of C-section, and patients will be followed at 24–48 h, 6 weeks and 6 and 12 months postpartum. Study groups will be classified as (1) GDM plus PS-UI; (2) GDM without PS-UI; (3) Non-GDM plus PS-UI; and (4) Non-GDM without PS-UI. We will analyze relationships between GDM, PS-UI and hyperglycemic myopathy at 12 months after C-section. The mediator variables to be evaluated include digital palpation, vaginal squeeze pressure, 3D pelvic floor ultrasound, and 3D RAM ultrasound. RAM samples obtained during C-section will be analyzed for ex-vivo contractility, morphological, molecular and OMICS profiles to further characterize the hyperglycemic myopathy. Additional variables to be evaluated include maternal age, socioeconomic status, educational level, ethnicity, body mass index, weight gain during pregnancy, quality of glycemic control and insulin therapy.

Discussion: To our knowledge, this will be the first study to provide data on the prevalence of PS-UI and RAM and PFM physical and biomolecular muscle profiles after C-section in mothers with GDM. The longitudinal design allows for the assessment of cause-effect relationships between GDM, PS-UI, and PFMs and RAMs myopathy. The findings may reveal previously undetermined consequences of GDM.

Keywords: Gestational diabetes mellitus, Hyperglycemic myopathy, Pelvic floor muscles, Rectus abdominis muscles, Urinary incontinence, Proteomics, Collagen, Electromyography, Transmission electron microscopy

RESEARCH ARTICLE

Prenatal exposure to gestational diabetes mellitus increases developmental defects in the enamel of offspring

Tawana Pascon¹, Angélica M. P. Barbosa^{1,2*}, Rita C. L. Cordeiro², Diego G. Bussanelli², Caroline B. Prudencio¹, Stefanie K. Nunes¹, Fabiane A. Pinheiro¹, Grasiela Bossolan¹, Leandro G. Oliveira¹, Iracema M. P. Calderon¹, Gabriela Marini⁴, Marilza V. C. Rudge¹

1 Department of Gynecology and Obstetrics, São Paulo State University (UNESP), Botucatu Medical School, Botucatu, São Paulo, Brazil, **2** Department of Physiotherapy and Occupational Therapy, São Paulo State University (UNESP), School of Philosophy and Sciences, Marília, São Paulo, Brazil, **3** Department of Pediatric Dentistry and Orthodontics, São Paulo State University (UNESP), Araraquara School of Dentistry, Araraquara, São Paulo, Brazil, **4** Health Sciences Center, University of the Sacred Heart (USC), Bauru, São Paulo, Brazil

* angelicapascon@gmail.com



Abstract

Background and objective

Gestational diabetes mellitus (GDM) is associated with short- and long-term maternal and perinatal repercussions. Our objective was to evaluate the long-term consequences of intra-uterine exposure to hyperglycemia on Developmental Defects of Enamel (DDE) in offspring.

Results

Overall, 50 children of women with GDM and 250 children of normoglycemic women participated, the latter serving as controls. Children were examined at the age between 3 and 12 years. In addition to physical examination, two independent observers examined and rated photographs to identify specific types of DDE in a blinded fashion. Among offspring of mothers with GDM, rates of DDE (all types combined) and hypoplasia (specific type) were significantly higher ($p < 0.001$, $p = 0.04$), in comparison to offspring of normoglycemic mothers. Considering only the affected teeth (1060 in GDM category; 5499 in controls), rates of DDE (all types combined) were significantly higher for total teeth ($p < 0.001$) and deciduous teeth ($p < 0.001$), but not permanent teeth. In specific types of DDE involving deciduous teeth, rates of demarcate opacity were significantly higher ($p < 0.001$; canine and 2nd mandibular molars) and hypoplasia ($p < 0.001$; 2nd maxillary molars and 2nd mandibular molars). In permanent teeth, the rate of diffuse opacity in association with GDM was significantly higher ($p < 0.001$; maxillary central incisors and 1st maxillary molars).

Conclusion

GDM was associated with the adverse effects of DDE on offspring. This study lays the foundation for future studies to determine the impact of GDM on long-term risk of DDE.

OPEN ACCESS

Citation: Pascon T, Barbosa AMP, Cordeiro RCL, Bussanelli DG, Prudencio CB, Nunes SK, et al. (2019) Prenatal exposure to gestational diabetes mellitus increases developmental defects in the enamel of offspring. *PLoS ONE* 14(2): e0211771. <https://doi.org/10.1371/journal.pone.0211771>

Editor: Victor Sánchez-Margalet, Virgen Macarena University Hospital, School of Medicine, University of Seville, SPAIN

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Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Funding: The authors received no specific funding for this work.

Competing interests: The authors have declared that no competing interests exist.

Anexo 4 - Resumos apresentados e publicados em anais de congressos



**World
Physiotherapy
Congress2021online**

9 – 11 April

CERTIFICATE OF PRESENTATION

This is to certify that

David Rafael Abreu Reyes, Prudencio C.B, Pinheiro F.A, Hallur L.S.R,
Pedroni C.R, Nunes S.K, Orlandi M.I.G, Jacomin M, Rudge, M.V.C,
Calderon I.M.P, Barbosa A.M.P.

presented

State of the art ePoster (PO) number PO-00865
DIGITAL PALPATION AND ELECTROMYOGRAPHY PELVIC FLOOR EVALUATION IN PREGNANT WOMEN WITH PREGNANCY SPECIFIC
URINARY INCONTINENCE

at the World Physiotherapy Congress 2021 online


President, World Physiotherapy




Chair, congress programme committee



5°

CONGRESO INTERNACIONAL
ASOCIACIÓN LATINOAMERICANA
DE PISO PÉLVICO

CERTIFICADO DE PARTICIPACIÓN



CERTIFICO QUE EL TRABAJO TITULADO

COMPARAÇÃO DA AVALIAÇÃO FUNCIONAL E ELETROMIOGRÁFICA DOS MÚSCULOS DO ASSOALHO PÉLVICO ENTRE GESTANTES COM E SEM INCONTINÊNCIA URINÁRIA ESPECÍFICA DA GESTAÇÃO

Ha sido presentado en formato Poster por

David Rafael Abreu Reyes
Larissa Neves Damasceno
Caroline Baldini Prudencio
Fabiane Affonso Pinheiro
Maria Victoria Candido Gaitero
Marilza Vieira Cunha Rudge
Cristiane Rodrigues Pedroni
Sthefanie Kenickel Nunes
Maíara Isabelle Gonçalves Orlandi
Angélica Mérica Pascon Barbosa

5o Congreso Internacional ALAPP 2020

celebrado en

Cartagena, Colombia, del 4 al 7 de marzo de 2020


Dra. Simone Botelho
Presidenta del Comité Científico


Dr. Alejandro Tarazona
Presidente de ALAPP


Dr. Carlos Díaz Támara
Presidente del 5o Congreso
Internacional ALAPP

Certificado

Certificamos que o trabalho COMPARAÇÃO DOS ACHADOS ELETROMIOGRAFICOS DOS MÚSCULOS DO ASSOALHO PÉLVICO ENTRE GESTANTES CONTINENTES E INCONTINENTES do(s) autor(es) DAMASCENO, LARISSA NEVES (); GAITERO, MARIA VICTÓRIA CANDIDA (UNESP); PRUDENCIO, CAROLINE BALDINI (UNESP); NUNES, STHEFANIE KENICKEL (UNESP); PEDRONI, CRISTIANE RODRIGUES (UNESP); BARBOSA, ANGÉLICA MÉRCIA PASCON (UNESP) integra os anais do VIII Congresso de Fisioterapia da UNESP de Marília, promovido pelo Conselho de Curso de Fisioterapia e pelo Departamento de Fisioterapia e Terapia Ocupacional da Faculdade de Filosofia e Ciências da UNESP, Câmpus de Marília, tendo sido realizado entre os dias 6 e 8 de novembro de 2019, na categoria Pôster.

Marília, 08 de novembro de 2019.

Doutor Marcos Eduardo Scheicher
Coordenador Geral do Evento

Professor Doutor Pedro Geraldo Aparecido Novelli
Presidente da CPEU
Vice-Diretor da Faculdade de Filosofia e Ciências

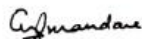


We hereby certify that the paper entitled

COMPARISON OF THE ELECTROMYOGRAPHIC RESPONSE BETWEEN THE SUPERFICIAL AND DEEP PELVIC FLOOR MUSCLES

by the authors **ANGÉLICA MÉRCIA PASCON BARBOSA; CAROLINE BALDINI PRUDENCIO; BARBARA VAZ SARMENTO; MAIARA ISABELE GONÇALVES ORLANDI; FABIANE AFFONSO PINHEIRO; STEFANIE KENICKEL NUNES; CRISTIANE RODRIGUES PEDRONI; MARILZA VIEIRA CUNHA RUDGE**

Was presented as an **E-POSTER** during the International Federation of Gynecology and Obstetrics (FIGO) XXII FIGO World Congress 2018 at RioCentro, Brazil, from October 14 to 19, 2018.


CN Purandare
FIGO President


Luis Cabero
Chair of Organizing Committee FIGO 2018


Johan Vos
FIGO Chief Executive



 **ICS 2018**
PHILADELPHIA

Certificate of Acceptance

Presented to

Rudge M V C1, Nunes S K1, Rudge C V C1, Quiroz S C B V1, Prudencio C B1, Pinheiro F A1, Heliodoro M L A1, Pascon T1, Sartorão Filho C I1, Calderon I M P1, Medolago A2, Barbosa A M P2

Had the following abstract accepted at the 48th International Continence Society Annual Meeting
28-31 August, Philadelphia, United States

Open Discussion ePoster, Abstract 558: A study of sexual function evaluated by the pregnancy sexual response inventory (PSRI) among women with gestational diabetes mellitus diagnosis.







XXIII
Congresso Paulista de
Obstetrícia e Ginecologia

23 a 25 de agosto de 2018
Transamérica Expo Center - São Paulo, SP



CERTIFICADO

Certificamos que
PRUDENCIO, C.B.; PINHEIRO, F.A.; PEDRONI, C.R.; NUNES, S.K.; RUDGE, M.V.C.; BARBOSA, A.M.P.
participaram do XXIII Congresso Paulista de Obstetrícia e Ginecologia 2018
realizado do dia 23 a 25 de Agosto de 2018 no Transamérica Expo Center,
em São Paulo - SP, com o trabalho
**O026 - "ALTERAÇÕES NEUROMUSCULARES DO ASSOALHO PÉLVICO DURANTE A GESTAÇÃO COMPLICADA PELO DIABETES
GESTACIONAL"**
em forma de e-pôster.

Rosana Pulcinelli Vieira Francisco
Presidente do Congresso

Manoel João Batista Castello Girão
Diretor Científico

Rosiane Mattar
Coordenadora Científica de Obstetrícia

Rogério Bonassi Machado
Coordenador Científico de Ginecologia

14/10/2021

ICS 2020 Abstract #271 Correlation Between Vaginal Digital Palpation and Pregnancy Specific Urinary Incontinence



ICS 2020 > Programme > S20 > ePoster Station 3 > Abstract 271

Correlation Between Vaginal Digital Palpation and Pregnancy Specific Urinary Incontinence

Angélica M¹, Ana Júlia B², Sthefanie K¹, Fabiane A¹, Henrique C¹, Tatiana D¹, Maíara I¹,
Carlos I¹, Marilza V¹, Caroline B¹

RESEARCH TYPE

Clinical

ABSTRACT CATEGORY

Female Lower Urinary Tract Symptoms (LUTS) / Voiding Dysfunction

Comments



#	Abstract 271
📄	ePoster 4 Scientific Open Discussion ePoster Session 20
📌	ON-DEMAND

<https://www.ics.org/2020/abstract/271>

14



Certificate of Participation

Presented to

Barbosa A M P1, Pinheiro F A1, Sartorão Filho C I1, Prudencio C B1, Kenickel S1, Orlandi M I G1, Pascon T1, Sarmento B V1, Melo J V F1, Oliveira L G D1, Sarmento B V1, Rudge M V C1

Had the following abstract accepted at the 48th International Continence Society Annual Meeting
28-31 August, Philadelphia, United States

Podium Short Oral, Abstract 42: Effect of gestational diabetes mellitus on pelvic floor muscle function: three-dimensional ultrasound

Laurence Stewart

Roger R. Dmochowski

Lori Birder

XXIII
Congresso Paulista de
Obstetrícia e Ginecologia

23 a 25 de agosto de 2018
Transamerica Expo Center • São Paulo, SP



CERTIFICADO

Certificamos que

SARTORÃO FILHO, C.I.S.; PINHEIRO, F.A.; PRUDENCIO, C.B.; NUNES, S.K.; BARBOSA, A.M.P.; RUDGE, M.V.C. participaram do XXIII Congresso Paulista de Obstetrícia e Ginecologia 2018, realizado do dia 23 a 25 de Agosto de 2018, no Transamerica Expo Center, em São Paulo - SP, com o trabalho

0034 - "PROGRESSÃO DA BIOMETRIA DA ÁREA HIATAL DO ASSOALHO PÉLVICO DE GESTANTES COM DIABETE MELLITUS GESTACIONAL AVALIADA PELA ULTRASSONOGRAFIA TRIDIMENSIONAL"
em forma de e-pôster.

Rossana Pulcineli Vieira Francisco
Presidente do Congresso

Manoel João Batista Castello Girão
Diretor Científico

Rosiane Mattar
Coordenadora Científica de Obstetrícia

Rogério Bonassi Machado
Coordenador Científico de Ginecologia



Certificate of Participation

Presented to

Barbosa A M P1, Prudencio C B2, Pinheiro F A2, Sartorão Filho C I2, Pedroni C R1, Kenickel S2, Orlandi M I G2, Gaitero M V C2, Prata G M2, Sarmento B V2, Quiroz S C B V2, Rudge M V C2

Had the following abstract accepted at the 48th International Continence Society Annual Meeting
28-31 August, Philadelphia, United States

Podium Short Oral, Abstract 321: Pelvic floor muscles rest-activity and hold contraction in diabetic pregnant women during pregnancy: cohort study

A handwritten signature in black ink, appearing to read "L Stewart".

Laurence Stewart

A handwritten signature in black ink, appearing to read "Roger".

Roger R. Dmochowski

A handwritten signature in black ink, appearing to read "Lori Birder".

Lori Birder

Anexo 5 – Orientações de trabalhos de conclusão de curso





CERTIFICADO

Certificamos que a Profa.

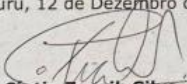
Sthefanie Kenickel Nunes,

Orientou a monografia intitulada

**"COMPARAÇÃO DE DOIS INSTRUMENTOS PARA AVALIAÇÃO DA
SEXUALIDADE DE MULHERES DURANTE A GESTAÇÃO: UMA REVISÃO DE
LITERATURA"**

de autoria da aluna Ana Paula Marques.

Bauru, 12 de Dezembro de 2020


Cintia Zacaib Silva
Coordenadora do Curso de Fisioterapia

www.fibbauru.br



CERTIFICADO

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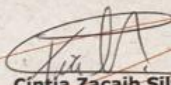
Sthefanie Kenickel Nunes,

Orientou a monografia intitulada

**"INTERVENÇÃO FISIOTERAPÊUTICA EM MULHERES ATLETAS COM
INCONTINÊNCIA URINÁRIA E O IMPACTO NA QUALIDADE DE VIDA: UMA REVISÃO
DE LITERATURA"**

de autoria da aluna Daiane Maria Santos Collaço.

Bauru, 13 de Dezembro de 2021


Cintia Zacaib Silva
Coordenadora do Curso de Fisioterapia

www.fibbauru.br



CERTIFICADO

Certificamos que a Profa.

Sthefanie Kenickel Nunes,

Orientou a monografia intitulada

"MASSAGEM PERINEAL NO PERÍODO GESTACIONAL: UMA REVISÃO DA LITERATURA"

de autoria da aluna Nadia Cristina Silvério De Souza.

Bauru, 12 de Dezembro de 2020

Cíntia Zacaib Silva
Coordenadora do Curso de Fisioterapia

www.fibbauru.br



CERTIFICADO

Certificamos que a Profa.

Sthefanie Kenickel Nunes,

Orientou a monografia intitulada

"IMPACTO DOS MÚSCULOS DO ASSOALHO PÉLVICO NA FUNÇÃO SEXUAL DAS GESTANTES: UMA REVISÃO DE LITERATURA"

de autoria da aluna Eduarda Trevisanuto Lucatto.

Bauru, 12 de Dezembro de 2020

Cíntia Zacaib Silva
Coordenadora do Curso de Fisioterapia

www.fibbauru.br



CERTIFICADO

Certificamos que a Profa.


Sthefanie Kenickel Nunes,

Orientou a monografia intitulada

**"PREVALÊNCIA DE INCONTINÊNCIA URINÁRIA DE ESFORÇO EM
MULHERES PRATICANTES DE CROSSFIT: UMA REVISÃO DE
LITERATURA"**

de autoria da aluna Ana Caroline Moura Santos.

Bauru, 12 de Dezembro de 2020


Cintia Zacaib Silva
Coordenadora do Curso de Fisioterapia

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Anexo 6 - Bancas examinadoras de Trabalhos de Conclusão de Curso



Marília, 07 de junho de 2021.

DECLARAÇÃO

Declaro para os devidos fins que o(a) Prof(a) Dr(a) Angélica Mércia Pascon Barbosa participou como orientador(a) da banca do Trabalho de Conclusão de Curso (TCC) de Kassiane Elizeu de Carvalho, intitulado "Hidroterapia com treinamento do assoalho pélvico na gestação reduz incontinência urinária após o parto". A defesa do TCC ocorreu via plataforma Google Meet. Participaram também da banca o(a) Prof(a) Ms(a) Caroline Baldini Prudêncio e o(a) Prof(a) Ms(a) Sthefanie Kenickel Nunes.

Marcos Eduardo Scheicher
Coordenador do curso de Fisioterapia/ FFC-Unesp/Marília



CERTIFICADO

Certificamos que a Profa.

Sthefanie Kenickel Nunes,

Foi banca da monografia intitulada

"A UTILIZAÇÃO DE RECURSOS FISIOTERAPÊUTICOS NO PROCESSO DE CICATRIZAÇÃO: REVISÃO DE LITERATURA"

de autoria da aluna Juliana Morais Palmira

Bauri, 12 de Dezembro de 2020


Cintia Zacaló Silva
Coordenadora do Curso de Fisioterapia

www.fibbauri.br



CERTIFICADO

Certificamos que a Profa.

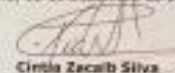
Sthefanie Kenickel Nunes,

Foi Banca da monografia intitulada

"ATUAÇÃO DA FISIOTERAPIA NAS PRINCIPAIS ALTERAÇÕES DERMATOLÓGICAS DECORRENTES DA GESTAÇÃO: UMA REVISÃO DE LITERATURA"

de autoria da aluna Raissa Mayara de Oliveira.

Bauri, 12 de Dezembro de 2020


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Coordenadora do Curso de Fisioterapia

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CERTIFICADO

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Sthefanie Kenickel Nunes,

Foi Banca da monografia intitulada

"OS BENEFÍCIOS DA RADIOFREQUÊNCIA NO TRATAMENTO DA FLACIDEZ FACIAL"

de autoria da aluna Débora Nunes Celighini

Bauru, 12 de Dezembro de 2020.


Cintia Zacchi Silva
Coordenadora do Curso de Fisioterapia

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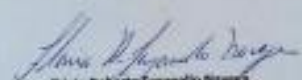
unesp Universidade Estadual Paulista
Faculdade de Filosofia e Ciências
Campus de Marília
Secretaria dos Conselhos de Cursos de Graduação
Conselho de Curso de Fisioterapia

DECLARAÇÃO

D E C L A R O, para os devidos fins, que o(a) Prof(a). M(a) Sthefanie Kenickel Nunes, participou, na qualidade de **BANCA EXAMINADORA** do Trabalho de Conclusão de Curso (TCC) em Fisioterapia, da aluna Larissa Nunes Diniziano, monografia intitulada: "**COMPARAÇÃO DA AVALIAÇÃO FUNCIONAL E ELETROMIOGRÁFICA DOS MÚSCULOS DO ASSOALHO PÉLVICO ENTRE GESTANTES COM E SEM INCONTINÊNCIA URINÁRIA ESPECÍFICA DA GESTAÇÃO**", realizada no dia 03 de dezembro de 2020, na Central de Sala de Aula do Prédio de Fisioterapia e Terapia Ocupacional da Faculdade de Filosofia e Ciências da UNESP - Campus de Marília.

Participaram, também, de Banca Examinadora, o(a) Prof(a) Dr(a) Angélica Mércia Pascon Barbosa e o(a) Prof(a) Dr(a) Cristiano Rodrigues Pedroni.

Marília, 03 de dezembro de 2020.


Dr(a) Flávia Roberta Faganelo Navega
Coordenadora do Conselho de Curso de Fisioterapia

DECLARAÇÃO

D E C L A R O, para os devidos fins, que o(a) **Mija Stefanie Kenickel Nunes**, participou, na qualidade de **BANCA EXAMINADORA** do Trabalho de Conclusão de Curso (TCC) em Fisioterapia, da aluna **Ana Julia Birbatti Silva**, monografia intitulada: **"CORRELAÇÃO DA FUNCIONALIDADE DOS MÚSCULOS DO ASSALHO PÉLVICO E INCONTINÊNCIA URINÁRIA ESPECÍFICA DA GESTAÇÃO"**, realizada no dia 03 de dezembro de 2019, na Central de Sala de Aulas do Prédio de Fisioterapia e Terapia Ocupacional da Faculdade de Filosofia e Ciências da UNESP - Campus de Marília.

Participaram, também, da Banca Examinadora: o(a) Profa(Dr)ª Angélica Nereza Pascon Barbosa e o(a) Prof. Dr. Marco Eduardo Scheicher.

Marília, 03 de dezembro de 2019.


Dra. Flávia Roberta Fagnello Navega
Coordenadora do Conselho de Curso de Fisioterapia



CERTIFICADO

Certificamos que a Profa.

Sthefanie Kenickel Nunes,

Foi Banca da monografia intitulada:

"FISIOTERAPIA NA DISFUNÇÃO MICCIONAL INFANTIL – REVISÃO DE LITERATURA"

de autoria da aluna **Wlária Vanessa Rubatti.**

Bauri, 04 de Dezembro de 2019.


Cibele Zaccab Silva
Coordenadora do Curso de Fisioterapia



CERTIFICADO

Certificamos que a Profa.

Sthefanie Kenickel Nunes,

Foi banca da monografia intitulada

"NÍVEL DE CONHECIMENTO SOBRE A FUNÇÃO DO ASSOALHO PÉLVICO E DA SEXUALIDADE NO PERÍODO GESTACIONAL DE BAURU-SP"

de autoria da aluna Amanda Gabriela dos Santos Constantino.

Bauri, 04 de Dezembro de 2019

Cintia Zacalib Silva
Coordenadora do Curso de Fisioterapia

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CERTIFICADO

Certificamos que a Profa.

Sthefanie Kenickel Nunes,

Foi banca da monografia intitulada

"PREVALÊNCIA DE CONSTIPAÇÃO INTESTINAL EM ACADÊMICOS DO CURSO DE FISIOTERAPIA"

de autoria da aluna Ederli Elise Suenno.

Bauri, 04 de Dezembro de 2019

Cintia Zacalib Silva
Coordenadora do Curso de Fisioterapia

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CERTIFICADO

Certificamos que a Profa.

Stefanie Kenickel Nunes,

Foi banca de monografia intitulada

"PREVALÊNCIA DE INCONTINÊNCIA URINÁRIA NO PUERPÉRIO E SEU IMPACTO NA QUALIDADE DE VIDA"

de autoria da aluna **Miriele Alana de Souza.**

Brasília, 04 de Dezembro de 2019

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Coordenadora do Curso de Fisioterapia

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unesp Universidade Estadual Paulista
Faculdade de Filosofia e Ciências
Campus de Marília
Secretaria dos Conselhos de Cursos de Graduação
Conselho de Curso de Fisioterapia

DECLARAÇÃO

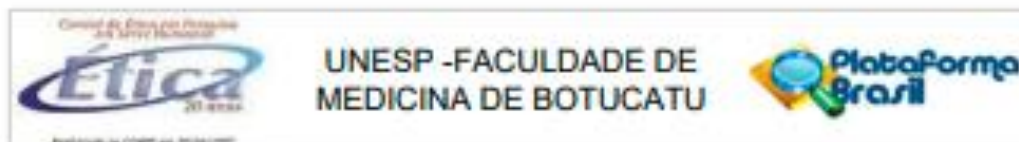
D E C L A R O, para os devidos fins, que a Mestre **STEFANIE KENICKEL** participou, na qualidade de **BANCA EXAMINADORA** do Trabalho de Conclusão de Curso (TCC) em Fisioterapia, da aluna **MARIA VICTÓRIA CAMOIA BARTERO**, monografia intitulada: **"ANÁLISE ELETRIOGRÁFICAS MÚSCULOS DO ANOVALHO PÉLVICO DE GESTANTES COM INCONTINÊNCIA URINÁRIA ESPECÍFICA DA GESTAÇÃO"**, realizada no dia 05 de dezembro de 2019, às 15:00, na sala 70 do prédio de atividades acadêmicas da Faculdade de Filosofia e Ciências da UNESP - Campus de Marília.

Participaram, também, da Banca Examinadora, a Doutora Angélica Mireia Pascon Barboza e o Doutor Marcos Scheffer.

Marília, 05 de dezembro de 2019.

Dra. Flávia Fabiana Figueiredo Nogueira
Coordenadora do Conselho de Curso de Fisioterapia

Anexo 7 - Aprovação Comitê de Ética em Pesquisa



PARECER CONSUBSTANCIADO DO CEP

DADOS DA EMENDA

Título da Pesquisa: Projeto Mãe: Estudo de coorte prospectivo: nova tríade gestacional (hiperglicemia, incontinência urinária e perfil clínico, molecular e ômico da miopatia hiperglicêmica) na predição de incontinência. Pesquisa translacional com biodevices para regeneração muscular em ratas com diabetes

Subprojeto 1: Relação dos achados eletromiográficos dos músculos do assoalho pélvico com os níveis de relaxina ao longo da gestação e após o parto de mulheres com hiperglicemia gestacional e incontinência urinária específica da gestação (Orientador: Marilza Vieira Cunha Rudge/ Orientando: Caroline Baldini Prudencio/ Nível: Doutorado)

Subprojeto 2: Ultrassonografia Tridimensional do assoalho pélvico de mulheres com hiperglicemia gestacional 16-18 meses após a gestação (Orientador: Marilza Vieira Cunha Rudge/ Orientando: Carlos Izaias Sartorão Filho/ Nível: Doutorado);

Subprojeto 3: Coorte prospectiva da tríade hiperglicemia gestacional, incontinência urinária específica da gestação e disfunção muscular do assoalho pélvico, avaliada pela ultrassonografia funcional, como preditora da incontinência urinária e disfunção muscular 6-18 meses após o parto (Orientador: Marilza Vieira Cunha Rudge/ Orientando: Fabiane Afonso Pinheiro/ Nível: Doutorado)

Subprojeto 4: Níveis de micronutrientes e da expressão de seus receptores em mulheres com diabetes mellitus gestacional e incontinência urinária específica da gestação (Orientador: Marilza Vieira Cunha Rudge/ Orientando: Sarah Maria Bameze Costa/ Nível: Doutorado).

Pesquisador: Marilza Vieira Cunha Rudge

Área Temática:

Versão: 5

CAAE: 82225617.0.0000.5411

Instituição Proponente: Departamento de Ginecologia e Obstetrícia

Patrocinador Principal: FUNDAÇÃO DE AMPARO A PESQUISA DO ESTADO DE SÃO PAULO

DADOS DO PARECER

Número do Parecer: 3.747.338

Endereço: Chácara Bagagnoli, s/n

Bairro: Rubião Junior

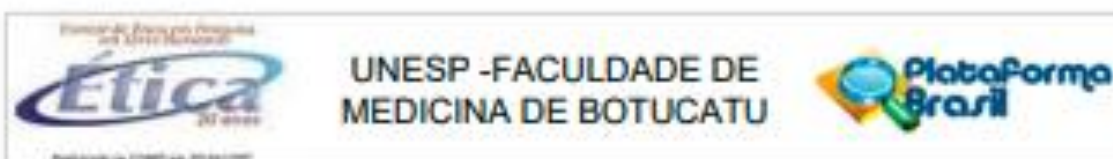
CEP: 18.618-070

UF: SP

Município: BOTUCATU

Telefone: (14)3883-1600

E-mail: cep@fmb.unesp.br



Continuação do Parecer: 3.747.338

Apresentação do Projeto:

Trata a presente solicitação de emenda ao projeto em questão referente ao envio de amostras para análise em dois destinos diferentes, com a finalidade de aprendizado da técnica e maior sensibilidade/especificidade da técnica adotada.

Objetivo da Pesquisa:

Avaliar a solicitação de emenda ao presente projeto para envio de amostras a dois destinos diferentes.

Avaliação dos Riscos e Benefícios:

Já avaliados.

Comentários e Considerações sobre a Pesquisa:

A pesquisadora solicita a emenda ao presente projeto para envio de amostras para dois destinos diferentes:

1) para Londres - UK: com a finalidade de envio de amostras já coletadas para o mesmo fim aprovado anteriormente por este CEP, sendo exclusivamente para aprendizado da técnica pela aluna de doutorado (Dra Juliana) com o grupo em questão. Os pesquisadores informam que não haverá alteração no projeto anteriormente aprovado.

2) Para Lincoln / Nebraska - EUA: com a finalidade de envio de amostras já coletadas para o mesmo fim aprovado anteriormente por este CEP, sendo para substituição da técnica anteriormente descrita (espectroscopia por RMN) pela técnica de 2 espectrômetro de massa, justificando maior especificidade e sensibilidade destas técnicas. Os pesquisadores informam que não haverá alteração no projeto anteriormente aprovado.

Os pesquisadores informam que o envio de amostras para o exterior, será feito por transportadora especializada], devendo seguir legislação vigente brasileira.

Considerações sobre os Termos de apresentação obrigatória:

Já avaliados.

Recomendações:

Não há.

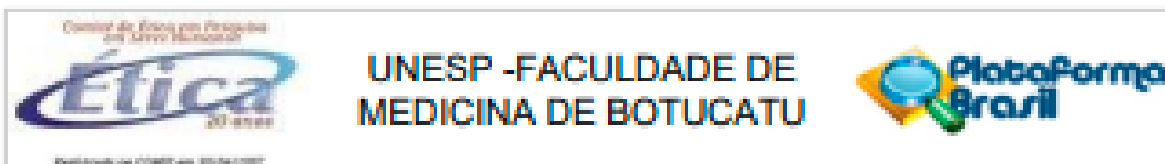
Conclusões ou Pendências e Lista de Inadequações:

Após análise em REUNIÃO EXTRAORDINÁRIA, o Colegiado deliberou APROVADA A EMENDA apresentada.

Considerações Finais a critério do CEP:

Conforme deliberação do Colegiado, em REUNIÃO EXTRAORDINÁRIA do Comitê de Ética em

Endereço: Chácara Butaguá, s/n
Bairro: Rubião Junior CEP: 18.616-870
UF: SP Município: BOTUCATU
Telefone: (14)3882-1009 E-mail: cep@fmb.unesp.br



PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: CONSTRUÇÃO E VALIDAÇÃO DO QUESTIONÁRIO PARA IDENTIFICAR E AVALIAR A INCONTINÊNCIA URINÁRIA ESPECÍFICA DA GESTAÇÃO (Q-IUEG) NA POPULAÇÃO BRASILEIRA.

Pesquisador: Mariza Vieira Cunha Rudge

Área Temática:

Versão: 3

CAAE: 31976620.1.0000.5411

Instituição Proponente: Faculdade de Medicina de Botucatu/UNESP

Patrocinador Principal: FUNDAÇÃO DE AMPARO A PESQUISA DO ESTADO DE SÃO PAULO

DADOS DO PARECER

Número do Parecer: 4.191.114

Apresentação do Projeto:

As informações descritas nos campos "Apresentação do Projeto", "Objetivo da Pesquisa" e "Avaliação dos Riscos e Benefícios" foram retiradas dos documentos e arquivo - Informações Básicas da Pesquisa.

O projeto "CONSTRUÇÃO E VALIDAÇÃO DO QUESTIONÁRIO PARA IDENTIFICAR E AVALIAR A INCONTINÊNCIA URINÁRIA ESPECÍFICA DA GESTAÇÃO (Q-IUEG) NA POPULAÇÃO BRASILEIRA" tem relevância científica, sendo parte integrante de projeto Fapesp Temático, constituindo em pesquisa de doutorado. Tem clareza metodológica, sendo factível e exequível no prazo apresentado.

Critério de Inclusão: Farão parte deste projeto três grupos amostrais intencionais e não probabilísticos distintas.

Primeiramente, serão selecionados 10 especialistas na área de obstetria e IU, que participaram do processo de validação de conteúdo e avaliação de clareza (Grupo I). Na segunda amostra (Grupo II), serão selecionadas gestantes que participarão das etapas de validade de clareza e reprodutibilidade do instrumento. A terceira amostra (Grupo III) será composta por gestantes que não participarem da etapa de validade de construto e consistência interna.

Tamanho da amostra: 80 participantes.

Endereço: Chácara Butignoli, s/n

Bairro: Rubião Junior

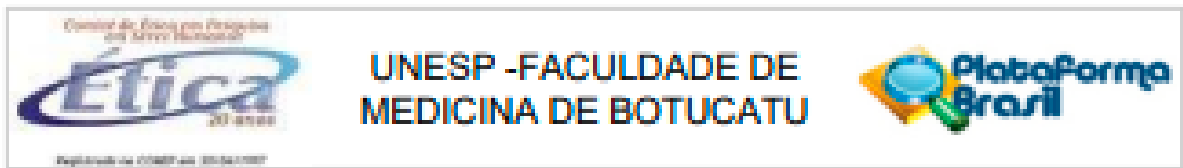
CEP: 18.618-970

UF: SP

Município: BOTUCATU

Telefone: (14)3882-1609

E-mail: cep@fmb.unesp.br



Continuação do Parecer: 4.181.114

Objetivo da Pesquisa:

Tem o objetivo de construir e validar o questionário inédito para identificar e avaliar a incontinência urinária específica da gestação (Q-IUEG) na população brasileira.

Avaliação dos Riscos e Benefícios:

Os riscos são mínimos aos participantes, ligados a anonimização dos dados. O presente estudo tem como principal benefício melhorar o instrumento que temos à disposição para diagnosticar, e posteriormente tratar, a incontinência urinária específica da gestação.

Comentários e Considerações sobre a Pesquisa:

Pesquisa exequível e factível, clara do ponto de vista de sua construção metodológica e de importância e relevância clínica no campo da qualidade de vida e uroginecologia. Cronograma consta coleta de dados a partir de 30/09/2020.

Considerações sobre os Termos de apresentação obrigatória:

Os termos de apresentação obrigatória foram: termos de anuência do HCFMB/FMB, folha de rosto e projeto de pesquisa (que trata de um subprojeto de um temático). Foram apresentados TCLE para juizes (parte 1) e TCLE para gestantes (parte2) e atendidas as solicitações, conforme Resolução 466/2012.

Recomendações:

Apresentar relatório final de atividades após finalização da pesquisa.

Conclusões ou Pendências e Lista de Inadequações:

Após análise em REUNIÃO ORDINÁRIA, o Colegiado deliberou APROVADO o Projeto de Pesquisa.

Considerações Finais a critério do CEP:

Conforme deliberação do Colegiado, em REUNIÃO ORDINÁRIA do Comitê de Ética em Pesquisa FMB/UNESP, realizada em 03/08/2020, o Projeto de Pesquisa apresentado encontra-se APROVADO. O Pesquisador deverá enviar Relatório Final de Atividades ao final da pesquisa.

Atenciosamente,

Comitê de Ética em Pesquisa FMB/UNESP

Endereço: Chácara Botucatu, s/n	CEP: 13.618-970
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