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RAFAELA NOLETO DOS SANTOS

Repercussões da Prática do *Ballet* Clássico no Crescimento e Desenvolvimento na Infância e Adolescência

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Dissertação de Mestrado apresentada ao Programa de Pós-Graduação em Ciências Aplicadas a Produtos para Saúde da Universidade Estadual de Goiás para obtenção do Título de Mestre em Ciências Aplicadas a Produtos para Saúde.

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Dedico este trabalho à minha família que com muita sabedoria enxergou através dos meus olhos e sonhou os meus sonhos.

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À **Deus**, que, em sua infinita bondade, jamais se esquece de nós. Sentindo sempre Sua presença, nunca trilhei nenhum caminho sozinha, não busquei por sonhos só meus. Sei que cada porta aberta e cada luz no meu trajeto foram demonstrações desse amor tão sublime. Meu equilíbrio e certeza, razão da minha maior gratidão.

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“Não quero ser poderoso, nem me entregar como um fraco, só estar com Deus na fraqueza e provar do Seu poder. Buscar a Sua vontade, boa, perfeita e agradável. E em Seu perdão a razão para lutar e vencer.”

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“Quando te desviares para a direita e quando te desviares para a esquerda, os teus ouvido ouvirão atrás de ti uma palavra dizendo: Este é o caminho, andai por ele.”

Isaías 30:21

"Os grandes navegadores devem sua reputação aos temporais e tempestades.”

Epicuro

PRÓLOGO

A arte sempre fez parte da minha caminhada e foi através dela que cheguei até a Fisioterapia. Sempre envolvida com a dança em seus diversos aspectos, quando tive a oportunidade de me aproximar mais da ciência do movimento logo percebi que seria uma experiência única e inovadora.

Certa vez, um cirurgião me disse: "O que aprendemos durante a faculdade é a ciência, a técnica. Mas o que fazemos nos momentos limítrofes em uma cirurgia é a arte". Em alguns momentos, elas se confundem, em outros, se separam. Na verdade uma depende da outra. Para mim, a ciência é uma arte.

Como dizia Rosa Luxemburgo: "Quem não se movimenta, não sente as correntes que o prendem". O movimento é essencial para o desenvolvimento humano. Albert Einstein concorda ao dizer que "Viver é como andar de bicicleta: É preciso estar em constante movimento para manter o equilíbrio". É a arte manifesta na ciência.

Leonardo da Vinci usou de fisiologia e anatomia para fazer as suas imagens tão convincentes, mostrando que seus trabalhos eram produzidos através da investigação científica. A estória do sábio e da borboleta conta que uma menina muito sagaz, resolveu desafiar o sábio levando uma pequena borboleta em sua mão e perguntando a ele se esta estava viva ou morta. Se ele respondesse que estava viva ela a esmagaria em sua mão e se ele dissesse que estava morta ela abriria sua mão, a borboleta voaria invicta e ele teria errado. No entanto, com toda sua sabedoria o sábio disse: "A resposta está em suas mãos". É assim que a ciência e a arte se misturam, a resposta está em nossas mãos, é a interdisciplinaridade.

Foi com esse pensamento que surgiu a Rede Brasil - Reino Unido de Medicina e Ciência da Dança (MCD) que aborda uma área que se desenvolve globalmente há mais de 20 anos. No Reino Unido, a University of Wolverhampton, em parceria com a organização denominada *National Institute of Dance Medicine And Science* (NIDMS), iniciou, em março de 2016, um diálogo com a Universidade Estadual de Goiás (UEG) no sentido de promover a cooperação desta universidade e de outras, para formação da Rede, com objetivo de desenvolver pesquisas e serviços colaborativos durante o período de 15 anos.

Tendo em vista este processo de formação da Rede com objetivos de ampliar as pesquisas e parcerias entre essas duas regiões mundiais, foi realizada uma primeira ação de aproximação, o workshop "As Potencialidades e Desafios da Pesquisa em Medicina e Ciência da Dança: construindo colaborações inovadoras entre o Reino Unido e o Brasil", que ocorreu no período de 27 a 31 de agosto de 2016, no Centro Cultural da Universidade Federal de Goiás (UFG). Este evento foi proposto e idealizado pelo Prof. Dr. Adriano Bittar, da UEG e o Prof. Dr. Matthew Wyon, da University of Wolverhampton. O encontro foi co-financiado pelo British Council, através do Newton Fund, e pela Fundação de Amparo à Pesquisa do Estado de Goiás (FAPEG).

Em meio a estas idéias decidi, em meu mestrado interdisciplinar, estudar como a arte do movimento no *Ballet* Clássico pode influenciar na ciência do desenvolvimento de crianças e adolescentes, sendo esse um assunto muito rico e ainda pouco explorado. Surgiu então este trabalho, que abre caminhos para um diálogo entre essas duas áreas tão diversas e com mais pontos em comum do que podemos imaginar.

SUMÁRIO

FIGURAS APÊNDICES E ANEXOS

SÍMBOLOS, SIGLAS E ABREVIATURAS

%: porcentagem

ABEP: Associação Brasileira de Empresas de Pesquisa

ADLs: *activities of daily living*

AP: antero-posterior

ATS: *American Thoracic Society*

BMI: *body mass index*

cm: centímetro

D: direito

DEXA: *Double X-ray Densitometry*

DP: desvio padrão

E: esquerdo

ECAAB: *eyes closed with arms along the body*

EOAAB : *eyes open and arms along the body*

EOAO: *eyes open and arms outstretched*

g: grama

IEG: Instituto Estadual de Educação

IMC: Índice de Massa Corporal

ISAK: *International Society for Advancement in Kinanthropometry*

ITEGO: Instituto Tecnológico em Artes Basileu França

Kg: kilograma

Kg/m2: kilo por massa ao quadrado

kPa: Quilopascal

L: left right (R)

LL: látero-lateral

OMS: Organização Mundial da Saúde

m: metro

mmHg: milímetros de mercúrio

MMSS: membros superiores

R: *right*

s: segundos

sem: semanas

6MWT: *Six-Minute Walk Test*

SPSS - *Statistical Package for the Social Sciences*

SRT: *Sitting-rising test*

TALE - Termo de Assentimento Livre e Esclarecido

TCLE - Termo de Consentimento Livre e Esclarecido

TC6’ - Teste de Caminhada de Seis Minutos

TSL - Teste de Sentar e Levantar

TUG - *Timed Up & Go Test*

UEG – Universidade Estadual de Goiás

WICF : *written informed consent form*

RESUMO

O crescimento e o desenvolvimento da criança estão sujeitos a muitas influências, sejam elas provenientes da hereditariedade ou do ambiente e estes aspectos interagem de maneira complexa. A prática da dança otimiza o controle motor, a coordenação dos movimentos, o equilíbrio e a capacidade de movimento, desenvolvendo estratégias posturais dinâmicas específicas. Entretanto as mudanças que a prática do *Ballet* proporciona ao corpo da criança e do adolescente precisam ser melhor estudadas. O objetivo do presente estudo foi comparar o desempenho funcional em tarefas do cotidiano e a composição corporal de meninas praticantes e não praticantes de *Ballet* Clássico e analisar o quanto a prática dessa atividade em nível profissionalizante, pode influenciar nas pressões plantares e na estabilidade postural, além de verificar se a visão e a postura dos membros superiores podem interferir neste resultado. Estudo transversal, com 111 meninas de 10 a 15 anos, praticantes (n = 56) e não praticantes de *Ballet* (n = 55). As avaliações realizadas foram: exame antropométrico, entrevista estruturada, teste de Tanner para a maturação sexual, avaliação funcional (testes *Timed Up and Go*, Sentar e Levantar e Caminhada de 6 Minutos) e análise das pressões plantares e estabilidade postural, por meio de uma plataforma de baropodometria, em três condições diferentes, a saber: olhos abertos com braços ao longo do corpo (OABF), olhos fechados com braços ao longo do corpo (OFBF) e olhos abertos com braços abertos (OABA). A análise de dados foi realizada usando testes de comparação de grupos, correlação e regressão. As participantes diferiram quanto à média do peso, índice de massa corporal, percentual de gordura, medidas antropométricas, maturação sexual das mamas, condição socioeconômica e escolaridade dos pais. Na comparação dos resultados dos testes verificou-se que as praticantes de *Ballet* tiveram desempenho funcional melhor, realizaram menor descarga de peso em antepé E, apresentaram menores valores de pressão máxima e área de superfície plantar em todas as condições avaliadas e tiveram menores deslocamentos. Observou-se ainda que elas foram mais influenciadas pela visão e posicionamento dos membros superiores do que o grupo das não praticantes de *Ballet*, e que o tempo de dança interferiu de forma a modificar os resultados encontrados. Conclui-se que a prática profissionalizante do *Ballet*, pode melhorar a aptidão física e o desenvolvimento motor em atividades funcionais do

cotidiano. Além disso, o Ballet, em combinação com outros fatores, como controle do peso e a seleção para entrada nas companhias de dança, pode contribuir para retardar o desenvolvimento da mama e a maturação óssea. Os resultados também demonstram que essa prática influencia em características específicas de pressões plantares e dependência visual e motora em relação aos membros superiores, de forma a desenvolver estrátegias motoras específicas de adaptação corporal.

Palavras-Chave: desenvolvimento infantil; aptidão física; saúde da criança; equilíbrio postural; dança.

ABSTRACT

Repercussions of the Classic Ballet Practice in Growth and Development in Childhood and Adolescence

The child's growth and development are subject to many influences, from heredity or environment and these aspects interact in a complex way. The practice of dance optimizes motor control, coordination of movements, balance and ability to move, developing specific dynamic posture strategies. But the changes that the practice of the Ballet provides to the body of the child and the adolescent need to be better studied. The aim of the present study was to compare the functional performance in everyday tasks and the body composition of practioners and non-practioners of classical Ballet girls and to analyze how the practice of this activity at a vocational level can influence plantar pressures and postural stability, besides to see if the vision and posture of the upper limbs can interfere with this result. A cross-sectional study was carried out with 111 girls from 10 to 15 years old, practioners (n = 56) and non-ballet practitioners (n = 55). The evaluations were: anthropometric examination, structured interview, Tanner test for sexual maturation, functional evaluation (Timed Up and Go tests, Sit and Lift and 6 Minute Walk Test) and analysis of plantar pressures and postural stability, in a baropodometry platform, in three different conditions: with eyes open and arms along the body (EOAAB), with eyes closed with arms along the body (ECAAB), and with eyes open and arms outstretched (EOAO). Data analysis was performed using group comparison, correlation and regression tests. Participants differed in mean weight, body mass index, fat percentage, anthropometric measures, sexual maturation of the breasts, socioeconomic condition and parents' schooling. In the comparison of the results of the tests, it was verified that the Ballet practitioners had better functional performance, performed lower weight discharge in the E forefoot, presented lower values of maximum pressure and plantar surface area in all evaluated conditions and had smaller displacements. It was also observed that they were more influenced by the vision and positioning of the upper limbs than the group of non-practitioners of Ballet, and that the dance time interfered in order to modify the results found. It is concluded that the vocational practice of ballet may improve physical fitness and

motor development in functional activities of daily life. In addition ballet, in combination with other factors, such as weight control and selection to enter in dancer's companies, may contribute to delayin the development of breasts and bone maturation. The results also demonstrate that this practice influences specific characteristics of plantar pressures and visual and motor dependence in relation to the upper limbs, in order to develop specific motor strategies of corporal adaptation.

Keywords: child development; physical aptitude; child health; postural balance; dance.

1 INTRODUÇÃO

1.1 Crescimento, Maturação e Desenvolvimento motor

O desenvolvimento humano abrange mudanças estruturais e funcionais no corpo, no cérebro, na capacidade sensorial e nas habilidades motoras. O processo de mudança no desenvolvimento ocorre de forma sistemática, coerente e organizada. Essa mudança é adaptativa, pois envolve a associação entre as condições internas e externas do indivíduo (BRITO et al., 2011; PAPALIA; OLDS; FELDMAN, 2006).

O desenvolvimento da criança está sujeito a muitas influências, sejam elas provenientes da hereditariedade ou do ambiente e estes aspectos não agem de modo isolado, mas interagem de maneira complexa (BARNETT et al., 2016; ISARANURUG; NANTHAMONGKOLCHAI; KAEWSIRI, 2005). A necessidade de determinadas experiências ambientais para iniciar um desenvolvimento maturacional específico é um exemplo dessas interações e pode variar de uma criança para outra. Então, o mesmo ambiente pode ter efeitos diferenciados sobre crianças que nasceram com características distintas (BEE, 2003).

Há cinco modelos de influência ambiental sobre o desenvolvimento humano. O primeiro descreve um padrão maturacional sem nenhum efeito ambiental, o segundo é chamado de manutenção e mostra um padrão em que algum *input* ambiental é necessário para sustentar uma habilidade ou um comportamento desenvolvido em questões maturacionais. O terceiro é um efeito de facilitação do ambiente, assim uma habilidade ou um comportamento se desenvolve precocemente em virtude de algumas experiências. O quarto modelo é a sintonia, que acontece quando uma determinada experiência leva a um ganho permanente ou a um nível persistentemente superior de desempenho. A indução é o quinto e último modelo. Ela descreve um efeito puramente ambiental, pois um determinado comportamento não se desenvolve se não houver uma experiência específica (BEE, 2003).

Segundo o Estatuto da Criança e do Adolescente, considera-se como criança a pessoa com até doze anos incompletos, enquanto que entre os doze e dezoito anos encontra-se a adolescência (BRASIL, 2002). Aos seis anos, inicia-se a idade escolar da criança, cujo momento é marcado pelo aumento da complexidade das habilidades motoras grossas e finas, além do incremento na força muscular e coordenação dos

movimentos dos membros (GALLAHUE; OZMUN, 2005). Na adolescência, diferentemente da infância, na qual a idade cronológica é fundamental para a caracterização de eventos e o delineamento de condutas, existem outros fatores de maior relevância para caracterização, tais como velocidade de crescimento, estirão pubertário, maturação sexual e óssea, maturação do eixo neuroendócrino e o estado das condições nutricionais (MORAIS et al., 2013).

O desenvolvimento motor é o campo de investigação que estuda o comportamento motor, tais como, habilidades padrões e capacidades físicas, em populações normais ou não, em diferentes faixas etárias. Estuda também as teorias que fundamentam o sentido e significado do movimento humano no processo de desenvolvimento e aprendizagem (HAYWOOD; GETCHELL, 2010).

Crescimento físico é um aumento quantitativo em tamanho ou magnitude, para os seres humanos, esse período começa com a concepção e termina no final da adolescência ou no início da segunda década de vida, incluindo também mudanças na capacidade funcional. O termo maturação é também associado ao termo crescimento, mas isso não é o mesmo que desenvolvimento. Maturação denota o progresso em direção à maturidade física, ao estado ótimo de integração funcional dos sistemas corporais de um indivíduo e à capacidade de reprodução. O desenvolvimento continua mesmo depois que se atinge a maturidade física (HAYWOOD; GETCHELL, 2010).

Outros conceitos que estão relacionados com as ideias discutidas neste trabalho englobam o controle motor e a aprendizagem motora. O controle motor é o campo que investiga as bases de como a habilidade motora ocorre, a forma de regulação ou o direcionamento dos mecanismos essenciais do movimento e aborda questões a respeito do controle neural, muscular, sensorial e perceptual das tarefas e habilidades (SHUMWAY-COOK; WOOLLACOTT, 2010). A aprendizagem motora investiga as mudanças internas no domínio motor do indivíduo, deduzida de uma melhoria relativamente permanente em seu desempenho, como resultado da prática ou experiência (TANI, 2008).

A avaliação da independência funcional e das habilidades de uma criança é de extrema importância para o conhecimento do desempenho dentro do processo de desenvolvimento motor, principalmente devido à importância destas habilidades nas atividades escolares e na participação social. O desenvolvimento da funcionalidade na infância tem início com a aquisição de um amplo espectro de habilidades motoras,

que possibilita o domínio do corpo em diferentes posturas, sejam elas estáticas ou dinâmicas. O conjunto dessas aquisições determina a função de mobilidade e apresenta íntima relação com o desenvolvimento cognitivo (FELS et al., 2015; PERROTTI; MANOEL, 2001).

1.2 Controle Postural e Estratégias Motoras

O controle postural é dividido em orientação postural, que é a capacidade de manter adequadamente a relação entre os segmentos do corpo e entre o corpo e o ambiente, para execução de uma determinada tarefa, e a estabilidade postural, que é definida como a capacidade de manter o centro de massa dentro dos limites da base de apoio. Estes limites não são fixos e modificam-se de acordo com a tarefa a ser executada, a biomecânica individual e a demanda ambiental. Equilíbrio, ou estabilidade postural, é então definido como a capacidade de manter o centro de massa do corpo dentro de sua base de suporte (SHUMWAY-COOK; WOOLLACOTT, 2010).

Manter a estabilidade postural requer o aferente sensorial que detecta o movimento corporal e sua posição e processa essa informação dentro do sistema nervoso central em eferente motor. As estratégias de controle postural são as soluções sensório-motoras utilizadas para manter o controle da postura, elas incluem sinergias musculares, padrões de movimento, torques e pressões plantares (HORAK; HENRY; SHUMWAY-COOK, 1997).

A integração adequada de recursos visuais, vestibulares e proprioceptivos são a informação base do controle postural eficiente (MANCINI et al., 2012). A formação dos comandos para modular a postura vertical está ligada à especificidade e complexidade da execução da ação. Esta associação é importante para esportes ou atividades artísticas, nos quais o controle da orientação e equilíbrio do corpo são críticos para otimizar o desempenho. Um questionamento importante é se o treinamento postural específico é benéfico para o controle permanente durante posturas comuns e em novas posturas desafiadoras (CASABONA et al., 2016; MICHALSKA et al., 2018; REIN et al., 2011).

Vários fatores influenciam as pressões plantares e podem ter um impacto na biomecânica de um indivíduo. Existe uma relação estatisticamente significante entre

as pressões do pé esquerdo e direito, entre as duas regiões dos pés (antepé e calcanhar) e as pressões médias de ambos os pés (SYED et al., 2012).

1.3 A Prática do *Ballet* Clássico na Infância e Adolescência

A prática de atividade física na infância e adolescência tem sido estudada na literatura a fim de esclarecer os efeitos em vários aspectos. Sabe-se que ocorre um viés de seleção em diversas modalidades esportivas, nas quais fatores constitucionais determinam a seleção de biotipos epecíficos privilegiados para determinados esportes, o que não significa que ocorra aumento ou diminuição da estatura com a prática deles. O exercício físico leve a moderado deve ser incentivado, porém quando extenuante, principalmente se associado à restrição dietética, afeta o desenvolvimento puberal, a função reprodutiva e a mineralização óssea (ALVES; LIMA, 2008; SILVA et al., 2004).

O envolvimento e a capacidade de desempenho esportivo sofrem interferência direta das diversas alterações morfológicas e funcionais que acontecem durante a puberdade. O processo de aquisição de habilidades motoras emerge em função das interações entre fatores biológicos e ambientais (RÉ, 2011). Estudos sobre os efeitos da atividade física na infância e adolescência enfatizam melhoras nos níveis de aptidão física, benefícios à promoção da saúde e prevenção de doenças, desvalorizando o investimento em formas sedentárias de divertimento (FARIAS et al., 2010; SILVA; COSTA JÚNIOR, 2011). Tais circunstâncias também podem ser aplicadas no âmbito da dança e esta temática tem sido mais estudada atualmente.

Alterações físicas associadas à puberdade podem entrar em conflito com ideais funcionais e estéticos de uma carreira no *Ballet* Clássico (MITCHELL et al., 2016). A transição puberal pode apresentar um interessante paradoxo para a jovem bailarina, com crescimento e maturação levando a melhorias em algumas áreas, como força e resistência em detrimento de outras, como flexibilidade e coordenação. Esses desafios destacam a necessidade de se considerar as interações entre fatores biológicos, psicológicos e socioculturais durante a transição puberal no contexto do ambiente do *Ballet* Clássico (MALINA et al., 2015; MITCHELL et al., 2017).

Na literatura, já é bem documentado que bailarinas têm menor massa corporal, maior incidência de amenorréia, menstruação irregular, menarca atrasada e são no geral mais flexíveis que a média das mulheres (HERGENROEDER et al.,

1993; PIGEON et al, 1997). O *Ballet* é uma atividade esportiva que promove o baixo peso corporal, que por sua vez está associado ao alto potencial de lesões, porém, os efeitos do treinamento intensivo em jovens ainda não foram totalmente avaliados (KADEL et al., 2005).

A procura de um corpo ideal entre as bailarinas promove substanciais alterações da composição corporal que parecem ser acompanhadas por modificações dos gastos metabólicos em repouso. Foi estabelecido que elas devem ser magras e privilegiar a linearidade das formas, o que pode induzir excessiva magreza e vários outros problemas, que já estão sendo relatados pela literatura em geral (SANTOS; AMORIM, 2014; WILMERDING; MCKINNON; MERMIER, 2005). Diversas desordens alimentares são diagnosticadas nessa população, que em média, parece apresentar um baixo conteúdo mineral ósseo, com elevado risco de fratura, baixo Índice de Massa Corporal (IMC), atraso pubertário e desregulação no aporte nutricional (ARCELUS; WITCOMB; MITCHELL, 2014; BURCKHARDT et al, 2011).

A busca da imagem corporal adequada para o *Ballet* Clássico ultrapassa os parâmetros de percentual de massa magra da população em geral. O peso adequado com baixa porcentagem de gordura deve ser mantido principalmente quando a bailarina se torna profissional (RIBEIRO; FONSECA, 2011). Inúmeras discussões sobre o que acontece na dança já abordaram estudos morfofuncionais e fisiológicos em bailarinos, porém o assunto é pouco abordado em publicações detalhadas na literatura (MARTINS, 2015). Poucos estudos já avaliaram as características corporais de adolescentes praticantes de *Ballet*, enquanto que estudos com pré-adolescentes e crianças praticantes dessa modalidade são ainda mais escassos (KADEL et al., 2005).

Embora se tenha conhecimento de que qualquer dança contribui para a melhora do desempenho motor, a modalidade é comprometida quando ocorre a utilização da técnica desrespeitando a faixa etária ou provocando movimentos e atitudes estereotipadas (CLARO, 1995). Em termos da dança, o desempenho será máximo desde que todos os segmentos corporais estejam apropriadamente posicionados para permitir o movimento correto e completo (GREGO et al., 1999).

A dança em geral, assim como o *Ballet*, é uma atividade que requer alta habilidade, na qual grandes demandas são colocadas sobre o corpo em termos de articulação, amplitude de movimento, coordenação, equilíbrio e controle motor. Na

preparação para a performance, é preciso ser capaz de recordar séries de movimentos complicados e coordenados (REDDING, 2013). É então esperado que uma parte significante dos ensaios seja designada para o treino da técnica, com o foco específico no desenvolvimento fisiológico geral e não somente na aquisição de habilidades, mas nem sempre isso acontece. Estudantes de *Ballet* participam de altos níveis de treinamento que estão um pouco além dos intervalos recomendados para a idade, isso leva a um aumento no risco de lesões (EKEGREN; QUESTED; BRODRICK, 2014; REDDING, 2013).

Bailarinos clássicos devem ter mecanismos sofisticados de equilíbrio para se posicionarem de forma eficaz durante sequências coreográficas complexas de suas performances, com atividades multidirecionais em diferentes amplitudes e ângulos de rotação (HUTT; REDDING, 2014). Com a experiência, eles adquirirem a capacidade de explorar representações cognitivas de padrões espaciais que formam seus movimentos durante o processamento de sinais sensoriais externos, como a informação visual, proprioceptiva e auditiva (MUELAS PÉREZ et al., 2014).

Em alguns passos do *Ballet*, é fácil de admirar a precisão, a confiabilidade e a harmonia de cada movimento, neles os bailarinos aparecem em posições extremas, as pernas devem estar altas e a coluna deve dobrar-se em todas as direções. No entanto, eles apenas são capazes de realizar essas habilidades técnicas com a qualidade artística e atlética necessária se forem suficientemente flexíveis e fortes. Isso significa que uma boa performance pressupõe um corpo completamente desenvolvido, no qual condições técnicas, estéticas e físicas trabalham juntas (BRINSON; DICK, 1996; KOUTEDAKIS; JAMURTAS, 2004).

Nesta perspectiva, uma habilidade que foi praticada um número suficiente de vezes torna-se memorizada de forma que, quando o indivíduo deseja realizar essa determinada habilidade, recorre novamente a esse padrão particular que é reinterpretado imediatamente. Os psicólogos chamaram esses padrões motores memorizados de engramas. Um engrama advém de um estímulo que modifica a configuração do setor sensorial do cérebro. Os padrões de coordenação neuromotores são armazenados na mente e, sempre que é necessário determinado movimento, o estímulo induz o centro armazenador a reproduzir a habilidade particular aprendida e o movimento então é realizado automaticamente (FOSS; KETEYIAN, 2000; SAKAGUCHI; HAYASHI, 2012).

Sendo assim, várias posturas do *Ballet* podem ser consideradas como habilidades motoras aprendidas e armazenadas. Portanto, quando o bailarino solicitar, elas se reproduzirão automaticamente. Como a estética corporal e a postura são de extrema importância para os praticantes de *Ballet* Clássico, estes acabam por solicitar essas habilidades constantemente, adquirindo uma nova natureza postural (GOMES et al., 2009).

Apesar do conhecimento de que a prática do *Ballet* otimiza o controle motor e a coordenação dos movimentos, ainda não estão totalmente esclarecidas as mudanças que a prática desta atividade proporciona no corpo da criança e do adolescente em fase de crescimento e em diferentes níveis de maturação sexual. Neste sentido, a hipótese desse estudo é de que a prática do *Ballet* pode influenciar no desenvolvimento de crianças e adolescentes e, inclusive, no desempenho funcional em atividades da vida diária.

2 OBJETIVOS

2. 1. Objetivo Geral

- Analisar a influência da prática do *Ballet* Clássico no desenvolvimento de meninas.

2.2. Específicos

Os objetivos do estudo foram divididos didaticamente de acordo com os artigos submetidos para publicação.

Artigo 1 – *The Impact of Body Composition and Family Income on Functional Performance in Adolescent Female Practitioners and Non-practitioners of Classical Ballet.*

- Caracterizar o perfil socioeconômico de meninas praticantes de *Ballet* Clássico;
- Caracterizar o perfil socioeconômico de meninas não praticantes de *Ballet* Clássico;
- Comparar o perfil socioeconômico de meninas praticantes e não praticantes de *Ballet* Clássico;
- Caracterizar medidas antropométricas de meninas praticantes de *Ballet* Clássico;
- Caracterizar medidas antropométricas de meninas não praticantes de *Ballet* Clássico;
- Comparar medidas antropométricas de meninas praticantes e não praticantes de *Ballet* Clássico;
- Comparar a maturação sexual de meninas praticantes e não praticantes de *Ballet* Clássico;
- Comparar o desempenho funcional de meninas praticantes e não praticantes de *Ballet* Clássico;

Artigo 2 – *Girls Who Practice Classical Ballet Develop Different Motor Strategies Regarding Postural Stability*

- Comparar as pressões plantares de meninas praticantes e não praticantes de *Ballet* Clássico;
- Comparar o equilíbrio de meninas praticantes e não praticantes de *Ballet* Clássico;
- Verificar a influência da prática do *Ballet* Clássico nas pressões plantares de meninas;
- Verificar a influência da prática do *Ballet* Clássico no equilíbrio de meninas;
- Verificar se a visão pode interferir nas pressões plantares de meninas praticantes de *Ballet* Clássico;
- Verificar se a postura dos membros superiores pode interferir nas pressões plantares de meninas praticantes de *Ballet* Clássico;
- Verificar se a visão pode interferir nas pressões plantares de meninas não praticantes de *Ballet* Clássico;
- Verificar se a postura dos membros superiores pode interferir nas pressões plantares de meninas não praticantes de *Ballet* Clássico.

3 MÉTODOS

3.1 Caracterização do Estudo e Participantes

O estudo é observacional com delineamento transversal e foi realizado na escola pública Instituto Estadual de Educação (IEG), localizado no setor Leste Vila Nova e na escola estadual de dança Instituto Tecnológico em Artes (ITEGO) Basileu França, localizada no setor Universitário, ambas na cidade de Goiânia-GO.

A amostra foi composta por 111 crianças e adolescentes saudáveis do sexo feminino, com idades entre 10 e 15 anos, residentes na cidade de Goiânia, Goiás, Brasil. Elas foram divididas em um grupo formado por meninas da escola pública e que não praticavam atividade física fora do horário escolar, sendo que dentro da escola a dança não era uma atividade proposta como educação física (n = 55) e um grupo formado por meninas praticantes de *Ballet* Clássico em nível profissionalizante, da escola pública de formação de bailarinos ITEGO Basileu França (n = 56).

Critérios de inclusão: faixa etária de 10 a 15 anos, sexo feminino, matriculadas na escola selecionada, assinatura do Termo de Consentimento Livre e Esclarecido (TCLE) (Apêndice I) e, para o grupo das bailarinas, ter no mínimo quatro anos de prática de *Ballet* Clássico.

Não foram incluídas meninas com problemas ortopédicos instalados (ex: pé torto congênito, luxação do quadril) ou de origem neurológica (ex: paralisia cerebral, síndrome de Down) ou com problemas sensoriais (ex: deficiência visual, deficiência auditiva).

Critérios de exclusão para o grupo das bailarinas: ter mais de quatro anos de prática de *Ballet* Clássico, mas não fazer parte do corpo de baile da escola selecionada; estar no corpo de baile da escola selecionada apenas por curto período de tempo.

As meninas inseridas foram todas aquelas que dentro da escola selecionada se encaixaram dentro dos critérios de inclusão e exclusão e possuíam disponibilidade de horário para as avaliações. O convite foi feito de forma oral e escrita (carta de autorização) às direções das escolas e de forma oral às voluntárias.

Foi necessário que os responsáveis autorizassem a participação assinando o TCLE e que as próprias participantes em consentimento assinassem o Termo de Assentimento Livre e Esclarecido (TALE) (Apêndice II).

As meninas que preencheram os critérios de inclusão foram avaliadas em dias e horários de acordo com a disponibilidade de cada uma, de forma a não acarretar custos para elas. As avaliações foram feitas nas próprias escolas, onde já eram desenvolvidas as atividades escolares e de dança.

3.2 Instrumentos e procedimentos

A pesquisa aconteceu em duas etapas, sendo que em um primeiro momento as avaliações físicas foram realizadas por uma equipe de fisioterapeutas treinadas com auxílio de alunas de iniciação científica do curso de Fisioterapia da Universidade Estadual de Goiás (UEG), e aconteceram dentro das escolas participantes, em salas reservadas durante 40 a 50 minutos com cada participante. Na segunda etapa, vários questionários foram respondidos por telefone pelas mães em uma chamada com duração de 20 a 30 minutos.

Na avaliação física, a massa corporal foi obtida com o uso de uma balança Filizola® (série 3134, nº 86713 com divisões de 100 gramas e carga máxima de 150 kilos) e cada menina foi colocada em posição ortostática com os membros ao longo do corpo e olhando para frente. A estatura foi mensurada pelo estadiômetro com base fixa e cursor móvel, com a voluntária na posição ortostática e os pés unidos. Para assegurar a exatidão da medida da estatura, utilizou-se um esquadro apoiado sobre o vértice da cabeça. As meninas foram pesadas e medidas sem sapatos, vestindo roupas usuais (Grupo 1: uniforme da escola; Grupo 2: roupa de *Ballet*).

O IMC foi calculado conforme dados de referência da Organização Mundial de Saúde (OMS, 2007) e expresso em kilos por massa ao quadrado (kg/m2). Para a classificação nutricional dos percentis, empregou-se o aplicativo MedCalc 3000.

As medidas antropométricas (Apêndice III) avaliadas foram as circunferências dos braços, coxas, pernas, cintura, quadril, pescoço e abdômen; os comprimentos das coxas, pernas e pés; os diâmetros dos joelhos; as alturas e larguras dos maléolos e as larguras do pés. Para tal, foram utilizados fita métrica inextensível com resolução em milímetros e comprimento de 2 metros e um paquímetro (Lafayette Instrument Company®, modelo 01290). A espessura das dobras cutâneas

triciptal, panturrilha, quadríceps, abdominal e subescapular foi verificada com o auxílio de um adipômetro científico (Cescorf®) com resolução de 0,1 mm. Todas as medidas foram feitas de acordo com os procedimentos da *International Society for Advancement in Kinanthropometry* (ISAK) (LOPES; RIBEIRO, 2014). Para o cálculo do percentual de gordura, foi utilizado o protocolo de Slaughter et al (1988), que utiliza a soma das pregas cutâneas tríceps e subescapular.

Figura 1: Avaliação física das meninas do grupo das praticantes de *Ballet* Clássico.

Para a análise do desempenho funcional e maturação sexual foram aplicados os seguintes testes:

a) Teste do Tempo de Levantar-se e Andar (*Timed Up & Go Test* – TUG): é uma versão modificada do teste original *Get up and Go*, criado com o objetivo principal de avaliar o equilíbrio e a capacidade funcional (MATHIAS, NAYAK; ISAAC, 1986; MIYAMOTO *et al*., 2004; MATJACIC; ZUPAN, 2006), de forma rápida e simples. As meninas foram orientadas a levantar da cadeira, na qual estavam com o dorso apoiado, sem ajuda dos braços, andar três metros, circundar um cone e retornar em direção à cadeira, na qual deviam parar, sentar e encostar o dorso novamente. O tempo foi cronometrado a partir da voz de comando até o final. O teste foi realizado uma vez para familiarização e outra para tomada do tempo.

Figura 2: TUG no grupo de praticantes de *Ballet* Clássico.

b) Teste de Caminhada de Seis Minutos (TC6'): mensura o estado de funcionalidade do participante e fornece informações complementares à avaliação principalmente cardiorrespiratória. Esse teste é amplamente utilizado em diversos perfis de pacientes, incluindo crianças e adolescentes saudáveis, adultos de diferentes faixas etárias e IMCs, idosos e pacientes portadores de Doença Pulmonar Obstrutiva Crônica e Insuficiência Cardíaca (AQUINO *et al*., 2010; FERREIRA; GUIMARÃES; TAVEIRA, 2009; PIRES *et al.*, 2007; RUBIM *et al*., 2006; STEFFEN; HACKER; MOLLINGER, 2002).

Dentre as contra-indicações absolutas do teste, tem-se angina instável e infarto agudo do miocárdio durante os meses anteriores ao teste e paciente que não esteja devidamente medicado. Como contra-indicações relativas, têm-se: pressão diastólica maior que 100 milímetros de mercúrio (mmHg) e sistólica maior que 180 mmHg (AMERICAN THORACIC SOCIETY, 2002).

O teste foi realizado em um ambiente fechado, em corredor de três metros de largura e 30 metros de comprimento em linha reta, com solo plano e firme, marcado a cada três metros. Os pontos de virada foram sinalizados com cones e uma linha de partida definiu o início do trajeto. As participantes obedeceram aos critérios gerais padronizados, com um descanso prévio de 10 minutos e ao final do teste, a distância percorrida foi anotada.

O avaliador permaneceu em um ponto fixo, esclareceu os procedimentos à participante e durante o teste comunicou-se com ela com o mesmo tom de voz e com as seguintes frases:

Depois do primeiro minuto, o avaliador falou: "Você está indo bem. Você ainda tem 5 minutos". Quando o cronômetro marcou 4 minutos restantes: "Prossiga o bom trabalho, você tem mais 4 minutos". Quando o cronômetro marcou 3 minutos restantes: "Você está indo bem. Você já andou meio caminho". Quando o cronômetro marcou 2 minutos restantes: "Prossiga o bom trabalho. Só lhe restam mais 2 minutos". Quando o cronômetro marcou somente 1 minuto restante: "Você está fazendo bem. Você tem somente mais 1 minuto". Quando o cronômetro marcou 15 segundos para completar, o avaliador disse: "Já estou quase dizendo para parar. Quando eu disser, você para que eu irei até você". Ao final do teste foi dito: "Pare!". (*AMERICAN THORACIC SOCIETY*, 2002).

Este teste é uma forma de avaliação clínica realizada por meio de um esforço submáximo e consiste na avaliação das respostas fisiológicas da atividade em um

tempo pré-determinado. Trate-se, portanto de um teste de baixo custo e fácil administração, sendo um método reprodutível e confiável. De acordo com a *American Thoracic Society* (ATS), as variáveis empregadas no teste devem avaliar as respostas integrais dos sistemas envolvidos, como o cardiorrespiratório e o musculoesquelético (AQUINO, 2010).

Figura 3: TC6’ no grupo de praticantes de *Ballet* Clássico.

c) Teste de Sentar e Levantar (TSL): administrado em uma superfície plana e não escorregadia, com a avaliada descalça e desprovida de roupas que limitassem seus movimentos. A instrução foi de forma simples e direta para sentar e levantar do solo utilizando o menor número possível de apoios e sem se desequilibrar. Nos casos em que o desempenho não foi bom, informações foram fornecidas para que fosse melhorado na segunda tentativa (SILVA; CAMPISTA; SALLES, 2010). A execução de cada tarefa foi pontuada individualmente, do pior ao melhor desempenho, de zero a cinco, de acordo com a quantidade de apoios necessários e os desequilíbrios decorrentes da tarefa. Dessa forma, a pontuação zero correspondeu ao sentar e levantar com mais de quatro apoios ou ajuda externa e assim sucessivamente até a cinco, que caracterizou a execução sem nenhum apoio.

Figura 4: TSL em praticantes de *Ballet* Clássico.

d) Baropodometria: o baropodômetro eletrônico é um equipamento desenvolvido pela escola francesa de postura, que analisa os pontos de pressão

plantar exercido pelo corpo, tanto em posição estática, quanto dinâmica capaz de detectar possíveis anomalias na marcha e na postura. Consiste de uma plataforma com sensor barosensível - piezoelétrico com alta concepção de tecnologia, conectado a um computador o qual utiliza um *software* apropriado para visualizar imagens coloridas e dados estatísticos, com um alto valor de impressão diagnóstica postural. Identifica agentes diretos ou indiretos causadores de instabilidade corporal, que são impressas sob a forma de gráficos e planilhas (OLIVEIRA, 2010).

Através da plataforma baropodométrica é possível detectar a estabilidade do corpo no espaço, ou seja, as oscilações posturais e o equilíbrio por meio da quantificação da posição corporal em relação a sua base de suporte que assegura o centro de gravidade dentro do polígono de sustentação. As alterações dos padrões posturais observadas no exame de baropodometria podem desencadear dores na região lombar, quadril, joelho, tornozelo e pé. Estas alterações podem ser prevenidas e tratadas através de um novo conceito denominado de palmilha postural. Este conceito utiliza os princípios da neurofisiologia humana (OLIVEIRA, 2010).

Com esse método, é possível reconhecer, na pisada, anormalidades que necessitem de compensação, de proteção ou uso de palmilhas, assim como detectar, na marcha, problemas que sejam passíveis de correção por meio de exercícios especiais.

As avaliações foram feitas em 60 segundos cada uma, em postura ortostática estática, sendo repetidas duas vezes, com olhos abertos (braços ao longo do corpo e braços abertos) e olhos fechados (braços ao longo do corpo e braços abertos).

Figura 5: Baropodometria em praticantes de *Ballet* Clássico.

e) Teste de Tanner (Anexo I): mensura a maturação sexual por auto-avaliação, através das figuras dos cinco estágios de desenvolvimento puberal, com diferentes níveis de desenvolvimento dos pêlos pubianos e das mamas (Tanner,

1981). As meninas ao verem as figuras, em um lugar privativo e sem influência de nenhuma opinião, escolheram quais delas se assemelhavam às suas características corporais. Os estágios 1 e 2 foram considerados como nada ou pouco desenvolvidos, o estágio 3 como desenvolvido e os estágios 4 e 5 como muito desenvolvidos (Tanner, 1981).

Na segunda etapa da avaliação, os questionários utilizados com as mães por telefone foram compostos pelos seguintes instrumentos:

a) Roteiro de Anamnese (Apêndice IV): identificação da criança ou adolescente (idade, sexo, escolaridade) e dos pais (idade, escolaridade, profissão, endereço, telefone), histórico gestacional, perinatal e pós-natal e dados atuais de saúde.

b) Protocolo do Questionário da Associação Brasileira de Empresas de Pesquisa (ABEP) (Anexo II): informações como o grau de instrução do chefe da família, posse de eletrodomésticos e condições da moradia para classificar a condição econômica (nível A1 a E).

c) Questionário Socioeconômico e de Atividade Física (BRACCO et al., 2006) (Apêndice V): adaptado e modificado para determinar o nível de atividade física da criança ou do adolescente e a situação socioeconômica de sua família.

Estes procedimentos não apresentaram graves riscos para a participante, visto que não possuiam qualquer tipo de procedimento invasivo. As chances de quedas foram mínimas e não ocorreu a exposição a algum fator externo como calor, chuva, vento ou qualquer circunstância que oferecesse risco à participante.

3.3 Aspectos Ético-Legais

O estudo foi elaborado de acordo com as Diretrizes e Normas Regulamentadoras de Pesquisas Envolvendo Seres Humanos (Resolução 466/2012, do Conselho Nacional de Saúde), e aprovado pelo Comitê de Ética em Pesquisa com Seres Humanos da UEG, sob o número CAAE 65387717.4.0000.8113 (Anexo III).

As voluntárias foram previamente informadas e esclarecidas a respeito dos objetivos desta pesquisa e sobre o protocolo a que seriam submetidas, explicitando o caráter não invasivo do mesmo e os riscos mínimos de desconforto, possíveis tropeços e quedas, para os quais foram tomados os devidos cuidados. Foi assegurada a privacidade durante a coleta dos dados, de forma que as voluntárias permaneceram

em local privado, apenas com a presença da pesquisadora e foram informadas de que poderiam desistir de participar a qualquer momento, independentemente do motivo e que os dados obtidos seriam mantidos em sigilo e não poderiam ser consultados por outras pessoas sem autorização prévia por escrito, resguardando a privacidade.

3.4 Análise dos Dados

A análise estatística foi realizada com o programa *Statistical Package for Social Sciences* (SPSS), versão 23.0. A normalidade foi verificada por meio do teste Kolmogorov-Smirnov. A análise descritiva foi processada utilizando-se média e desvio-padrão para as variáveis contínuas e cálculo de frequência e porcentagem para as variáveis discretas ou categóricas. Os procedimentos estatísticos utilizados foram o teste T de Student para a comparação das médias entre os grupos, o teste T de Student pareado para as comparações intragrupo e o teste Qui-Quadrado para comparar as frequências entre as variáveis discretas.

Foi usado também o teste de Pearson para correlacionar variáveis contínuas. Logo após, as variáveis que apresentaram correlações estatisticamente significativas foram selecionadas para a análise de regressão linear múltipla e elaboração de modelos preditivos. O modelo que melhor descreveu as relações encontradas foi o que envolveu as variáveis distância percorrida no TC6', IMC e renda familiar. Em todos os testes, considerou-se nível de significância de 5% ($p \leq 0,05$).

3.5 Propriedade das Informações

As informações advindas desta investigação ficarão arquivadas pelo período de cinco anos. Tais informações serão de propriedade dos pesquisadores, sendo disponibilizadas apenas para fins de pesquisa e poderão ser utilizadas em outras investigações de acordo com o tipo e protocolo de pesquisa e aspectos éticos. As informações coletadas serão utilizadas para apresentação dos resultados esperados,

bem como para subsidiar outras investigações conforme relatado neste protocolo. Os resultados deste estudo serão comparados a outros desenvolvidos com metodologia semelhante e divulgados à comunidade cientifica e em geral, pelos meios correntes, de interesse no tema.

Todo o material gerado, questionários, fichas de avaliação, o TCLE e o TALE serão armazenados por um período de cinco anos e posteriormente picotados e reciclados.

4 PUBLICAÇÕES

Artigo 1 – The Impact of Body Composition and Family Income on Functional Performance in Adolescent Female Practitioners and Non-practitioners of Classical Ballet

Autores: Rafaela Noleto dos Santos, Adriano Jabur Bittar, Tânia Cristina Dias da Silva Hamu, Aline Nogueira Hass, Siobhan B. Mitchell, Cibelle Kayenne Martins Roberto Formiga

Revista: Journal of Adolescence (submetido)

Artigo 2 – Girls Who Practice Classical Ballet Develop Different Motor Strategies Regarding Postural Stability

Autores: Rafaela Noleto dos Santos, Adriano Jabur Bittar, Tânia Cristina Dias da Silva Hamu, Andreja Picon, Cibelle Kayenne Martins Roberto Formiga

Revista: Gait & Posture (submetido)

The Impact of Body Composition and Family Income on Functional Performance in Adolescent Female Practitioners and Non-practitioners of Classical Ballet

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Abstract

The aim of this study was compare and correlate the functional performance in daily tasks, body composition and family income of practitioners, at vocational level, and non-practitioners of classical ballet. A cross-sectional study was conducted with 111 girls (10 to 15 years), practitioners and non-practitioners. Anthropometry, sexual maturation (Tanner stage) and functionality (Timed Up & Go, Sitting-Rising and 6 Minute Walk tests) were assessed. Data analysis was performed using group comparison, correlation and regression tests. Participants differed in mean weight, body mass index, fat percentage, anthropometric measures, sexual maturation of the breasts, socioeconomic condition and parents' schooling. It was verified that the ballet practitioners had better functional performance ($p < 0.005$) and that the variables BMI and family income are predictors. It is concluded that the vocational practice of ballet

may improve physical fitness and motor development in functional activities of daily life. In addition ballet, in combination with other factors, such as weight control and selection, may contribute to delaying the development of breasts and bone maturation.

Keywords: child development; physical aptitude; child health; dance.

Introduction

Child development is the result of continuous changes in motor behavior that occur during the lifecourse, influenced by the interaction between genetic, biological and environmental factors (Barnett et al, 2016; Bronfenbrenner & Morris, 2006; Cross, 2017). Interventions performed at each stage may define different motor skills, so it is necessary to consider the relationship between variables such as prematurity, food habits, socioeconomic level, parental schooling, body mass index (BMI), physical activity level of children and parents and other conditions that may interfere in the motor development (Barnett al, 2016; Cruz et al., 2017; Deng & Fredriksen, 2018; O' Donoghue et al., 2018).

The practice of physical activity is related to the promotion of health and benefits such as motor development, better physical performance, bone mass increase, improvement of locomotor ability and increase of strength and muscle mass (Han, Fu, Cobley, & Sanders, 2018; Resaland et al., 2016). Physical fitness and motor capacity, as well as the influence of the physiological and anatomical changes resulting from the hormonal changes of puberty, are influenced by the amount of habitual physical activity (Ré, 2011). The pre-adolescent period is a critical time to develop and reinforce fundamental movement skills due to the developmental window for brain development

and the neuroplasticity associated with learning during this period (Dahl, 2004; Myer et al., 2015a).

While there is no doubt that it is important to encourage healthy physical activities, there is considerable controversy over when, how, and why a young person should become a practitioner of a single sport, or dance style. This type of precocious specialization, under the age of 18, has become more popular to achieve more knowledge, focus and high levels of performance. However, the effects of this practice need to be better studied, especially in relation to the risk of injury due to musculoskeletal immaturity (Brenner, 2016; Feeley, Agel, & Laprade, 2016; Jayanthi & Brenner, 2017; Myer et al., 2015b; Smith et al., 2017). Recent guidelines have suggested that weekly training hours should not exceed the age of the young athlete (Jayanthi, Labella, Fischer, Pasulka, & Dugas, 2015).

Another important point is that some sports activities and certain dance styles, which favor a lean and slender body, express in their practitioners the desire to lose weight, but this does not always happen in a healthy way. The ballet dancers are often thin, aligning with the linearity of the dance form, which may promote excessive thinness and several other problems reported in the literature. This population presents a low bone mineral content, high risk of fracture, low BMI, pubertal delay and deregulation in nutrition (Burckhardt, Wynn, Krieg, Bagutti, & Faouzi, 2011; Carl, Johnson, & Martin, 2017).

Although the physical changes associated with male puberty, such as greater stature, strength, and endurance, are generally welcome in dance, for females, they can be more challenging and may not be considered conducive to good performance (Mitchell, Haase, Malina, & Cumming, 2016; Pickard, 2013). This stage presents both

opportunity and challenge for young ballet practitioners, bringing advantages in increasing strength and better cognitive functions, while also bringing the potential for increases in fat mass and decreases in flexibility (Malina, Rogol, Cumming, Coelho-e-Silva, & Figueiredo, 2015; Mitchell, Haase, Cumming, & Malina, 2017).

Despite the knowledge that dance practice optimizes motor control and coordination of movements (Duncan, Ingram, Mansfield, Byrne, & McIlroy, 2016; Sirois-Leclerc, Remaud, & Bilodeau, 2017; Yan et al., 2018), the changes that the practice of the ballet promotes for girls of differing sexual maturity are not yet fully understood. It is still possible to infer that any sport or artistic activity that leads to early specialization can be detrimental in some way, physically or psychologically (Jayanthi, et al., 2015; Yin, Sugimoto,Martin, & Stracciolini, 2016).

The aim of the present study was to verify how the practice of classical ballet, at a vocational level, body characteristics and family income can influence functional performance in activities of daily living (ADLs) of girls. The hypothesis is that this influence is positive, as long as it does not lead to excessive and precocious specialization.

Method

Characterization of the Study and Participants

An observational study with a cross-sectional design was carried out in two schools in the city of Goiânia, Goiás, Brazil. The sample consisted of 111 healthy girls, aged between 10 and 15 years, living in the city of Goiânia, Goiás, Brazil were divided into two groups: Group 1 (n = 55) comprised of girls from a public school who did not

practice physical activity outside of school hours, and within the school, dance was not a proposed activity as part of physical education; Group 2 (n = 56) comprised of girls who practice classical ballet at a vocational level, in a public school. Vocational training offers dancers daily dance classes within their normal schooling, so that they can participate in festivals, national and international competitions representing the State of Goiás with important awards.

Group 1 inclusion criteria: age group of 10 to 15 years, female, student at the selected school, signature of the written informed consent form (WICF). Inclusion criteria of Group 2: the same as the previous group plus having at least four years of classical ballet practice. It was necessary to obtain parental consent for the participants and additional consent from responsibles for completion of the questionnaires. The participants also provided assent to take part. The evaluations were made in the schools where activities were already developed, in days and at times established in agreement with the responsible.

Exclusion criteria for both groups: girls with orthopedic problems (such as clubfoot, hip dislocation, etc.) or neurological (such as cerebral palsy, Down syndrome, etc.) or with sensory problems (including visual and hearing impairment, etc.).

The study was prepared in accordance with the Directives and Norms Regulating Research Involving Human Beings (Resolution 466/2012 of the National Health Council), and approved by the Ethics Committee in Research with Human Beings of the University under the number CAAE 65387717.4.0000.8113.

Instruments and procedures

At first, the physical evaluations were carried out by a team of physiotherapists trained with the help of Physiotherapy students of the University's, and took place within the participating schools, in rooms reserved, for 40 to 50 minutes with each participant. In the second stage, questionnaires were answered by telephone by the mothers of participants (duration of 20 to 30 minutes).

In the physical evaluation, body mass was obtained using a Filizola® scale (series 3134, nº 86713 with divisions of 100 grams and maximum load of 150 kilos). Each girl was placed in orthostatic position in the center of the scale, with arms positioned beside the body, legs hip width apart and looking forward. The stature was measured by the stadiometer with fixed base and mobile cursor, with the volunteer in the orthostatic position and the feet joined. The girls were weighed and measured without shoes, wearing usual clothes (Group 1 - school uniform, Group 2 - Ballet clothing).

BMI was based on World Health Organization (2007) reference data and expressed in kilos per square mass (kg / m^2). For a nutritional rating of the percentiles the MedCalc 3000 application was applied.

The anthropometric measures evaluated were according to the procedures of the International Society for Advancement in Kinanthropometry (ISAK) (Lopes & Ribeiro, 2014) by ISAK trained practitioners. An inextensible tape measure with a length of 2 meters and a pachymeter (Lafayette Instrument Company®, model 01290) were used. The thickness of the skin folds was verified with a scientific adipometer (Cescorf®) with resolution of 0.1 mm. For the calculation of fat percentage, the protocol of Slaughter et al (1988) was used, which uses the sum of the triceps and subscapular cutaneous folds.

For the functional performance and sexual maturation analysis the following tests were applied:

a) Timed Up & Go Test (TUG): a modified version of the original Get Up and Go test, created with the primary objective of assessing balance and functional capacity (Panisson & Donadio, 2013), quickly and simply. The test was performed once for familiarization and then for time-taking.

b) Six-Minute Walk Test (6MWT): measures functionality and provides complementary information to the cardiorespiratory evaluation. The measure has been used in healthy children and adolescents (Aquino, Mourão, Souza, Glicério, & Coelho, 2010). The test was performed in a private place with a corridor of three meters wide and 30 meters long in a straight line, marked every three meters. The turning points were signaled with cones and a starting line defined the beginning of the route. The participants obeyed the standard general criteria, with a previous rest of 10 minutes (American Thoracic Society, 2002; Aquino et al, 2010). At the end of the test, the distance was recorded.

c) Sitting-rising test (SRT): performed without shoes and clothes that could limit movement (Silva, Campista & Salles, 2010). The execution of each task was scored individually, from worst to best performance, from zero to five, according to the amount of support needed and the imbalances arising from the task.

d) Tanner Score: assesses sexual maturation by self-evaluation, through the figures of the five stages of pubertal development, with different levels of development of pubic hair and breasts (Tanner, 1981).

In the second stage of the evaluation, the questionnaires used with the mothers by telephone were composed of the following instruments:

a) Anamnese script: identification of the child or adolescent (age, sex, schooling) and their parents (age, education, profession, address, telephone), gestational, perinatal, and postnatal history and current health data.

b) Protocol of the Questionnaire of Associação Brasileira de Empresas de Pesquisa (ABEP): information such as the degree of instruction of the chef of the family, possession of household appliances and living conditions to classify the economic condition.

c) Socioeconomic and Physical Activity Questionnaire (Bracco, Colugnati, Pratt, & Taddei, 2006): adapted and modified to determine the level of physical activity of the child or adolescent and the socioeconomic situation of her family.

Data analysis

The statistical analysis was performed with Statistical Package for Social Sciences (SPSS), version 23.0 (IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.). Normality was verified by Kolmogorov-Smirnov test. The descriptive analysis was processed using mean and standard deviation for the continuous variables and calculation of frequency and percentage for the discrete or categorical variables. The statistical procedures used were the Student's T test for independent groups (comparison of anthropometric characteristics, sample characterization and functional performance in their continuous variables) and Chi-Square test to compare the frequencies between the discrete variables of the sample characterization and sexual maturation.

The Pearson test was also used to correlate body composition, sample characterization and functional performance in its continuous variables. The variables

that presented statistically significant correlations were selected for the analysis of multiple linear regression and elaboration of predictive models. The model that best described the relationships found was the one that involved the variables distance walked on the 6MWT, BMI and family income. In all tests, we considered a level of significance of 5% ($p \leq 0.05$).

Results

The study sample consisted of 111 girls, 10 to 15 years of age, distributed in Group 1 (n = 55) non-practitioners of Ballet and Group 2 (n = 56) vocational practitioners of classical ballet with an average dance time of 6.98 (± 1.92) years (Table 1), all of them with a daily exercise routine of three to six times a week, around two to five hours a day.

Table 1
Characterization of the sample of classical ballet practitioners in dance time.

Time (years)	n / (%)
4	8 (14,28)
5	6 (10,71)
6	9 (16,07)
7	9 (16,07)
8	10 (17,86)
9	9 (16,07)
10	4 (7,14)
11	1 (1,78)
TOTAL	56 (100)

Table 2 shows the characterization of the sample, regarding gestational, perinatal and postnatal history, socioeconomic status, parents' schooling and sexual maturation.

Table 2

Characterization of the sample of non-practitioners (Group 1) and practitioners (Group 2) of classical ballet.

Variables	Group 1 n = 55		Group 2 n = 56		
	Mean	**SD**	**Mean**	**SD**	**p+**
Birth data					
Weight at birth (grams)	3116.56	535.73	3263	419.83	0.14
Gestational age (weeks)	39.27	2.37	39	2.16	0.60
Gait start (months)	12.30	3.52	11.30	1.40	0.08
	N	**%**	**N**	**%**	**p++**
Type of birth					
Normal	30	61.20	19	38.80	0.005*
Cesarean	17	32.10	36	67.90	
Breast-feeding					
Yes	43	44.80	53	55.20	0.33
No	3	75	1	25	
ABEP classification					
A2	0	0	4	100	< 0.01*
B1	1	8.30	11	91.70	
B2	9	25.70	26	74.30	
C	27	69.20	12	30.80	
D	9	90	1	10	
Residence types					
Own	16	33.30	32	66.70	0.05*
Leased	22	61.10	14	38.90	
Assigned	7	46.70	8	53.30	
Others	1	100	0	0	
Mother's schooling					
Fundamental	21	91.30	2	8.70	< 0.01*
Medium	21	45.70	25	54.30	
Superior	3	10	27	90	
Father's schooling					
Fundamental	18	75	6	25	< 0.01*
Medium	14	35.90	25	64.10	
Superior	5	20	20	80	
Sexual maturation of breasts					
Nothing or little developed (stages 1 and 2)	9	32.10	19	67.90	0.05*
Developed (stage 3)	27	50.90	26	49.10	
Very developed (stages 4 and 5)	19	63.30	11	36.70	
Sexual maturation of pubic hair					
Nothing or little developed (stages 1 and 2)	20	62.50	12	37.50	0.15
Developed (stage 3)	24	48	26	52	
Very developed (stages 4 and 5)	11	37.90	18	62.10	

[+]Student T test;[++]Chi Square test;*p <0.05 (significant);SD:standard deviation; N: number; %: percentage.

Table 3 presents the anthropometric data evaluated. It describes the values of age, weight, height, BMI, percentage of fat and measures with significant differences collected according to the procedures ISAK (Lopes & Ribeiro 2014). Other measures such as thigh lengths, leg lengths, malleolus widths and foot widths did not show significant differences, so they are not represented in the table.

Table 3
Comparison between the anthropometric characteristics of non-practitioners (Group 1) and practitioners (Group 2) of classical ballet.

Characteristics	Group 1 (n = 55)		Group 2 (n = 56)		
	Mean	**SD**	**Mean**	**SD**	**p+**
Age (years)	12.09	1.09	12.32	1.32	0.32
Weight (g)	46.99	8.62	41.97	7.99	0.002*
Height (cm)	1.54	0.06	1.56	0.09	0.21
BMI (Kg/m^2)	19.64	2.97	17.03	1.96	< 0.001*
BMI Percentile (%)	59.03	27.70	31.28	21.61	< 0.001*
Fat percentage(%)	23.07	5.63	18.76	4.14	< 0.001*
Arm Circumference R(cm)	23.42	2.84	20.73	2.01	< 0.001*
Arm Circumference L (cm)	23.41	2.98	20.53	1.98	< 0.001*
Thigh Circumference R (cm)	44.77	4.86	41.14	4.37	< 0.001*
Thigh Circumference L (cm)	44.56	4.75	41.06	4.49	< 0.001*
Waist circumference (cm)	63.97	6.02	60.43	4.13	0.001*
Hip circumference (cm)	84.98	7.55	80.64	7.44	0.03*
Neck circumference (cm)	29.87	2.03	28.23	1.60	< 0.001*
Abdominalcircumference (cm)	70.16	7.01	64.53	5.04	< 0.001*
Leg circumferenceR (cm)	29.26	3.30	30.74	3.06	0.016*
Leg circumference L (cm)	29.26	3.28	30.99	3.06	0.005*
Knee diameter R (cm)	9.20	0.78	8.76	1.03	0.012*
Knee diameter L (cm)	9.24	0.90	8.77	1.05	0.013*
Foot length R (cm)	24.11	4.36	22.57	1.37	0.013*
Foot length L (cm)	24.09	4.37	22.51	1.38	0.011*
Malleolus height R (cm)	5.30	1.17	4.72	0.52	0.001*
Malleolus height L (cm)	5.28	1.14	4.68	0.49	< 0.001*

[+]Student T test; *p <0.05 (significant); SD: standard deviation; g: grams; cm: centimeter; Kg: kilogram; m: meter; BMI: Body Mass Index; R: right; L: left.

It was observed that the sample did not differ in age and height, but Group 2 presented lower weight and BMI (lower classification in the percentiles), lower fat

percentage and lower values in several anthropometric measurements except for leg circumferences, with higher values for the dancers. Also, lower values were observed in knee diameters, foot lengths and malleolus heights, measures that indicate bone maturation.

Table 4 shows the comparison of the functional performance of the two groups in the TUG, SRT and 6MWT tests. The classical ballet practitioners had a better functional performance in all tests applied.

Table 4
Relation of functional performance of non-practitioners (Group 1) and practitioners (Group 2) of classical ballet.

Characteristics / Test	Group 1		Group 2		
	Mean	SD	Mean	SD	p+
6-minute walk test					
Distance (m)	428.11	66.83	505.05	49	< 0.001*
Sitting-rising test					
Sit on the floor (score)	4.63	0.32	4.82	0.29	0.002*
Lift off the floor (score)	4.47	0.73	4.82	0.32	0.002*
Timein Timed Up& Go (s)	6.95	1.27	5.95	0.87	< 0.001*

+Student T test; * p<0.05 (significant); SD: standard deviation; m: meters; s: seconds.

When correlations between predictor variables and functional performance were verified, the distance walked on the 6MWT was correlated with BMI (r = -0.337) and the family income (r = 0.325). The time in TUG was associated only with the family income (r = -0.298). The SRT sit score correlated with BMI (r = -0.215) and family income (r = 0.265) and the lift score correlated only with BMI (r = -0.418).

The linear regression between these variables is shown in table 5. The BMI (p = 0.002) and the family income (p = 0.027) explained 19.8% of the distance variation in the 6MWT. Regarding the TUG time, the family income explained 8.9% of the cases variation (p = 0.004). For SRT, 9.1% of the variation in the score to sit is explained by

the family income (p = 0.041) and 17.5% of the variation of the score to raise is explained by the BMI (p < 0.001).

In summary, the results of the study suggest that the variables BMI and family income are predictive of the functional performance of non-practicing and practitioners of classical ballet.

Table 5
Linear regression models for prediction of the functional performance of non-practitioners (Group 1) and practitioners (Group 2) of classical ballet.

Model	R	R2	B	SE	β	p
Outcome distance on 6MWT (m)						
BMI (kg/m^2)	0.445	0.198	-7.838	2.427	-0.321	0.002*
Family income (R$)			0.004	0.002	0.224	0.027*
Outcome time on TUG (s)						
Family income (real)	0.298	0.089	0.000	0.000	-0.298	0.004*
Outcome score to seat						
BMI (kg/m^2)	0.301	0.091	-0.018	0.012	-0.151	0.154
Family income (real)			0.000	0.000	0.218	0.041*
Outcome score to rise						
BMI (kg/m^2)	0.418	0.175	-0.087	0.018	-0.418	<0.001*

β - standardized partial regression coefficient from the linear regression analysis. R², multiple correlation coefficient squared adjusted based on the sample size; SE, Standard error; B, non-standardized coefficient; p, t test*p < 0.05 (significant); m: meter; Kg /m^2: kilogram / meter^2; s: seconds.

Discussion

The aim of the present study was to verify how the body composition and the family income could influence the functional performance of practitioners and non-practitioners of classical ballet. This study provides evidence of how biological and environmental factors may influence girls' functional performance, especially regarding the practice of a regular, systematized and vocational artistic activity. It was observed that girls undertaking vocational ballet training had better responses in all applied functional tests, with characteristics such as BMI and family income appearing to have influence this result. It was also observed that dancers had lower values for weight,

BMI, percentage of fat and Tanner scores, suggesting a delay in sexual and bone maturation.

It is known that the data related to the gestational, perinatal and postnatal histories of the children, as well as maternal breastfeeding, can be predictors of future characteristics of the development (Ahmad, Frey, Fierro, Kenton, & Placencia, 2017; Belfort et al., 2016; Kafouri et al., 2013; Logan et al., 2017; Pascal et al., 2018). However, in the present study, these characteristics were similar and did not appear to have contributed to performance in the functional tests.

Through the anthropometric evaluation it was possible to verify that the ballet practitioners presented low body composition (weight and BMI) and low percentage of fat, but without prejudice to the growth. Amateur and professional classical ballet practitioners often have hormonal disorders related to menstrual changes (Bacchi, Spiazzi, Zendrini, Bonin, & Moghetti, 2013; Stracciolini et al., 2017a) and growth problems (Amorim et al., 2017), besides delay in sexual maturation mainly of the breasts, constituted in great part by fatty tissue (Amorim et al., 2017; Bowerman, Whatman, Harris, Bradshaw, & Karin, 2014; Kadel, Donaldson-Fletcher, Gerberg, & Micheli, 2005).

The participants of the present study were self-rated through the Tanner test, and it was possible to observe that ballet practitioners presented less developed breasts when compared to girls of the same age who did not practice this activity. This can be justified by the low BMI and percentage of fat and by the high level of physical activity of the group that practices ballet at the vocational level (Benedet, Lopes, Adami, Hinnig, & Vasconcelos, 2014; Georgopoulos et al., 2010).

In relating these findings to the demands of the classical ballet of a slender body and with undeveloped breasts, it can be inferred that the dancers suffer psychological pressure when realizing that the breasts are developing more than the expected (Carl et al., 2017; Mitchell et al., 2016; Pozzo, Cibinello, & Fujisawa, 2018). This fact can lead to eating disorders and nutritional deficits, already described in the specialized literature (Pickard, 2013; Wyon, Hutchings, Wells, & Nevill, 2014).

It was also noticed that the circumference measurements of the dancers were lower, with the exception of the circumferences of the legs that were increased. This can be explained by the nature of physical movement within the technique of classical ballet which emphasizes plantar flexion during the usual movements and the use of the pointe shoe, in this way the triceps muscle is constantly activated (O'Loughlin, Hodgkins, & Kennedy, 2008), which may lead to increased hypertrophy. Since this muscle has a low fat percentage, it was possible that the muscular volume was evidenced.

Several other studies have shown the same results found here regarding low body weight, BMI and percentage of fat in ballet practitioners, either in comparison with a control group or in a description of the populations of young people practicing this art (Burckhardt, et al., 2011; Grochowska-Niedworok et al., 2018; Haas, Plaza, & De Rose, 2000; Stracciolini et al., 2017b; Wyon et al., 2014).

In relation to bone maturation, it is possible to predict the bone development of a person through equations that use factors such as height, chronological age, body mass and femoral diameter (Cabral et al., 2013; Macêdo, Linhares, & Fernandes, 2015). In the present study, the group of dancers, compared to the control group, presented smaller measures of body mass and knee diameter, while height and chronological age were similar. Therefore, the bone age of the girls who practice ballet at a vocational

level was lower, suggesting either an impact of dance upon bone maturation or alternatively, the impact of selection or self-selection of those delayed in maturation into vocational ballet training (Brooks-Gunn, Attie, Burrow, Rosso, & Warren, 1989; Brooks-Gunn & Warren, 1985; Hamilton, Brooks-Gunn, Warren,& Hamilton, 1988; Mitchell et al, 2016; Pickard, 2013; Steinberg et al., 2008). Further longitudinal studies are needed in order to fully understand this relationship.

Other researchers have suggested delayed maturation to be an indirect 'product' of intensive dance training, with intensive dance training leading to weight control and subsequent delayed maturation (Pigeon, Oliver, Charlet, & Rochiccioli, 1997). However, intensive training per se has been shown to have no negative effect on growth and maturation in gymnasts and dancers (Malina et al., 2013; Matthews et al., 2006; Steinberg et al., 2008). In fact, lesser breast development and delayed maturation in general are more likely to be associated with selection into (and self-selection into) vocational ballet training – the physical characteristics of later maturation being more aesthetically in line with ballet ideals (Brooks-Gunn & Warren, 1985; Hamilton et al., 1997; Mitchell et al., 2017).

Regarding the functional performance in the proposed tests, the girls who presented the best results in the tests were the dancers, who are inserted in families with higher purchasing power and with parents with a higher educational level, besides having lower BMI and percentage of fat and lower values for body composition. Statistical analyzes showed a weak to moderate correlation between functional performance and BMI and family income characteristics. It was possible, through linear regression, to establish a prediction relationship between these variables. Combined,

these conditions and the practice of ballet led to a better performance in the functional tests applied.

This result was also seen in a study of 247 school children who investigated lifestyle habits that may influence the 6MWT performance in eutrophic and overweight children. It was observed that the practice of artistic activities (rhythmic gymnastics, ballet and dance) and nutritional classification positively influence, even poorly, performance in the 6MWT between girls in the evaluated age group (Pozzo et al., 2018).

The tests applied here enable evaluation of the importance of daily functional activities in normalmotor development. Strength, flexibility, agility and balance are needed for good execution. These skills are acquiredand improve with each new experience a child is exposed to. The motor experience of activities such as climbing trees, playing and physical practices, such as dance, leads to better performance in evaluations such as these. The results presented here show a good performance in both groups, since all the girls were healthy and without physical limitations that could restrict these experiences. However, it is observed that the practice of intensive regular physical activity, such as ballet, outside school hours, played a differential role in the best development of these skills.

Classical ballet is an activity that requires discipline, concentration, dedication and commitment, in hours of rehearsals and daily classes in search of aesthetic perfection and harmonious movement. So girls who are dedicated to this art form become more focused and physically resilient, even before they are professionals. This may also explain the better functional performance in tests that require physical

capacities and also characteristics such as discipline, concentration, dedication and commitment.

Although some studies indicate that there is an inversely proportional relationship between BMI and performance in tests such as the 6MWT, TUG and SRT, there is still no consensus regarding the relationship between these variables, and this is a subject of continued study, mainly because there are many variables potentially involved in this outcome (Cibinello, Pozzo, Moura, Santos, & Fujisawa, 2017; Nunez-Gaunaurd, Moore, Roach, Miller, & Kirk-Sanchez, 2013; Pozzo, Cibinello, & Fujisawa, 2018; Silva et al., 2010; Tsiros et al., 2012).

It was not possible to establish a classification regarding early specialization in the sample presented here due to a lack of data. This can be considered a limitation of the study, since fully whether the dancers chose ballet as their only activity, meaning they did not sample other activities. In addition, whether they trained at least eight months in a year and the number of hours of dedication, criteria already established to characterize early specialization, were not assessed (Jayanthi, et al., 2015; Myer et al., 2015b; Smith et al., 2017). Therefore it is not possible to comment accurately on the precocity of the dance involvement. Even with this limitation, it was possible to evaluate the influence of this professionalizing practice on the physical characteristics and physical abilities of dancers and non-dancers.

Other limitations of the study included the method of body composition assessment. Gold standard methods such as DEXA were not used, thereby limiting the accuracy with which body composition can be assessed. However, ISAK protocols were used in order to increase the accuracy of skinfold assessments. Further, the study did not include motor performance tests with higher physical demands. However, the tests used

were appropriate to assess how functional skills can be influenced by the characteristics determined by vocational training in ballet.

This is the first study to address the functional performance of dancers through tests that evaluate daily activities, such as walking, sitting and lifting, being a pioneer in the elucidation of the influences that this practice can bring to adolescent girls. Another differential is the analysis of body composition performed with various measures and an important comparison with girls of the same age, but with different motor experiences. Further research is needed in order to explore more specifically if parameters such as total dance time may affect outcomes for functional performance.

The results presented here suggest that ballet practice, as a systematized and vocational physical activity, influenced the functional performance of female children and adolescents in the improvement of mobility, balance and cardiorespiratory capacity, indicating that the requirements imposed by this task motor skills improve physical fitness and development in childhood in the performance of ADLs. It is acknowledged that characteristics such as BMI, percentage of body fat, socioeconomic status of the family and parents' schooling may have had a weak influence on this result. While longitudinal data would be needed to comment in more detail upon the relationship between involvement in vocational ballet training and delays in sexual and bone maturation, in this study the maturation of those involved in vocational ballet was delayed in comparison to that of non-dancers. Dancers reported lower tanner scores, indicators of delayed bone maturation and lower body fat compared to non-dancers. Height was similar across both groups with the circumference of the legs higher for those involved in ballet training. Existing research suggests delayed maturation to be an indirect ‘product’ of intensive dance training, with intensive dance training leading to

weight control and subsequent delayed maturation (Pigeon et al., 1997). Future studies should examine this further.

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GIRLS WHO PRACTICE CLASSICAL BALLET DEVELOP DIFFERENT MOTOR STRATEGIES REGARDING POSTURAL STABILITY

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Abstract

Background: classical ballet improves balance and movement capacity by developing specific dynamic posture strategies. **Research question:** The objective of the present study was to verify how such practice, at a professional level, can influence the plantar pressures and balance of children and adolescents, as well as to verify if subjects' vision and posture of the upper limbs can interfere in this result. **Methods:** This is a cross-sectional study that was carried out with 111 girls aged 10 to 15 years who practice classical ballet (n = 56) and non-dancers (n = 55). Anthropometry and analysis of plantar pressures and postural stability were assessed by means of a baropodometry platform, in three different conditions: with eyes open and arms along the body (EOAAB), with eyes closed with arms along the body (ECAAB), and with eyes open and arms outstretched (EOAO). Data analysis was performed by using group

comparison and correlation tests. **Results:** Those who practiced classical ballet placed less weight onto the left forefoot, presented lower values of maximum pressure and plantar surface area in all the evaluated conditions and moved less in the stabilometry analysis. It was also observed that ballet dancers were more influenced by vision and positioning of the upper limbs than the group of non-dancers. Length of time as a dancer influenced the results found. **Significance:** To understand the postural motor strategies of children and adolescents who practice ballet may have implications in the practice of systematic training and in the prevention of long-term injuries.

Keywords: child development; postural balance and dance.

Introduction

To maintain balance being on vertical position is a complex task and requires a combination of sensory and motor control [1]. Classical ballet dancers maintain postural stability during challenging tasks more easily than non-dancers, and proprioceptive and visual stimuli are key sensory inputs for that [2,3,4,5].

Dance training improves balance and movement capacity by developing specific dynamic postural strategies that relevant to its mandatory requirements [6]. The commands required to modulate the vertical posture is linked to the specificity and complexity of the execution of the movement. Such association is important for sports or artistic activities where body orientation and balance control are critical to optimizing performance. An important question is whether specific postural training is beneficial for permanent control during common postures and new challenging postures [5,7].

On the other hand, dynamic balance strategies seem to be influenced by growth accelerations, which can distort proprioceptive references and representations of the body. In static balance, young dancers' postural control is less efficient than that of adults, and they are more dependent on vision [8]. Classical ballet dancers must have sophisticated balance mechanisms to effectively position themselves during the complex choreographic sequences of their performances, with multidirectional activities at different amplitudes and angles of rotation [9].

A review of the literature showed that researches that use force platforms or kinematic systems indicated the importance of vision to maintain balance and the need to understand the postural balance characteristics of this population. No study analyzing the influence of upper limb positioning was found and most of them did not control this positioning, so the dancers could have assumed different positions to achieve a better balance [3].

The traditional view of the science of movement that tended to universally associate variability with decreases in performance and pathology is no longer sustainable. Tools and methodologies that emerged from the perspective of dynamic systems (eg, nonlinear dynamics and chaos theory) are discussed in the context of postural coordination and control. Variability may play a functional role in the detection and exploration of stability limits [10,11].

In this sense, the objective of the present study was to verify how classical ballet practice at a vocational level can influence the plantar pressures and variability of girls' postural control and to verify if vision and the position of the upper limbs can influence this result. The hypothesis is that dancers present different strategies of postural stability, which may be represented by different values of plantar surface pressure,

plantar surface area and variations of the Center of Pressure when compared to non-dancers, but they are more dependent on vision.

Methods

Study characterization and Participants

This is cross-sectional observational study that was carried out in two schools in the city of Goiânia, Goiás, Brazil. The sample consisted of 111 healthy girls aged 10 to 15 years and divided into two groups. Group 1 (n = 56): classical ballet dancers at a vocational level in a public school for ballet; Group 2 (n = 55): girls attending a public school who did not practice Ballet or any other physical activity after school.

Criteria for inclusion in the groups: females aged 10 to 15 years studying in the selected school and previous signing of the written informed consent form (WICF). For Group 1, it was also a criterion to have at least four years of classical ballet practice.

Exclusion criteria for both groups: girls with orthopedic problems (eg. congenital clubfoot, hip dislocation) or with problems of neurological origin (eg. cerebral palsy, Down syndrome) or with sensory problems (eg. visual impairment, hearing impairment).

The participants' parents or their legal guardians had to sign the WICF and the participants also provided assent to take part.

Instruments and procedures

The physical evaluations were performed by trained evaluators and took place in the schools, in rooms reserved for 15 to 20 minutes with each participant. Body mass

was obtained with the use of a Filizola® scale (series 3134, nº. 86713 with divisions of 100 grams and maximum load of 150 kilos). Height was measured by a stadiometer with fixed base and mobile cursor. The BMI was expressed in kilos per square mass (kg / m^2).

For the analysis of plantar pressures and postural stability, a baropodometry platform with a Midcaptures piezoelectric quartz sensor was used, with a sampling frequency of 150 Hz, and data analysis was performed by FootWork® software.

In this study, we defined maximum pressure peak as the highest pressure value detected throughout a measurement [12,13], and the Quilopascal unit (kPa) was used. The mean pressure peak was defined as the mean of all pressure values for each measurement [13], described as a percentage to represent the forefoot and rearfoot weight load on each side.

The plantar surface area corresponds to the measurement of the foot contact region with the platform sensors. It is determined by the sum of the area of all sensors activated within a given region [14]. In this study, we analyzed the data referring to the plantar surface of the left foot (L) and right (R) by using the square centimeter unit (cm^2).

The arch index and foot type were calculated according to Staheli et al. [15] and postural stability was analyzed through stabilometric parameters derived from the spatial and temporal behavior of the pressure center [16].

The evaluations were performed in static orthostatic posture, being repeated twice with 60 seconds of in the same position in each repetition, in three different conditions as follows: open eyes with arms along the body (OEAAB), eyes closed with arms along of the body (ECAAB) and open eyes with arms outstretched (OEAO). The

girls were given the command to stand on the platform with one foot next to the other in their usual posture.

The study was prepared in accordance with the Regulatory Guidelines and Norms for Research Involving Human Beings (Resolution no. 466/2012 of the National Health Council) and approved by the Research Ethics Committee with Human Beings under the number CAAE 65387717.4.0000.8113.

Data Analysis

The statistical analysis was performed with Statistical Package for Social Sciences (SPSS), version 23.0 (IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.). Normality was verified by Kolmogorov-Smirnov test. The descriptive analysis was processed using mean and standard deviation. The statistical procedures used were the Student's t-test for the comparison of the means between the groups and the paired Student's T test for the intragroup comparisons. For the correlation with the dance practice in the group of dancers, the Pearson correlation test was performed. In all tests, a significance level of 5% ($p \leq 0.05$) was considered.

Results

The study sample consisted of 111 girls, 10 to 15 years of age (mean = 12.21 ± 1.21), predominantly right-handed, distributed in Group 1 (n = 56; mean age = 12 , 32 ± 1.32) vocational classical ballet dancers; and Group 2 (n = 55, mean age = 12.09 ± 1.09) non-dancers. The average dance time of the dancers was 6.98 (± 1.92) years, with a

daily exercise routine corresponding to classes and rehearsals three to six times a week, around two to five hours a day. Table 1 shows the sample characterization.

Mean Pressure Analysis (Table 2)

In the three conditions assessed, the dancers loaded less weight on the L forefoot when compared to non-dancers. In the ECAAB condition, a higher mean pressure on the left rearfoot was also significant in this group. In the intragroup evaluation, for the three conditions, the dancers' weight load is more intensely placed on the L rearfoot. In Group 2, bodyweight loading is more usual on the rearfoot, with no difference between L and R.

Maximum Pressure Analysis (Table 2)

In all the assessed conditions, the female ballet dancers had lower values of maximum pressure on both L and R foot when compared with the girls who did not practice that activity. It is also possible to notice that such values were lower on the R foot for both groups, except for the EOAAB condition in the group of dancers, whose difference was not significant.

Analysis of the Plantar Surface Area (Table 2)

In the comparison of the groups, in all evaluated conditions, the female ballet dancers had lower values of plantar surface area, both on the L and R foot, being these values smaller on the R foot in the EOAAB condition. It is noteworthy that most of them had cavus feet (56% had L cavus foot and 57% had R cavus foot), whereas most

of those who did not practice classical ballet had normal feet (71% had normal L foot and 76% had normal R foot).

Stabilometry (Table 3)

The group of dancers presented lower antero-posterior displacement (AP) in the ECAAB and ECAO conditions and lower latero-lateral displacement (LL) and ellipse area in the EOAO condition.

Influence of Vision (Table 3 and Table 4)

For both groups, the "eyes closed" condition influenced in a larger surface area of contact on both feet. In the stabilometry, it was possible to observe greater displacements and area of an ellipse. However, such difference was not significant for Group 2 in the LL displacement.

Influence of the Upper Limbs position (Table 3 and Table 5)

The 90º abduction position of the upper limbs had the same influence on the static baropodometric parameters in both groups, leading to: lower mean pressure on the L rearfoot, higher mean pressure on the R forefoot and lower maximum pressure in the standing position. However, only the female ballet dancers had larger contact surfaces in both feet and higher values in all stabilometric parameters.

Correlation between time of dance practice and Baropodometry and Stabilometry (Table 6)

Through the analysis of Pearson's correlation it was observed that the longer the time of dance practice in years, the greater the mean pressure on the forefoot for both feet, in addition to a larger surface contact on the L foot. In the stabilometric parameters, there were no significant correlations.

Discussion

This study has brought evidence on how the practice of classical ballet in a systematic and professionalizing way can influence plantar pressures and postural stability strategies of girls. It was observed, in short, that classical Ballet dancers placed lower bodyweight load on the L forefoot, had lower values of maximum pressure and plantar surface area in all the conditions assessed and had less displacements according to the stabilometric analysis. It was also observed that they were more influenced by vision and position of the upper limbs than the group of non-dancers, and that the time of dance practice influenced in the development of specific motor strategies.

The analysis of normal pressure distribution on the feet is characterized by a 60% occurrence in the rearfoot, 8% in the midfoot and 28% in the forefoot, considering both sides [17]. The girls who were evaluated here had similar results, with a higher peak pressure on the rearfoot. However, when comparing groups, this was more evident in dancers on their L foot.

The nature of pressure distribution on cavus feet is not yet entirely clear, and different conclusions were drawn from comparisons with normal feet. One study showed greater pressure on the heel and lateral forefoot and lower pressure and contact area in the midfoot and hallux [18]. Another study showed that there is an increase in

pressure on both forefoot and rearfoot [19] in cavus feet when compared to normal ones. The dancers of the present study, for the most part, have cavus feet and a lower mean pressure value on the L forefoot when compared to the Group 2 of girls, with predominantly normal feet.

The cavus foot is most often caused by muscle imbalance, which causes the plantar arch to become excessively high and to decrease the plantar surface area [20]. This is aggravated by the use of ballet pointe shoes since they make compression on the feet and limit the areas of plantar contact [21]. The dancers of the present study also had smaller plantar surface area.

Conventionally, the dominant side of an individual is used to perform tasks, whereas the non-dominant side is used to support or maintain balance [22]. In classical ballet, there is a difference in muscular effort and coordination capacity required for the support leg and gesture leg, respectively, in the execution of asymmetric movements. However, the effect of lateral dominance on the performance of such movements has not yet been studied. Generally, the choice of which leg to use is made individually, since most movements involve unilateral postures on a small supporting base [22,23].

Younger, inexperienced dancers have less laterality skills than the more experienced dancers because of training effects [22]. The dancers of the present study, who are mostly right-handle and young, presented higher mean pressures on the L rearfoot, which may be justified because this is the most frequently used support leg.

Maximum pressure is the highest pressure value detected during a measurement [12] and in the group of dancers this value was lower in all the conditions assessed. This may represent a better control of the stabilizing muscles, since the dance practice leads to a better postural stability and dancers present a more active posture control in relation

to untrained individuals [3,4,6,24]. These data also corroborate with the stabilometry findings shown here.

Studies such as those previously mentioned show lower postural oscillation as better balance control, but some researchers argue that this may be interpreted differently [5]. It has already been analyzed that athletes with a high demand for balance control, such as those participating in martial arts and gymnastics, have greater postural oscillation than non-athletes [25,26]. The common controversy comes from the interpretation of the results of the Romberg test, which is used to assess the neurological function for balance, in which high postural oscillation is a sign of postural disorders. However, this should not be interpreted as a worse balance, but rather attributed to more demanding motor tasks of sports practice [5].

Highly qualified athletes, in the face of the body's disruption to environmental stimuli, can successfully manage postural instabilities despite increased oscillation. According to the idea of motor abundance, this is good for qualified motor performance [27]. When the center of pression behaves as a fixed point there is resistance to disturbances, but less flexibility and adaptation when a change in the postural state is required [10]. Most probably, a greater postural oscillation allows the rapid and precise change of body position, which is crucial for ballet practice [5] and the variability functionality depends on the task being performed [10]. The relation between variability and stability is complex and variability can not be equated with instability without knowing about the dynamics of movement [11].

Based on this assumption, it may be possible to justify the results found here for the higher values of stabilometry and plantar surface area found for the group of dancers

in the condition of the upper limbs abducted to 90º, being this a motor control strategy used by them as a common practice in ballet.

There is a general consensus in the literature that dancers use proprioceptive and visual stimuli as their fundamental sensory inputs [2]. Their balancing abilities are superior to those of non-dancers when their eyes are open, but not with eyes closed, suggesting that the ability to change acutely from one balancing mechanism to another is not sophisticated [2,5,8,9,28]. This fact may explain the greater changes observed in the stabilometry of the dancers group when compared to the open and closed eyes conditions.

There were no significant correlations between the stabilometric parameters and time as a dancer, probably because all the dancers of the sample have professional level and similar experience, so that it was not possible to perceive the effect of training on the postural balance as described in the literature [29].

As regards the static baropodometric data, as time as a dancers increases, the higher was the mean pressure on the forefoot, in addition to a larger contact area. The long period of training required to become a dancer produces postural memories for an anatomical configuration of the foot. This specificity is independent of the level of difficulty, and considers both the postural stability and the structure of the motor control [7]. Thus, new studies are necessary to understand the effects of ballet in the long term on the biomechanics of dancers' feet.

The results shown here suggest that dancers at the vocational level, when compared to ordinary girls who do not experience classical ballet practice, had lower weight load on the L forefoot weight and lower values of plantar surface area, which may be related to higher prevalence of cavus feet. In relation to postural stability, they

present lower values of maximum pressure and lower displacements in the stabilometric analysis. However, they were more vision-dependent and had greater displacements with upper limbs abducted to 90º, which may be related to different motor control strategies. The findings on the influence of the upper limbs posture have not yet been fully clarified and further research is needed to elucidate the actual motor balance strategy in that population.

The findings of the present study may contribute to the understanding of postural motor strategies of children and adolescents who practice ballet, with implications in the practice of systematic training and prevention of long-term injuries. Based on this, it is possible to develop programs focused on the improvement and development of correct strategies for coordination and management of instabilities within motor abundance [27], so that the harmful effects of much variability in balance and movement do not occur [11].

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Table 1
Sample characterization.

	Group 1		Group 2		
Characteristic	**Mean**	**SD**	**Mean**	**SD**	**p+**
Age (years)	12.32	1.32	12.09	1.09	0.32
Weight (Kg)	41.97	7.99	46.99	8.62	0.002*
Height (m)	1.56	0.09	1.54	0.06	0.21
BMI (Kg/m2)	17.03	1.96	19.64	2.97	< 0.001*

+Student`s T test; *p < 0.05 (significant); SD: standard deviation; Kg: kilogram; m: meter; BMI: Body mass index.

Table 2: Comparison between the classical ballet dancers' (Group 1) and non-dancers' (Group 2) static baropometric characteristics.

Parameter / Condition	MeanGroup 1 (±SD)	MeanGroup 2 (± SD)	p^{+}
Mean Pressure (%)			
L forefoot EOAAB (A)	18.16 (± 5.53)	20.84 (± 5.25)	0.01
L rearfoot EOAAB (B)	31.91 (± 7.98)	30.49 (± 6.43)	NSD
R forefoot EOAAB (C)	21.7 (± 6.72)	20.51 (± 4.45)	NSD
R rearfoot EOAAB (D)	28.39 (± 6.08)	28.17 (± 5.43)	NSD
p^{++} A ≠ B	< 0.001	< 0.001	
p^{++} C ≠ D	< 0.001	< 0.001	

p^{++} A ≠ C	< 0.001	< 0.001	
p^{++} B ≠ D	0.004	NSD	
L forefoot ECAAB (A)	17.36 (± 5.49)	21.31 (± 5.38)	< 0.001
L rearfoot ECAAB(B)	32.6 (± 6.96)	29.86 (± 6.12)	0.03
R forefoot ECAAB(C)	21.1 (± 6.22)	20.89 (± 4.34)	NSD
R rearfoot ECAAB (D)	29.04 (± 6.08)	27.91 (± 5.14)	NSD
p^{++} A ≠ B	< 0.001	< 0.001	
p^{++} C ≠ D	< 0.001	< 0.001	
p^{++} A ≠ C	< 0.001	NS	
p^{++} B ≠ D	0.001	NS	
L forefoot EOAO (A)	18.98 (± 5.58)	21.3 (± 5.7)	0.03
L rearfoot EOAO (B)	30.3 (± 6.9)	29.39 (± 6.77)	NSD
R forefoot EOAO (C)	23.36 (± 6.55)	21.6 (± 5.11)	NSD
R rearfoot EOAO (D)	27.35 (± 6.48)	27.8 (± 5.86)	NSD
p^{++} A ≠ B	< 0.001	< 0.001	
p^{++} C ≠ D	0.02	< 0.001	
p^{++} A ≠ C	< 0.001	NSD	
p^{++} B ≠ D	0.005	NSD	
Maximum Pressure (Kpa)			
L foot EOAAB (E)	144.59 (± 35.99)	174.61 (± 46.98)	< 0.001
R foot EOBAB (F)	136.18 (± 34.73)	157.93 (± 38.61)	0.02
p^{++} E ≠ F	0.02	0.004	
L foot ECAAB(E)	144.15 (± 34.43)	173.61 (± 46.47)	< 0.001
R foot ECAAB (F)	129.77 (± 32.2)	157.1 (± 39.37)	< 0.001
p^{++} E ≠ F	0.001	0.003	
L foot EOAO (E)	136.99 (± 35.08)	170.21 (± 45.2)	< 0.001
R foot EOAO (F)	132.35 (± 37.46)	155.14 (± 39.85)	0.02
p^{++} E ≠ F	NSD	0.009	
Area (cm^2)			
L foot EOAAB (E)	66.49 (± 14.34)	95.92 (± 14.28)	< 0.001
R foot EOAAB (F)	66.32 (± 14.46)	96.12 (± 13.49)	< 0.001
p^{++} E ≠ F	< 0.001	NS	
L foot ECAAB(E)	69.6 (± 14.06)	97.99 (± 14.49)	< 0.001
R foot ECAAB (F)	70,54 (± 15.18)	98.14 (± 13.8)	< 0.001
p^{++} E ≠ F	NSD	NSD	
L foot EOAO (E)	70.29 (± 14.98)	96.46 (± 14.66)	< 0.001
R foot EOAO(F)	70.95 (± 15.82)	97.33 (± 13.96)	< 0.001
p^{++} E ≠ F	NSD	NSD	

+Student's T test; ++Paired T test;p < 0.05 (significant); SD: standand deviation; L: left; R: right; EOAO: eyes open and arms outstretched; EOAAB: eyes open and arms along the body; ECAAB: eyes closed and arms along the body; %: percentage; Kpa: kilopascal; cm: centimeters; NSD, non-significant difference.

Table 3: Comparison between the classical ballet dancers' (Group 1) and non-dancers' (Group 2) stabilometric characteristics.

Parameter / Condition	MeanGroup 1 (± SD)	Mean Group 2 (± SD)	p+

AP displacement (cm)			
EOAAB (A)	1.82 (± 0.69)	2.27 (± 0.82)	0.002
ECAAB (B)	2.08 (± 1.07)	2.66 (± 1.09)	0.006
EOAO (C)	2.49 (± 1.06)	2.37 (± 0.91)	NSD
p^{++} A ≠ B	0.02	0.006	
p^{++} A ≠ C	< 0.001	NSD	
LL displacement (cm)			
EOAAB (A)	1.41 (± 0.54)	1.71 (± 0.67)	0.009
EOAAB (B)	1.76 (± 0.65)	1.89 (± 1.02)	NSD
EOAO (C)	1.83 (± 0.78)	1.66 (± 0.6)	NSD
p^{++} A ≠ B	< 0.001	NSD	
p^{++} A ≠ C	< 0.001	NSD	
Area of an Ellipse (cm^2)			
EOAAB (A)	2.2 (± 1.78)	3.37 (± 2.22)	0.003
ECAAB (B)	3.25 (± 3.55)	4.61 (± 4.92)	NSD
EOAO(C)	4.06 (± 3.8)	3.41 (± 2.58)	NSD
p^{++} A ≠ B	< 0.001	0.03	
p^{++} A ≠ C	< 0.001	NSD	

+Student's T test;++Paired T test; *p < 0.05 (significant); SD: standard deviation; EOAAB: eyes open and arms along the body; ECAAB: eyes closed and arms along the body; AP: antero-posterior; LL: latero-lateral; cm: centimeters; NSD: non-significant difference.

Table 4: Comparison between the classical ballet dancers' (Group 1) and non-dancers' (Group 2) static baropodometric characteristics with eyes open and arms along the body.

Parameter	Group 1		p++	Grupo 2		p++
	EOAAB	ECAAB		EOAAB	ECAAB	
	Mean (± SD)			Mean (± SD)		
MP(%)						
L forefoot E	18.16 (±5.53)	17.36 (±5.49)	NSD	20.84 (± 5.25)	21.31 (±5.38)	NSD
L rearfoot	31,91 (± 7.98)	32.6 (± 6.96)	NSD	30.49 (± 6.43)	29.86 (± 6.12)	NSD
R forefoot	21.7 (± 6.72)	21.1 (± 6.22)	NSD	20.51 (± 4.45)	20.89 (± 4.34)	NSD
R rearfoot	28.39 (± 6.08)	29.04 (± 6.08)	NSD	28.17 (± 5.43)	27.91 (± 5.14)	NSD
Max P (Kpa)						
L foot	144.59 (± 35.99)	144.15 (± 34.43)	NSD	174.61 (± 46.98)	173.61 (± 46.47)	NSD
R foot	136.18 (± 34.73)	129.77 (± 32.2)	NSD	157.93 (± 38.61)	157.1 (± 39.37)	NSD
Area (cm^2)						
L foot	66.49 (± 14.34)	69.6 (± 14.06)	0.003	95.92 (± 14.28)	97.99 (± 14.49)	< 0.001
R foot	66.32 (± 14.46)	70.54 (± 15.18)	0.003	96.12 (± 13.49)	98.14 (± 13.8)	< 0.001

++Paired T test;*p < 0.05 (significant); SD: standard deviation; L: left; R: right; EOAO: eyes open and arms outstretched; EOAAB: eyes open and arms along the body; ECAAB: eyes closed and arms along the body; MP: mean pressure; Max P: maximum pressure; Surf: surface; %: percentage; Kpa: kilopascal; cm: centimeters; NSD, non-significant difference.

Table 5: Comparison between the classical ballet dancers' (Group 1) and non-dancers' (Group 2) static baropodometric characteristics with eyes open and arms outstretched and along the body.

Parameter	Group 1		p^{++}	Group 2		p^{++}
	EOAAB	EOAO		OABF	OABA	
	Mean (± SD)			Mean (± SD)		
MP (%)						
L forefoot	18.16 (± 5.53)	18.98 (± 5.58)	NSD	20.84 (± 5.25)	21.30 (± 5.7)	NSD
L rearfoot	31.91 (± 7.98)	30.30 (± 6.9)	0.005	30.49 (± 6.43)	29.39 (± 6,.77)	0.002
R forefoot	21.70 (± 6.72)	23.36 (± 6.55)	0.002	20.51 (± 4.45)	21.60 (± 5.11)	0.003
R rearfoot	28.39 (± 6.08)	27.35 (± 6.48)	NSD	28.17 (± 5.43)	27.80 (± 5.86)	NSD
Max P(Kpa)						
L foot	144.59 (± 35.99)	136.99 (± 35.08)	0.04	174.61 (± 46.98)	170.21 (± 45.2)	0.04
R foot	136.18 (± 34.73)	132.35 (± 37.46)	NSD	157.93 (± 38.61)	155.14 (± 39.85)	NSD
Area (cm^2)						
L foot	66.49 (± 14.34)	70.29 (± 14.98)	<0.001	95.92 (± 14.28)	96.46 (± 14.66)	NSD
R foot	66.32 (± 14.46)	70.95 (± 15.82)	<0.001	96.12 (± 13.49)	97.33 (± 13.96)	NSD

$^{++}$ Paired T test;*p < 0.05 (significant); SD: standard deviation; L: left; R: right; EOAO: eyes open and arms outstretched; EOAAB: eyes open and arms along the body; ECAAB: eyes closed and arms along the body; MP: mean pressure; Max P: maximum pressure; Surf: surface; %: percentage; Kpa: kilopascal; cm: centimeters; NSD, non-significant difference.

Table 6: Correlation between time as a dancer and classical ballet dancers' baropodometric and stabilometric characteristics.

Correlation Variable	Assessed Parameter	value of r	P
Time as a dancer (years)	Mean Pressure (%)		
	L forefoot	0.409	0.002
	L rearfoot	-0.43	0.001
	R forefoot	0.356	0.007
	R rearfoot	-0.544	<0.001
	Maximum Pressure (Kpa)		
	L foot	-0.185	NSD
	R foot	0.111	NSD
	Surface (cm^2)		
	L foot	0.283	0.03
	R foot	0.117	NSD
	Stabilometry		
	AP displacement (cm)	0.155	NSD
	LL displacement (cm)	-0.009	NSD
	Area of an Ellipse (cm^2)	0.102	NSD

r: Pearson correlation coefficient; p < 0.05 (significant); SD: standard deviation; AP: antero-posterior; LL: latero-lateral; cm: centimeters; %: percentage; Kpa:kilopascal; L: left; R: right; NSD: non-significant difference.

5 CONCLUSÕES

Os resultados aqui apresentados concluem que:

✓ As meninas praticantes de *Ballet* Clássico estão inseridas em famílias com melhor condição sócio-econômica do que as meninas não praticantes desta atividade;

✓ As bailarinas apresentaram menores valores de IMC, percentual de gordura e de todas as medidas antropométricas avaliadas, com exceção da altura que foi semelhante em ambos os grupos e a circunferência das pernas que foi maior no grupo das bailarinas;

✓ Praticantes de *Ballet* relataram menores estágios de Tanner e indicadores sugestivos de maturação óssea tardia em comparação com as não praticantes;

✓ A prática do *Ballet*, como uma atividade física sistematizada e profissionalizante influenciou no desempenho funcional de crianças e adolescentes do sexo feminino no que diz respeito à melhora da mobilidade, equilíbrio e capacidade cardiorrespiratória, indicando que exigências impostas por esta tarefa motora aperfeiçoam a aptidão física e o desenvolvimento na infância na realização das atividades de vida diária;

✓ Características como IMC, percentual de gordura corporal, condição socioeconômica da família e escolaridade dos pais parecem ter influenciado nesse resultado;

✓ Bailarinas em nível profissionalizante, quando comparadas com meninas típicas que não vivenciam a prática do *Ballet* Clássico, apresentaram menor descarga de peso em antepé E (o que pode estar relacionado ao membro dominante) e menores valores de área de superfície plantar, o que pode estar relacionado a maior prevalência de pés cavos;

✓ Em relação à estabilidade postural, as praticantes de *Ballet* apresentaram menores valores de pressão máxima e menores deslocamentos na análise da estabilometria;

✓ As bailarinas foram mais dependentes da visão e apresentaram maiores deslocamentos com os MMSS abduzidos a 90º, o que pode estar relacionado às diferentes estratégias de controle motor.

6 CONSIDERAÇÕES FINAIS

Este é um trabalho interdisciplinar, pois envolve a arte e sai do campo exclusivo da ciência. Através dele é possível obter como produtos o conhecimento das influências da prática do *Ballet* Clássico em crianças e adolescentes em diferentes fases de maturação sexual e óssea, além do serviço de avaliação de bailarinos já implantado na escola de dança participante, importante relevância social da pesquisa.

Como limitaçãos do estudo, pode-se citar a não coleta de dados de caracterização da amostra de bailarinas quanto a prática diária do *Ballet* (quantas horas por dia, quantas vezes por semana e a rotina de apresentações), de forma que não foi possível classificar a especialização precoce.

Uma dificuldade encontrada foi organizar os horários das bailarinas para a aplicação dos testes e dos responsáveis para a realização da entrevista, porém no período de janeiro a dezembro de 2017 foi possível que tudo acontecesse como programado.

A contribuição, dos conhecimentos aqui adquiridos, para a ciência é a exploração de um tema novo que nunca havia sido abordado dessa forma, sendo este então um trabalho pioneiro e fonte de inspiração para diversas outras variáveis que podem ser exploradas nesta população. Este é o primeiro estudo que aborda o desempenho funcional de bailarinas em testes que avaliam atividades diárias, como andar, sentar e levantar, sendo também pioneiro na elucidação das influências que essa prática pode trazer a meninas em fase de maturação sexual e óssea. Outro diferencial é a análise de composição corporal realizada com várias medidas e uma importante comparação com meninas da mesma idade, porém com experiências motoras diferentes.

Os achados auxiliam também na compreensão das estratégias motoras posturais de crianças e adolescentes praticantes de Ballet com implicações na prática do treinamento sistematizado e prevenção de lesões em longo prazo. A partir desse conhecimento é possível desenvolver programas focados no aperfeiçoamento e desenvolvimento de estratégias corretas de coordenação e gerenciamento de

instabilidades dentro da abundância motora, de forma que não aconteçam os efeitos prejudiciais da variabilidade no equilíbrio e movimento.

Este trabalho está vinculado à Rede Brasil-Reino Unido e faz parte de um conjunto de pesquisas presentes na MCD, que tem o objetivo de promover o bem-estar e saúde dos dançarinos, através do desenvolvimento de discussões, pesquisas e serviços de excelência em Dança nas diversas vertentes que abrangem aspectos da área da saúde, treinamento, *performance*, bem-estar, educação e arte.

A rede está desenvolvendo um serviço de atendimento aos bailarinos do Instituto Tecnológico Basileu França, integrado ao projeto de Preparação Poética na Dança do professor Adriano Bittar. Integrado a isso o presente projeto entregou a cada bailarina um relatório individual com os dados da avaliação física realizada durante a pesquisa, para que elas tivessem conhecimento dos resultados que foram obtidos. Será também realizada uma palestra explicativa sobre o tema à todos os professores, pais e bailarinos da escola.

Sugere-se que novos estudos sejam feitos de forma a verificar se o tempo de dança pode interferir em achados diferentes.

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APÊNDICES E ANEXOS

Apêndice I – Termo de Consentimento Livre e Esclarecido

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

Você/Sr./Sra. está sendo convidado(a) a participar, como voluntário(a), da pesquisa intitulada "A Influência da Prática do Balé no Desempenho Funcional e Características Corporais de Crianças e Adolescentes". Meu nome é Rafaela Noleto do Santos, sou fisioterapeuta e pesquisadora responsável. Após receber os esclarecimentos e as informações a seguir, se você aceitar fazer parte do estudo, assine ao final deste documento, que está impresso em duas vias, sendo que uma delas é sua e a outra pertence à pesquisadora responsável. Esclareço que em caso de recusa na participação você não será penalizado(a) de forma alguma. Mas se aceitar participar, as dúvidas sobre a pesquisa poderão ser esclarecidas pela pesquisadora responsável, via e-mail (rafinhanoleto@hotmail.com) e, inclusive, sob forma de ligação a cobrar, através do seguinte contato telefônico: (62)981808490. Ao persistirem as dúvidas sobre os seus direitos como participante desta pesquisa, você também poderá fazer contato com o Comitê de Ética em Pesquisa da PUC-GO, no telefone (62) 3946-1512. A dança em geral, assim como o Balé, é uma atividade que requer alta habilidade, na qual grandes demandas são colocadas sobre o corpo do dançarino em termos de articulação, amplitude de movimento, coordenação, equilíbrio e controle motor. Durante a puberdade ocorrem diversas alterações morfológicas e funcionais, que levarão a criança à fase adulta, dessa forma qualquer influência nesta fase pode gerar repercussões em diversos aspectos. Sendo assim, o presente estudo justifica-se pelo fato de que apesar do conhecimento de que a prática do Balé otimiza o controle motor e a coordenação dos movimentos, ainda não está totalmente esclarecido as mudanças que a prática desta atividade proporciona no corpo da criança e do adolescente em fase de crescimento e em diferentes níveis de maturação sexual. Esta pesquisa tem o objetivo de analisar a influência da prática do Balé no desempenho funcional e características corporais de crianças e adolescentes.

Você será esclarecido sobre os objetivos da pesquisa e o caráter voluntário da participação, através da leitura deste termo, que será feita pela pesquisadora, de

forma que todas as dúvidas ou questionamentos sejam elucidados no momento em que houver

a concordância com a participação ou em qualquer momento no desenvolvimento dos procedimentos. A pesquisa será feita em duas (2) etapas. Na primeira etapa será aplicado um questionário com os pais e na segunda etapa será realizada avaliação física da criança com duração média de 40 minutos. O responsável pela criança responderá um questionário com perguntas relacionadas a ela, a seus dados e às condições gerais da família. A criança será submetida à avaliação física (peso, usando uma balança; altura e circunferências do corpo, usando uma fita métrica; pregas cutâneas, usando um plicômetro); avaliação do andar e do sentar e levantar; a baropodometria, que faz uma avaliação da pisada e um teste de maturação sexual e imagem corporal através a escolha de figuras. Toda avaliação será realizada no Instituto Tecnológico em Artes (ITEGO) Basileu França em sala reservada e o participante será avaliado com roupas confortáveis. O período da pesquisa será de janeiro a julho de 2017.

Estes procedimentos não apresentam graves riscos para você participante, e não possuem nenhum procedimento invasivo. As chances de quedas são mínimas devido ao piso antiderrapante da sala de dança e não existe a exposição a nenhum fator externo como calor, chuva, vento ou qualquer circunstância que ofereça risco. Existe o risco mínimo de lesões durante a execução dos movimentos requeridos durante as avaliações, no entanto todos os, bailarinos, são preparados fisicamente para este tipo de execução e serão corretamente orientados pela pesquisadora. Além disso, durante todo o momento existe o pronto atendimento da fisioterapeuta Rafaela Noleto dos Santos que concordou em realizar qualquer atendimento e explicar o que for necessário. Pode haver possível desconforto emocional e/ou de possíveis riscos psicossociais (ex.; constrangimento, intimidação, angústia, insatisfação, irritação, mal-estar, etc.), porém fica assegurado a você o direito de interromper a participação a qualquer momento sem que isto incorra em qualquer penalidade ou prejuízo. Também fica assegurado a você a apresentação da garantia expressa de liberdade de se recusar a responder questões que lhe causem desconforto emocional e/ou constrangimento no questionário que for aplicado na pesquisa. A sua identidade não será revelada.

Esta pesquisa garante benefícios a você participante e à sociedade. Você será esclarecido sobre os resultados dos testes o que poderá auxiliá-lo em um melhor

conhecimento sobre os efeitos da dança. Serão assegurados a você, como sujeito da pesquisa, os benefícios resultantes do projeto, seja em termos de retorno social como em acesso aos procedimentos. Os resultados da pesquisa serão tornados públicos, sejam eles favoráveis ou não, através de uma reunião realizada na escola de dança à qual você pertence. A sua participação neste estudo é voluntária. Quanto às informações divulgadas e/ou publicadas, ressalta-se a garantia de que a sua identidade será preservada e mantida sob sigilo. E após cinco anos, as informações e todos os dados serão incinerados e as fontes de arquivo deletadas. Mesmo considerando que esta pesquisa não apresenta graves riscos para você, participante, será garantido, caso algum incidente ocorra, uma indenização por parte da pesquisadora. Os sujeitos da pesquisa que vierem a sofrer qualquer tipo de dano previsto ou não no termo de consentimento e resultante de sua participação, além do direito à assistência integral, têm direito à indenização (reparação a danos imediatos ou futuros), garantida em lei, decorrentes da sua participação na pesquisa Também será garantido que você não terá nenhum tipo de despesa, nem mesmo com transporte até o local da pesquisa, ou alimentação, será tudo oferecido gratuitamente pela pesquisadora. E caso haja algum tipo de despesa com transporte, será garantido o ressarcimento completo de tal. O presente termo é feito em caráter gratuito, sem qualquer ônus para a pesquisadora ou para a instituição.

CONSENTIMENTO PARA PARTICIPAÇÃO COMO SUJEITO DA PESQUISA

Eu_____
, portador (a) do RG nº _____, residente na cidade de _____, possuo o (s) telefone (s)_____, responsável pelo (a) menor_____,
autorizo a participação de meu (minha) filho (a) na pesquisa intitulada: "A Influência da Prática do Balé no Desempenho Funcional e Características Corporais de Crianças e Adolescentes", realizada pela Fisioterapeuta Rafaela Noleto dos Santos. Fui devidamente informado e esclarecido pela pesquisadora sobre a pesquisa, os procedimentos nela envolvidos, assim como os possíveis riscos e benefícios decorrentes de minha participação. Foi-me garantido que posso retirar meu

consentimento qualquer momento, sem que isto leve a qualquer penalidade. Eu estou de acordo com a participação de meu (minha) filho (filha) no estudo de livre e espontânea vontade e entendo a relevância dele. Julgo que é meu direito manter uma cópia deste consentimento. Compreendo e concordo que as informações divulgadas e/ou publicadas têm a garantia de que a identidade de meu filho (a) e de minha família, serão preservadas e mantidas sob sigilo.

Goiânia, ... de ..... de .....

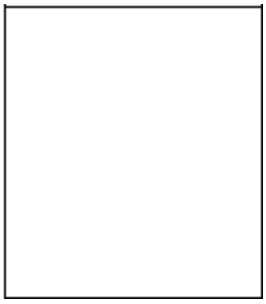
_____

Assinatura por extenso do(a) participante

_____

Assinatura por extenso da pesquisadora responsável

Testemunhas em caso de uso da assinatura datiloscópica



_____

_____

Apêndice II : Termo de Assentimento Livre e Esclarecido

TERMO DE ASSENTIMENTO LIVRE E ESCLARECIDO

PÚBLICO DE 10 A 15 ANOS

Você está sendo convidado(a) a participar, como voluntário(a), da pesquisa intitulada "A Influência da Prática do Balé no Desempenho Funcional e Características Corporais de Crianças e Adolescentes". Meu nome é Rafaela Noleto do Santos, sou fisioterapeuta e pesquisadora responsável. Após receber os esclarecimentos e as informações a seguir, se você aceitar fazer parte do estudo, assine ao final deste documento, que está impresso em duas vias, sendo que uma delas é sua e a outra pertence à pesquisadora responsável. Esclareço que em caso de recusa na participação você não será penalizado(a) de forma alguma. Mas se aceitar participar, as dúvidas sobre a pesquisa poderão ser esclarecidas pela pesquisadora responsável, via e-mail (rafinhanoleto@hotmail.com) e, inclusive, sob forma de ligação a cobrar, através do seguinte contato telefônico: (62)981808490. Ao persistirem as dúvidas sobre os seus direitos como participante desta pesquisa, você também poderá fazer contato com o Comitê de Ética em Pesquisa da PUC-GO, no telefone (62) 3946-1512. A dança em geral, assim como o Balé, é uma atividade que requer alta habilidade, na qual grandes demandas são colocadas sobre o corpo do dançarino em termos de articulação, amplitude de movimento, coordenação, equilíbrio e controle motor. Durante a puberdade ocorrem diversas alterações morfológicas e funcionais, que levarão a criança à fase adulta, dessa forma qualquer influência nesta fase pode gerar repercussões em diversos aspectos. Sendo assim, o presente estudo justifica-se pelo fato de que apesar do conhecimento de que a prática do Balé otimiza o controle motor e a coordenação dos movimentos, ainda não está totalmente esclarecido as mudanças que a prática desta atividade proporciona no corpo da criança e do adolescente em fase de crescimento e em diferentes níveis de maturação sexual. Esta pesquisa tem o objetivo de analisar a influência da prática do Balé no desempenho funcional e características corporais de crianças e adolescentes.

Você será esclarecido sobre os objetivos da pesquisa e o caráter voluntário da participação, através da leitura deste termo, que será feita pela pesquisadora, de forma que todas as dúvidas ou questionamentos sejam elucidados no momento em que houver a concordância com a participação ou em qualquer momento no

desenvolvimento dos procedimentos. A pesquisa será feita em duas (2) etapas. Na primeira etapa será aplicado um questionário com os pais e na segunda etapa será realizada a sua avaliação física com duração média de 40 minutos. O seu responsável responderá um questionário com perguntas relacionadas a ela, a seus dados e às condições gerais da família. A criança será submetida à avaliação física (peso, usando uma balança; altura e circunferências do corpo, usando uma fita métrica; pregas cutâneas, usando um plicômetro); avaliação do andar e do sentar e levantar; a baropodometria, que faz uma avaliação da pisada e um teste de maturação sexual e imagem corporal através a escolha de figuras. Toda avaliação será realizada no Instituto Tecnológico em Artes (ITEGO) Basileu França em sala reservada e o participante será avaliado com roupas confortáveis. O período da pesquisa será de janeiro a julho de 2017.

Estes procedimentos não apresentam graves riscos para você participante, e não possuem nenhum procedimento invasivo. As chances de quedas são mínimas devido ao piso antiderrapante da sala de dança e não existe a exposição a nenhum fator externo como calor, chuva, vento ou qualquer circunstância que ofereça risco. Existe o risco mínimo de lesões durante a execução dos movimentos requeridos durante as avaliações, no entanto todos os, bailarinos, são preparados fisicamente para este tipo de execução e serão corretamente orientados pela pesquisadora. Além disso, durante todo o momento existe o pronto atendimento da fisioterapeuta Rafaela Noleto dos Santos que concordou em realizar qualquer atendimento e explicar o que for necessário. Pode haver possível desconforto emocional e/ou de possíveis riscos psicossociais (ex.; constrangimento, intimidação, angústia, insatisfação, irritação, mal-estar, etc.), porém fica assegurado a você o direito de interromper a participação a qualquer momento sem que isto incorra em qualquer penalidade ou prejuízo. Também fica assegurado a você a apresentação da garantia expressa de liberdade de se recusar a responder questões que lhe causem desconforto emocional e/ou constrangimento no questionário que for aplicado na pesquisa.

A sua identidade não será revelada.

Esta pesquisa garante benefícios a você participante e à sociedade. Você será esclarecido sobre os resultados dos testes o que poderá auxiliá-lo em um melhor conhecimento sobre os efeitos da dança. Serão assegurados a você, como sujeito da pesquisa, os benefícios resultantes do projeto, seja em termos de retorno social como em acesso aos procedimentos. Os resultados da pesquisa serão tornados públicos,

sejam eles favoráveis ou não, através de uma reunião realizada na escola de dança à qual você pertence. A sua participação neste estudo é voluntária. Quanto às informações divulgadas e/ou publicadas, ressalta-se a garantia de que a sua identidade será preservada e mantida sob sigilo. E após cinco anos, as informações e todos os dados serão incinerados e as fontes de arquivo deletadas. Mesmo considerando que esta pesquisa não apresenta graves riscos para você, participante, será garantido, caso algum incidente ocorra, uma indenização por parte da pesquisadora. Os sujeitos da pesquisa que vierem a sofrer qualquer tipo de dano previsto ou não no termo de consentimento e resultante de sua participação, além do direito à assistência integral, têm direito à indenização (reparação a danos imediatos ou futuros), garantida em lei, decorrentes da sua participação na pesquisa Também será garantido que você não terá nenhum tipo de despesa, nem mesmo com transporte até o local da pesquisa, ou alimentação, será tudo oferecido gratuitamente pela pesquisadora. E caso haja algum tipo de despesa com transporte, será garantido o ressarcimento completo de tal. O presente termo é feito em caráter gratuito, sem qualquer ônus para a pesquisadora ou para a instituição.

CONSENTIMENTO PARA PARTICIPAÇÃO COMO SUJEITO DA PESQUISA

Eu, ..., inscrito(a) sob o RG/ CPF....., abaixo assinado, concordo em participar do estudo intitulado "A Influência da Prática do Ballet no Desempenho Funcional e Características Corporais de Crianças e Adolescentes". Destaco que minha participação nesta pesquisa é de caráter voluntário. Fui devidamente informado(a) e esclarecido(a) pela pesquisadora responsável Rafaela Noleto dos Santos sobre a pesquisa, os procedimentos e métodos nela envolvidos, assim como os possíveis riscos e benefícios decorrentes de minha participação no estudo. Foi-me garantido que posso retirar meu consentimento a qualquer momento, sem que isto leve a qualquer penalidade. Declaro, portanto, que concordo com a minha participação no projeto de pesquisa acima descrito.

Goiânia, ... de ..... de .....

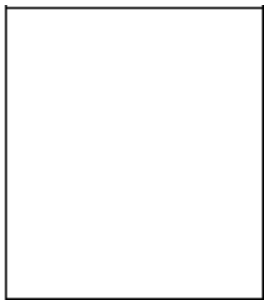
_____

Assinatura por extenso do(a) participante

_____

Assinatura por extenso da pesquisadora responsável

Testemunhas em caso de uso da assinatura datiloscópica



_____

_____

Apêndice III : Ficha de Avaliação Antropométrica

Data: _____/_____/_____ Ficha nº:_____

Nome da criança: _____

Sexo: ( ) masculino ( ) feminino Idade:_____

Dados físicos: Peso: _____kg; Altura:_____cm; IMC_____

Pregas cutâneas		
Local	**Membro Direito**	**Membro Esquerdo**
Triciptal		
Panturrilha		
Quadríceps		
Abdominal		
Subescapular		
Circunferências		
Local	**Membro Direito**	**Membro Esquerdo**
Braço (1/3 médio)		
Coxa (1/3 médio)		
Cintura		
Quadril		
Pescoço		
Abdominal		
	Membro Direito (R)	**Esquerdo (L)**
Comprimento da coxa		
Circunferência da coxa		
Comprimento da perna		
Circunferência da perna		
Diâmetro do joelho		
Comprimento do pé		
Altura do maléolo		
Largura dos maléolos		
Largura do pé		

Apêncie IV: Roteiro de Entrevista com os Pais

Data da avaliação: _____/_____/___

Identificação

Nome da criança:_____

Data de nascimento: ___/___/___. Idade da Criança: ___anos e ___ meses

Sexo: ( ) feminino ( ) masculino

Escolaridade da criança:_____

Nome do responsável: _____

Idade:_____Profissão:_____

Telefones:_____

Endereço: _____

Histórico de saúde

1) Houve complicações durante a gestação?

( ) Não ( )Sim. Qual (is)?

2) Tipo de parto: ( ) cesárea ( ) normal

3) Houve complicações durante o parto?

( ) Não ( )Sim. Qual (is)?

4) Dados da criança ao nascimento:

Peso em g:_____

IG em semanas: _____

5) A criança apresentou complicações de saúde neonatal?

( ) Não ( )Sim. Qual (is)?

6) Idade em que iniciou a marcha (em anos e meses):

( ) não se recorda.

Informações de saúde

7) Possui algum problema de saúde cardiopulmonar atualmente?(exemplos: bronquite, asma, sopro no coração e/ou outros)

( ) Não ( )Sim. Qual (is)?

8) Possui algum problema ortopédico?

( ) Não

( ) Sim. Qual?

( ) pé torto congênito

( ) luxação do quadril

( ) escoliose

( ) fratura de MMII. Há quanto tempo?

( ) outros. Qual (is)?

9) A criança foi submetida a algum tipo de cirurgia em MMII ou tronco?

( ) Não

( ) Sim. Qual? Quando?_____

10) A criança utiliza algum tipo de órtese ou prótese?

( ) Não.

( ) Não sabe dizer

( ) Não se recorda

( )Sim. Qual tipo?Em qual membro utiliza?

11) A criança apresenta algum problema de saúde de origem neurológica?

( ) Não

( ) Sim. Qual?

( ) paralisia cerebral

( ) hidrocefalia

( ) microcefalia

( ) espinha bífida

( ) síndrome Down

( ) outras síndromes. Qual?

( ) distrofia muscular. Qual?

12) A criança já apresentou crises convulsivas?

( ) Não ( )Sim. Quando?

13) Usa algum medicamento (remédio) atualmente?

( ) Não

( ) Sim. Qual? Há quanto tempo?Qual a posologia?

14) A criança realiza algum atendimento especializado?

( ) Não

( )Sim: ( ) Fisioterapêutico

( ) Psicológico

( ) Fonoaudiológico

( )Outros: Qual(is)?

Apêndice V: Questionário Socioeconomico e de Atividade Física
(FONTE: Instrumento adaptado e modificado de Bracco, Colugnati e Taddei (2006))

Nome da criança:_____ **Série:** _____

Nome de quem respondeu o questionário: _____

O que você é da criança: ☐ **mãe** ☐ **pai** ☐ **responsável**

ITENS DO SOCIOECONOMICO

1- A renda da família é de:_____ Reais por mês

2- Há quantas pessoas moram na casa ou apartamento?_____

3. A casa ou apartamento onde a família mora é feita de:

☐ tijolo (bloco) (1) ☐ madeira (2) ☐ outros: _____

4- A casa ou apartamento onde a família mora é:

☐ própria (1) ☐ alugada (2) ☐ cedida (3) ☐ outro (4)

5- A casa ou apartamento possui:

a. água tratada e encanada ☐ sim (1) ☐ não (2)

b. luz ☐ sim (1) ☐ não (2)

c. esgoto ☐ sim (1) ☐ não (2)

6- Quando está fora da escola a criança fica:

☐em casa (1) ☐ creche(2) ☐ casa de parentes(3) ☐ casa de vizinhos(4) ☐ outros(5)

7- A coleta de lixo acontece:

☐ todos os dias (1) ☐ 2 a 3x/semana (2) ☐ 1x/semana (3) ☐ não acontece (4)

8- Situação conjugal:

☐ Pai e Mãe moram juntos (1)

☐ Mãe mora sozinha com o(s) filho(s) (2)

☐ Pai mora sozinho com o(s) filho(s) (3)

☐ Mãe mora com companheiro e o(s) filho(s) (4)

☐ Pai mora com companheira e o(s) filho(s) (5)

9- Escolaridade da Mãe:

Estudou até que série?_____ E do Pai?_____

10- Qual a profissão ou ocupação da mãe ? _____

☐ está desempregada (1) ☐ autônoma (2)

☐ está empregada e registrada (3) ☐ está empregada sem registro (4)

11- Qual a profissão ou ocupação do pai ? _____

☐ está desempregado (1) ☐ autônomo (2)

☐ está empregado e registrado (3) ☐ está empregado sem registro (4)

12- A criança foi amamentada ao peito desde o nascimento?

☐ sim (1) ☐ não (2)

Se sim, por quanto tempo? ☐ até 1 mês (1) ☐ até 3 meses (2) ☐ até 6 meses (3) ☐ até 1 ano (4) ☐ acima de 1 ano (5)

13- Com que idade a criança parou de mamar na mamadeira?

☐ com menos de 6 meses (1) ☐ entre 6 meses e 1 ano (2)

☐ entre 1 e 2 anos (3) ☐ commais de 2 anos (4)

☐ nunca usou mamadeira (5)

14- Com que idade a criança começou a comer os mesmos alimentos da família?

☐ com menos de 6 meses (1) ☐ entre 6 meses e 1 ano (2) ☐ com mais de 1 ano (3)

15- O apetite da criança nas refeições (café da manhã, almoço e jantar) é:

☐ Muito Bom (1) ☐ Bom (2) ☐ Regular (3) ☐ Ruim (4) ☐ Muito Ruim (5)

16- O apetite da criança nos intervalos entre as refeições é:

☐ Muito Bom (1) ☐ Bom (2) ☐ Regular (3) ☐ Ruim (4) ☐ Muito Ruim (5)

17- Em relação à alimentação, a criança:

a. toma o café da manhã, almoço e jantar sempre nos mesmos horários

☐ sim (1) ☐ não (2)

18- Nos intervalos das refeições, o que a criança costuma comer?

☐ leite(1) ☐ pão (2) ☐ fruta(3) ☐ refrigerante (4)

☐ bolacha (5) ☐ salgadinhos (6) ☐ doces (7) ☐ café (8)

☐ suco (9) ☐ danoninho(10) ☐ yakult (11) ☐ miojo(12)

☐ outro (13)

19- Na hora das refeições as pessoas da casa sentam à mesa para comerem juntas?

☐ sim (1) ☐ não (2)

20- Em casa, qual o local que a criança come?

☐ Em frente à televisão (1)

☐ Sentada no sofá (3)

☐ Assistindo TV, sentada à mesa (5) ☐ Sentada à mesa (2)

□ Sentada no sofá assistindo TV (4)

□ Outro locd: _____ (6)

ITENS DE ATIVIDADE FÍSICA

21- Seu(a) filho(a) pratica regularmente algum esporte fora das aulas de Educação Física?

□ sim (1) □ não (2)

Se sim, quantas vezes e horas por semana ele(a) pratica?

Vezes por semana

□ 1x por semana (1)

□ 2x por semana (2)

□ 3x por semana (3)

□ mais de 3x por semana (4)Horas por dia

□ 30 minutos (1)

□ de 30 min. a 1 hora (2)

□ mais de 1 hora por dia (3)

22- O que a criança mais gosta de fazer nos momentos de lazer?

□ brincar deboneca (1)

□ casinha (2)

□ desenhar (3)

□ assistir TV ou jogar videogame (4)

□ bola (esporte) (5) □ carrinho (6)

□ bicicleta ou patins (7)

□ pega-pega (8)

□ outros (9) Quais?_____

23- Como você vê a criança:

□ mais ativo que as outras (1)

□ menos ativo que as outras (2)

□ igual as outras (3)

□ não sei (4)

24- Como você classificaria a sua criança em termos de atividade física?

□ Sedentário (1) □ Pouco Ativo (2) □ Ativo (3) □ Muito Ativo (4)

25- Como você classificaria você mesmo(a)?

□ Sedentário (1) □ Pouco Ativo (2) □ Ativo (3) □ Muito Ativo (4)

26- Como você classificaria seu/sua Companheiro(a)?

□ Sedentário (1) □ Pouco Ativo (2) □ Ativo (3) □ Muito Ativo (4)

27- Durante o dia, fora do horário escolar, a sua criança brinca mais:

□ Narua (1)

□ No quintal da casa (3) □ Dentro de casa (2)

□ Casa de vizinhos (4)

28- Em geral como sua criança vai a escola?

□ a pé (1)

□ ônibus (2)

□ Van (3)

□ outros (4) Qual?_____

29- Participa de alguma associação, clube ou equipe de algum esporte, na escola ou fora dela?

□ Sim (1) □ Não (2)

Se sim, qual esporte e equipe?_____

30- Quantas horas por dia a criança fica na frente da televisão?

□ até 1 hora (1) □ 1 a 2 horas (2) □ 2 a 4 horas (3) □ 4 a 6 horas (4) □ mais de 6 horas (5)

31- Quantas horas a criança normalmente dorme a noite?

□ menos de 7 horas (1) □ de 7 a 10 horas (2) □ mais de 10 horas (3)

32- A criança tem o hábito de dormir durante o dia?

□ sim (1) □ não (2)

Se sim, quantas horas?

□ até 1 hora (1) □ 1 a 2 horas (2) □ mais de 2 horas (3)

33-Classifique sua criança e você mesma em termos do peso corporal:

A – Criança

□ Muito pesado (1)

□ Pesado (2)

□ No peso médio (3)

□ Muito abaixo do peso (4)

B – Você

□ Muito pesado (1)

□ Pesado (2)

□ No peso médio (3)

□ Muito abaixo do peso (4)

PARA A ESCOLA

1- Quantas horas por dia a criança permanece na escola? _____

2- Quantas vezes por semana a criança tem aula de Educação Física na escola?

Qual o tempo de duração?

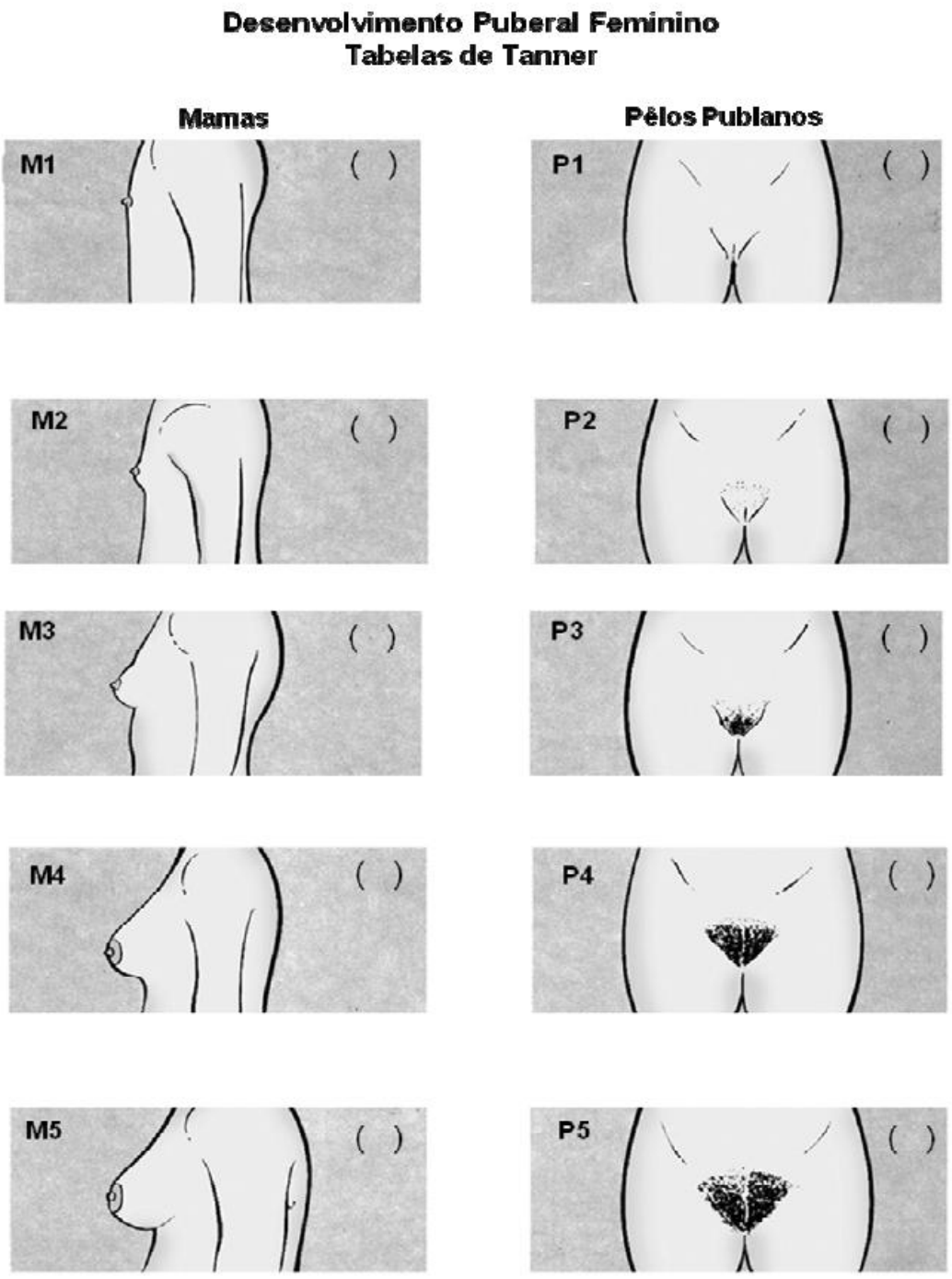
Vezes por semana _____ Horas por dia_____

3- Quantas vezes por semana a criança tem outros exercícios físicos na escola?

Qual o tempo de duração?

Vezes por semana _____ Horas por dia_____

Anexo I: Avaliação de Tanner da Maturação Sexual



Anexo II:

Protocolo do Questionário ABEP (Associação Brasileira de Empresas de Pesquisa)

Nome: _____ Data: _____
Nome da Mãe: _____ Código: _____

Dados de Classificação

1. Quem é o chefe da família na sua casa? _____
2. Grau de instrução do chefe da família _____

Analfabeto / Primário incompleto	0
Primário completo / Ginasial incompleto	1
Ginasial completo / Colegial incompleto	2
Colegial completo / Superior incompleto	3
Superior completo	5

3. Posse de itens

Itens	Quantidade de itens				
	0	1	2	3	4 ou +
Televisão em cores	0	2	3	4	5
Rádio	0	1	2	3	4
Banheiro	0	2	3	4	4
Automóvel	0	2	4	5	5
Empregada mensalista	0	2	4	4	4
Aspirador de pó	0	1	1	1	1
Máquina de lavar	0	1	1	1	1
Videocassete e/ou DVD	0	2	2	2	2
Geladeira	0	2	2	2	2
Freezer (aparelho independente ou parte da geladeira duplex)	0	1	1	1	1

Total de pontos: _____

4. Classes econômicas -

Classe	Pontos
A1	30-34
A2	25-29
B1	21-24
B2	17-20
C	11-16
D	6-10
E	0-5

Anexo III – Parecer do Comitê de Ética e Normas de publicação das revistas *Journal of Adolescence e* Gait & Posture

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: A Influência da Prática do Balé no Desempenho Funcional e Características Corporais de Crianças e Adolescentes

Pesquisador: RAFAELA NOLETO DOS SANTOS

Área Temática:

Versão: 2

CAAE: 65387717.4.0000.8113

Instituição Proponente: Universidade Estadual de Goiás

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 2.016.428

Apresentação do Projeto:

Muito se ouve falar a respeito da ocorrência de diversas lesões e de um padrão locomotor diferente na população de bailarinos, seja devido à demanda física, à alta exigência funcional ou até mesmo à falta de preparo e treino específico. Pouco se sabe sobre as mudanças que a prática desta atividade proporciona no corpo da criança e do adolescente em fase de crescimento e em diferentes níveis de maturação sexual e até mesmo no que diz respeito ao perfil funcional. Frequentemente, os bailarinos realizam movimentos antagônicos se comparados a movimentos corporais típicos, o que favorece o aparecimento de lesões. Além disso, a repetitividade característica da dança clássica pode estar associada a desequilíbrios entre grupos musculares e a biomecânica do sistema musculoesquelético pode ser alterada de forma a comprometer a estrutura e a função do corpo, atuando como fator de sobrecarga sobre o aparelho locomotor. Sendo assim, o presente estudo justifica-se pela necessidade de um maior conhecimento sobre os efeitos que a prática do Balé pode trazer sobre crianças e adolescentes. Acredita-se que a prática do Balé pode trazer influências sobre o desempenho funcional e características corporais de crianças e adolescentes.

O estudo será realizado na UEG, onde será composta por 140 crianças saudáveis, com idades entre 10 e 14 anos, sendo elas divididas em dois grupos:

- Grupo 1 (Controle): não praticantes de Balé Clássico, selecionados de uma escola pública da cidade de Goiânia- Goiás, Instituto Estadual de Educação (IEG);
- Grupo 2 (Balé) - praticantes de Balé Clássico, selecionados da escola de dança também da cidade de Goiânia- Goiás, Instituto Tecnológico em Artes (ITEGO) Basileu França.

Os bailarinos escolhidos serão todos aqueles que dentro das escolas selecionadas se encaixarem dentro dos critérios de inclusão e exclusão e possuírem disponibilidade de horário para as avaliações. Critério de Inclusão: Grupo 1: faixa etária de 10 a 14 anos, de ambos os sexos, matriculadas na escola selecionada; Grupo 2: os mesmos do grupo anterior acrescido de ter no mínimo cinco anos de prática de Balé Clássico. Critérios de exclusão: para ambos os grupos: crianças com problemas ortopédicos instalados (ex: pé torto congênito, luxação do quadril, etc) ou de origem neurológica (paralisia cerebral, síndrome de Down, etc); com problemas sensoriais (deficiência visual ou deficiência auditiva, etc.

Para alcançar os objetivos do presente estudo serão utilizados os seguintes instrumentos de coleta de dados:

a) Roteiro de Anamnese;
b) Protocolo do Questionário ABEP (Associação Brasileira de Empresas de Pesquisa) 2008;
c) Ficha de Avaliação Física da Criança;
d) O IPAQ (Questionário Internacional de Atividade Física);
e) Teste do Tempo de Levantar-se e Andar (Timed Up & Go Test – TUG);
f) Teste de Caminhada de Seis Minutos (TC6';
g) Teste de sentar e levantar (TSL);
h) Baropodometria;
i) Teste de Tanner (maturação sexual);
j) Imagem corporal através da escala da silhueta.

Objetivo da Pesquisa:

Objetivo Primário:

Analisar a influência da prática do Balé no desempenho funcional e características corporais de crianças e adolescentes.

Objetivos Secundário:

- Caracterizar o perfil socioeconômico e o nível de atividade física de crianças e adolescentes praticantes e não praticantes de Balé Clássico;
- Comparar a percepção da imagem corporal entre crianças e adolescentes praticantes e não

praticantes de Balé Clássico;
- Comparar medidas antropométricas e pressões plantares de crianças e adolescentes praticantes e não praticantes de Balé Clássico;
- Comparar o desempenho funcional de crianças e adolescentes praticantes e não praticantes de Balé Clássico;

Avaliação dos Riscos e Benefícios:
Os pesquisadores relataram de forma clara e satisfatória os riscos decorrentes do desenvolvimento da pesquisa para os participantes. Considerando que os mesmos serão constituídos por crianças, é fundamental que os pesquisadores estejam plenamente cientes dos riscos e resguardem os participantes de eventuais danos.

Comentários e Considerações sobre a Pesquisa:
O projeto apresenta relevância científica. O TCLE e o TALE contêm todas as informações imprescindíveis para resguardar as garantias de integridade física / psicológica dos participantes.

Considerações sobre os Termos de apresentação obrigatória:
O TCLE contém informações imprescindíveis para os participantes da pesquisa: contato do pesquisador, garantia de sigilo, o caráter voluntário da mesma e informação de que o participante pode se retirar da pesquisa a qualquer momento sem penalidades.

Conclusões ou Pendências e Lista de Inadequações:
Todas as recomendações e pendências elencadas por este Comitê foram satisfatoriamente cumpridas pelos pesquisadores.

Considerações Finais a critério do CEP:
Solicitamos ao pesquisador que nos encaminhe os Relatórios Parciais semestralmente e o Relatório Final até 30 dias após o término da pesquisa. Solicitamos também que nos envie possíveis Emendas ou qualquer modificação relevante para que possamos fazer o devido acompanhamento deste estudo.

Este parecer foi elaborado baseado nos documentos abaixo relacionados:

Tipo Documento	Arquivo	Postagem	Autor	Situação
Informações Básicas do Projeto	PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_867569.pdf	10/04/2017 15:21:11		Aceito
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Situação do Parecer:
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ANAPOLIS, 15 de Abril de 2017

Assinado por:
Luciana de Souza Ondei
(Coordenador)

JOURNAL OF ADOLESCENCE

The Journal of the Foundation for Professionals in Services to Adolescents (FPSA)

AUTHOR INFORMATION PACK

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ISSN: 0140-1971

DESCRIPTION

The *Journal of Adolescence* is an international, broad based, cross-disciplinary journal that addresses issues of professional and academic importance concerning development between **puberty** and the attainment of **adult status** within society. It provides a forum for all who are concerned with the nature of **adolescence**, whether involved in teaching, research, guidance, counseling, treatment, or other services. The aim of the journal is to encourage research and foster good practice through publishing both empirical and clinical studies as well as integrative reviews and theoretical advances. The *Journal of Adolescence* is essential reading for psychiatrists, psychologists, social workers, and youth workers in practice, and for university and college faculty in the fields of psychology, sociology, education, criminal justice, and social work.

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GAIT & POSTURE

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AUTHOR INFORMATION PACK

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Gait & Posture is a vehicle for the publication of up-to-date basic and clinical research on all aspects of **locomotion** and **balance**.

The topics covered include: Techniques for the measurement of **gait** and **posture**, and the standardization of results presentation; Studies of normal and **pathological gait**; Treatment of gait and **postural abnormalities**; Biomechanical and theoretical approaches to gait and posture; Mathematical models of **joint** and **muscle mechanics**; **Neurological** and **musculoskeletal** function in gait and posture; The evolution of **upright posture** and **bipedal locomotion**; Adaptations of carrying loads, walking on uneven surfaces, climbing stairs etc; spinal biomechanics only if they are directly related to gait and/or posture and are of general interest to our readers; The effect of aging and development on gait and posture; Psychological and cultural aspects of gait; Patient education.

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