



# Related-factors of social support for students' physical activity in a network perspective

## Fatores relacionados ao suporte social para atividade física de estudantes em uma perspectiva de rede

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### ABSTRACT

This study investigates the relationship between social support and moderate to vigorous physical activity, as well as the possible relationships between social support and socioeconomic status, gender and body mass index. Cross-sectional study with a non-randomized sample of 71 students (boys and girls) aged 7 to 12 and their parents or legal guardians. Social support and socioeconomic status were assessed using validated questionnaires. Height and body mass measurements were used for the body mass index equation. Moderate to vigorous physical activity was measured by accelerometers. The associations between all variables were tested by a network analysis. Moderate to vigorous physical activity is negatively correlated with socioeconomic status, body mass index and a question from the social support questionnaire: "How many times in the last week have you watched your child be physically active?". We observed a positive correlation between moderate to vigorous physical activity with gender and a question from the social support questionnaire: "How many times in the last week did you provide transport for your child's physical activity?". Thus, moderate to vigorous physical activity has a negative correlation with socioeconomic status, body mass index and the variable "parents sometimes observe their child to be physically active", and parents who provide transportation for the child to practice physical activity. In future, it is important to consider the network analysis in the intervention studies to promote adolescents' physical activity.

**Keywords:** Physical activity; Health promotion, Perceived social support; Social care; Child.

### RESUMO

*Este estudo investiga a relação entre suporte social e atividade física moderada-vigorosa, bem como as possíveis relações entre suporte social e nível socioeconômico, gênero e índice de massa corporal. Estudo transversal com amostra não randomizada de 71 escolares (meninos e meninas) de 7 a 12 anos e seus pais ou responsáveis. Apoio social e nível socioeconômico foram avaliados por meio de questionários validados. Medidas de altura e massa corporal foram usadas para a equação do índice de massa corporal. Atividade física moderada-vigorosa foi medida por acelerômetros. As associações entre todas as variáveis foram testadas por uma análise de rede. A atividade física moderada a vigorosa está negativamente correlacionada com o nível socioeconômico, índice de massa corporal e uma questão do questionário de apoio social: "Quantas vezes na última semana você observou seu filho ser fisicamente ativo?". Observou-se correlação positiva entre atividade física moderada-vigorosa com o gênero e uma questão do questionário de apoio social: "Quantas vezes na última semana você forneceu transporte para a atividade física de seu filho?". Assim, a atividade física moderada-vigorosa tem correlação negativa com o nível socioeconômico, índice de massa corporal e a variável "os pais às vezes observam que seu filho é fisicamente ativo, e pais que fornecem transporte para a criança praticar atividade física. No futuro, é importante considerar a análise de rede nos estudos de intervenção para promover a atividade física em adolescentes.*

**Palavras-chave:** Atividade física; Promoção da saúde; Apoio social percebido; Assistência social; Criança.

## Introduction

Levels of moderate to vigorous physical activity (MVPA) are an important predictor of health in childhood and in all stages of life, acting as a preventive factor for chronic non-communicable diseases, such as obesity, hypertension, and diabetes<sup>1</sup>. According to the new World Health Organization guidelines for physical activity, children and adolescents must perform an

average of 60 minutes per day of MVPA. However, it is estimated that about 78% of boys and 84% of girls worldwide do not meet the MVPA guidelines<sup>2</sup>.

In this sense, the promotion of regular physical activity is an emerging approach in the public health sector and is among the main health promotion initiatives in the world<sup>1</sup>, with the family environment being included in the main suggested strategies. The involve-

ment of parents or guardians (uncles, grandparents, cousins, siblings) has a fundamental role as behavioural models for their children<sup>3</sup>. Parents or guardians (uncles, grandparents, cousins, siblings) have a key role as behavioural models for their children<sup>4</sup>.

Parents are responsible for supporting their children's physical activity practice, especially in childhood<sup>4</sup> and they can become active agents in healthy lifestyle initiatives<sup>3</sup>. Such statements agreed with the proposal for an ecological model for the PA promotion<sup>5</sup>, in which the importance of the family context was suggested, as well as the parents' knowledge and actions in promoting physical activity in different contexts. Even so, the social support of the country plays an important role in preventing the decrease in physical activity manifested in the transition from primary school to final years of primary school and high school, that is, at the beginning of adolescence<sup>6</sup>.

A systematic review study conducted by Xu et al.<sup>7</sup> reported 30 studies from seven different countries and indicated that Social Support for physical activity practice is associated with an increase in the children's physical activity levels. However, in Brazil, there are few evidence about this relationship<sup>8</sup>. Some social factors are associated with their children's physical activity practice such as greater support for boys when compared to girls and socioeconomic status<sup>9</sup>. In addition to social factors, studies report that overweight or obese children are less physically active when compared to their peers<sup>10</sup>. In this sense, understanding how the relationship between physical activity, body mass index (BMI) and social factors is manifested is important.

Physical activity and this correlates, such as BMI, socioeconomic status (SES), gender, and social support are presented as a system with many different factors involved<sup>11</sup>, the interaction of these factors can occur in various ways, usually these systems with many agents of different natures present behaviours, which in most cases, are non-linear<sup>12</sup>. In this sense, systems that present these characteristics can be called complex systems and can be better understood from network analysis<sup>13</sup>.

In this line, in the present study, the relationship between physical activity, BMI, gender socioeconomic status and Social Support in children was understood from a network perspective, that is, a set of variables that are coupled and related at different levels, interacting and generating an emergent behaviour<sup>14</sup>. From the network perspective, a change in one variable could generate a new behaviour in the network, allowing the

understanding of which variables are most sensitive to changes in cross-sectional studies, with this information being essential for the development of intervention programs. Several topics have been understood from the network's perspective, such as childhood obesity, cognition, psychopathologies<sup>15,16</sup>. Therefore, the aim of the present study was to investigate the relationship between Social Support and moderate to vigorous physical activity, as well as the possible relationships between Social Support and socioeconomic status, gender, body mass index in a network perspective.

## Methods

The present study was a cross-sectional analysis included in the first phase of the research program "Effects of an intervention program with football on variables associated with cognition, metabolic syndrome and inflammatory markers in children". The non-randomized sample is justified by the fact that the school where the collections were carried out has a partnership with the researcher's university. 328 children were invited for research, and all manifested interest for participate. However, we did not have success in evaluating all children with all instruments, so the final research project sample was accelerometry data from 134 children, parental social support data from 230 children's parents or guardians and socioeconomic level from 158 children/family. Finally, only 71 students (of both genders) aged between 7- 12 years ( $8.8 \pm 52.1$ ) and their respective parents or legal guardians were evaluated. The exclusion criteria were students and parents with incomplete data regarding questionnaires and students with less than four days of physical activity data by accelerometers. Following approval from the school board, parents and children were invited to participate in a meet to inform them about the research objectives.

A questionnaire was applied to parents to assess their support for physical activity offered to their children. In this questionnaire, the parents reported their support through five questions: Q1) How many times in the last week did you offer support to your child to practice physical activity or sport? Ex: Buy sporting materials such as tennis shoes, clothes or pay the monthly fee for any sport; Q2) How many times in the last week did you engage in physical activity or play sports with your child? Ex: Played football or walked / ran with your child; Q3) How many times in the last week have you provided transportation for your child to practice physical activity or sport? Ex: took your

child (a) by car to the practice site, or offered money for bus, taxi or app transportation; Q4) How many times in the past week have you watched your child do physical activity or sports? Ex: He watched his son ride a bicycle or play football; Q5) How many times in the past week have you talked about the benefits of engaging in physical activity or sport. Ex: Child, practicing physical activity or sport is important for weight reduction.

These questions were originally adapted by Sallis et al.<sup>11</sup> and assessed for reliability Trost et al.<sup>17</sup>. We previously carried-out a composite reliability analysis regarding social support. The composite reliability value resulting from our sample proved to be adequate (CR > 0.70)<sup>18</sup> for the use of the scale (CR = 0.75). We chose to apply individually and not collectively because we intend to analyse the strength and intensity of each item (question) through network analysis. Parents' social support is assessed on a weekly basis. The punctuation was done as a Likert scale. For the present study, responses were grouped into "not receiving support" (parents who reported not offering support more than twice during the week) and "receiving support" (parents who reported offering support three times or more during the week).

The SES, an estimate for the average household income, was assessed using a questionnaire<sup>19</sup> that aims to identify the real consumption potential of Brazilian families through a points system. For the present study, economic classes were classified as "upper class" (A1 + A2 + B1), "middle class" (B2 + C1 + C2) and "low class" (D + E). The researchers helped parents complete the questionnaires. Height, body mass measurements and BMI equation followed the protocols suggested by Cole et al.<sup>20</sup>.

The children's physical activity levels were assessed using an ActiGraph accelerometer (wActiSleep-BT Monitor). The accelerometer was placed on the children's waist on an elastic belt, on the right axillary midline. Children used accelerometers during seven consecutive days (week and weekend). The equipment was used throughout the day, removing just in bathing or water activities. The minimum amount of accelerometer data considered as acceptable for analysis purposes was five days (including at least one weekend day), with at least 10 hours/day of usage time. The data were collected at a sampling rate of 80 Hz, downloaded in periods of one second and aggregated for periods of 15 seconds. For the accelerometer cut-off points, counts for periods of 15 seconds ( $\leq 25$  counts for sedentary

activity, 26-573 light intensity, 574-1002 moderate intensity, >1003 high intensity) were used, as proposed by Evenson et al.<sup>24</sup>. In the present study, the physical activity variable was dichotomized according to WHO recommendations: Children who complete sixty minutes of MVPA every day of the week and children who do not comply with WHO recommendations<sup>1</sup>.

Central tendency statistics (mean and standard deviation) and frequency distribution statistics were used to describe continuous variables (BMI, age) and dichotomous variables (Gender, Socioeconomic status, Social Support and MVPA), respectively. To investigate the associations between BMI, MVPA, social support for PA practice and SES, a "Machine Learning" procedure entitled "Network Analysis" was conducted, with the aim of establishing interactions between variables from a graphical representation. The relationship between the variables (nodes) are represented by lines, where the thickness indicates the strength of the relationship and the colours indicate negative (red) or positive (green) relationships<sup>21</sup>.

In the present study, the R package "qgraph" was used to calculate and visualize the network graph, with the "Fruchterman-Reingold" algorithm. The data would, then, be presented in the relative space in which variables with stronger associations remain together, and the less strongly associated variables are repelled from each other<sup>22</sup>. The "pairwise markov" random field model was used to improve the accuracy of the partial correlation network estimated from regularized regression by L1- "regularized neighbourhood". The less absolute contraction and selection operator was used to obtain regularization and make the model less sparse. The EBIC parameter was adjusted to 0.5 to create a network with greater parsimony and specificity.

The network analysis generates several measures to evaluate interactions between variables (nodes). In general, these measures are related to three aspects: (1) betweenness, estimated from the number of times that a node is part of the shortest path among all other pairs of nodes connected to the network, variables with greater betweenness are more sensitive changes which can be useful for planning interventions; (2) closeness, which is determined from the inverse of the distances from one node to all others, variables with greater closeness spread the effect of possible interventions more quickly across the network and; (3) strength (centrality of the force), which is the sum of all the weights of the paths that connect one node to the oth-

ers, indicating which variables showed the strongest relationships in the current network pattern<sup>23</sup>. In addition, the relationships between variables could be analysed from a weight matrix, derived from an adjacency matrix, positive relationships are displayed in blue and negative ones are shown in red, the thickness of the line indicates the relationship intensity.

Data collection was approved by the Human Research Ethics Committee of the Federal University of Rio Grande do Sul, Brazil, under number 2,581,951. The study included students who agreed to participate in the research by signing the term of free and informed consent and parents, who agreed to participate by signing the term of free and informed consent. During the collections, the children could feel some physical discomfort during the measurement of weight and height and during the use of the accelerometer. They could also feel some discomfort, such as a headache when answering the social support questionnaire. Parents, in turn, could also feel some discomfort, such as a headache when answering the social support questionnaire. However, when experiencing any of these risks, the participants were assisted by the researchers. If necessary, medical emergency teams would be called in. As a benefit of the research, children were able to have a closer contact with physical activity and consequently improving their levels. Parents could be made aware of the importance of offering support for the practice of physical activities.

### Results

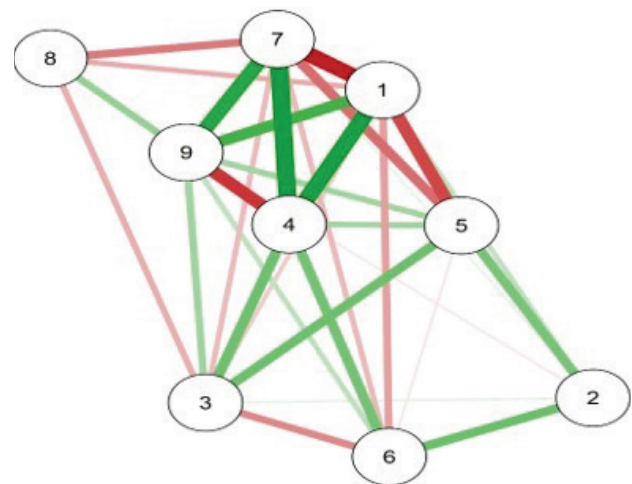
Sample characteristics stratified by gender was show in Table 1. Mean age of children was  $8.8 \pm 52.1$  and majority being girls (52%). In the present study, no child was selected in the category of high socioeconomic status. Most children were middle class (73.2%). Approximately 86% of the subjects did not comply with the PA guidelines proposed by WHO<sup>1</sup>. In terms of family support, most parents say that do not encourage their children to PA practice.

In the Figure 1 and Table 2, the decrease in MVPA is related to the social support variable “parents who observed their child in the last week to be physically active” (-0.42). The increase in MVPA is related to be low socioeconomic status ( $r = -0.81$ ), to a decrease in BMI ( $r = -0.42$ ), to be male ( $r = 0.71$ ) and the offer of transportation for the practice of physical activity ( $r = 0.79$ ). Other important relationships indicated that children from the middle socioeconomic status ( $r =$

**Table 1** – Characteristics of the sample, Porto Alegre, 2017.

Variables	N (%) / Mean ± SD	
Gender		
Feminine	37 (52.1)	
Male	34 (47.9)	
Age	8.80 ± 1.53	
BMI	18.27 ± 3.97	
Achieves recommendations		
Yes	10 (14.1)	
No	61 (85.9)	
Socioeconomic status		
Middle class	52 (73.2)	
Low class	19 (26.8)	
Parental support for PA	encourage	not encourage
Q1	30 (42.3)	41 (57.7)
Q2	10 (14.1)	61 (85.9)
Q3	13 (18.3)	58 (81.7)
Q4	51 (71.8)	20 (28.2)
Q5	35 (49.3)	36 (50.7)

N = sample number; M = mean; BMI = body mass index Q1 = How many times, in the past week, did you encourage your child for to do PA?; Q2 = How many times, in the past week, did you do PA with your child?; Q3 = How many times, in the past week, did you provide transportation for your child’s PA practice?; Q4 = How many times, in the past week, did you watch your child been physically active?; Q5 = How many times, in the past week, did you talk about the benefits of PA practice?.



**Figure 1** – Networks of the relationship between body mass index (BMI), moderate to vigorous physical activity (MVPA), social support, gender, socioeconomic status (SES) 1: Classification of socioeconomic status (SES). 2: Q1 = How many times, in the past week, did you encourage your child for to do PA (physical activity)? 3: Q2 = How many times, in the past week, did you do PA with your child? 4: Q3 = How many times, in the past week, did you provide transportation for your child’s PA practice? 5: Q4 = How many times, in the past week, did you watch your child been physically active? 6: Q5 = How many times, in the past week, did you talk about the benefits of PA practice? 7: Classification of the moderate to vigorous physical activity according to the World Health Organization. 8: BMI. 9: Gender.



0.77) and that girls ( $r = -0.64$ ) received more transport support for the practice of physical activity by their parents and that parents of average socioeconomic status offer more transport support for the practice of physical activity ( $r = 0.77$ ) while parents of low socioeconomic status watched their children be physically active in the last week ( $r = -0.58$ ).

Figure 2 shows the network centrality measures. Social support for the provision of transportation for the practice of physical activities, assisting the child is physically active and MVPA presented the highest values of betweenness. Social support for the provision of transportation for physical activity, socioeconomic

status and MVPA were the variables with the greatest closeness and strength.

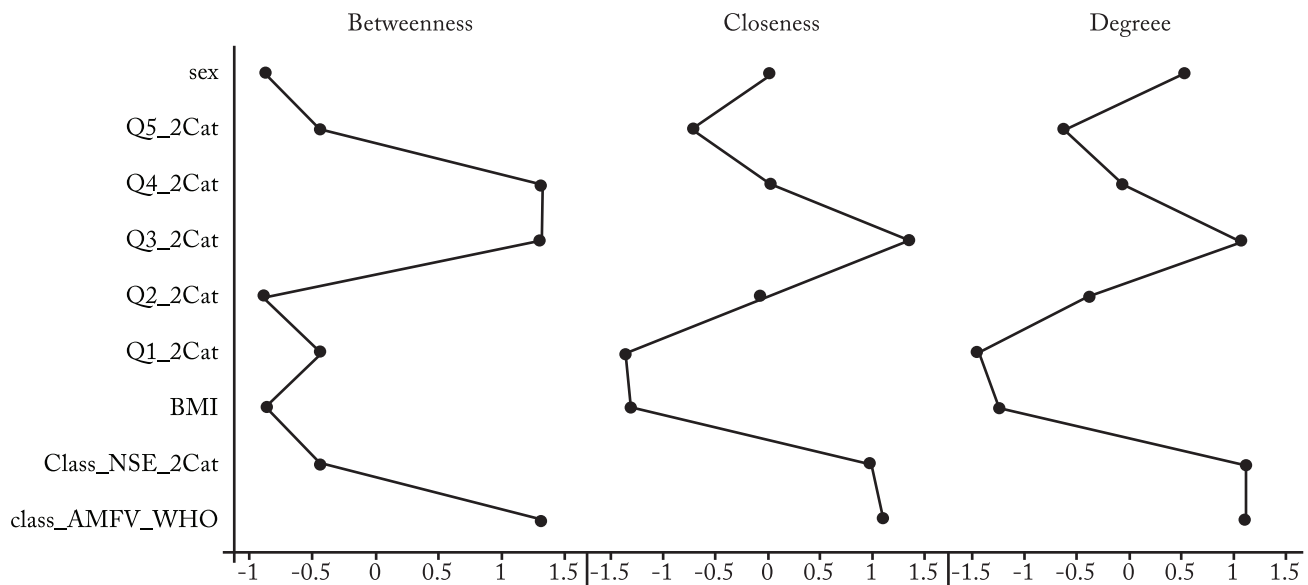
### Discussion

The main evidence of this study indicated that the decrease in MVPA is related to watching the child be active (by parents or guardians). We believe that some parents may confuse their role as encouragers and up playing a responsible role in their children, which can cause some cognitive stress or even demotivate the practice of PA<sup>24</sup>. Transport-related support was positively associated with MVPA. This can be observed in other countries and cultures, for example, in the studies

**Table 2** – Weights matrix.

Variables	SES	Q1	Q2	Q3	Q4	Q5	MVPA	BMI	Gender
SES	0.000	0.206	-0.170	0.777	-0.588	-0.308	-0.818	-0.268	0.607
Q1	0.206	0.000	0.088	0.000	0.431	0.478	0.078	0.000	-0.080
Q2	-0.170	0.088	0.000	0.467	0.472	-0.379	-0.218	-0.261	0.306
Q3	0.777	0.000	0.467	0.000	0.303	0.445	0.798	0.268	-0.648
Q4	-0.588	0.431	0.472	0.303	0.000	-0.081	-0.468	0.000	0.306
Q5	-0.308	0.478	-0.379	0.445	-0.081	0.000	-0.225	0.000	0.216
MVPA	-0.818	0.078	-0.218	0.798	-0.468	-0.225	0.000	-0.426	0.711
BMI	-0.268	0.000	-0.261	0.268	0.000	0.000	-0.426	0.000	0.340
Gender	0.607	-0.080	0.306	-0.648	0.306	0.216	0.711	0.340	0.000

SES = socioeconomic status; MVPA = moderate to vigorous physical activity; BMI = body mass index; Blue = positive associations; Red = negative associations; Q1 = How many times, in the past week, did you encourage your child for to do PA?; Q2 = How many times, in the past week, did you do PA with your child?; Q3 = How many times, in the past week, did you provide transportation for your child's PA practice?; Q4 = How many times, in the past week, did you watch your child been physically active?; Q5 = How many times, in the past week, did you talk about the benefits of PA practice?.



**Figure 2** – Graphical representation of the centrality of the association between the BMI, PA levels, parental support for the practice of PA and socioeconomic status

BMI = body mass index; PA = physical activity; SES = socioeconomic status; WHO = World Health Organization.

by Suen et al.<sup>25</sup> with Chinese children. The three studies also report positive associations between transport support and MVPA. In this stage of life, the child does not have the autonomy to commuting alone. In this sense, social support to transport is important for child practice physical activities, since aspects of vulnerability and perception of neighbourhood security are related to the practice of MVPA, especially in countries with high urban violence<sup>26</sup>.

Our results indicated that children of low socioeconomic status have a higher level of MVPA. Research points to results similar to ours, for example in Brazil the study by Matsudo et al.<sup>9</sup> and in Kenya the study by Muthuri et al.<sup>27</sup> also reported that a higher annual family income was associated the fact that children practice less MVPA.

The results also indicate that the increase in MVPA is related to the decrease in BMI. This result followed a worldwide trend<sup>10</sup>. Our findings also revealed that boys tend to be more physically active compared to girls. We believe that social support from parents, for a cultural reason, benefits boys more than girls. These are less encouraged to practice physical activities<sup>28</sup>. Other important results indicate that regardless of socioeconomic status, transportation support was more offer to girls.

Although, not an aspect evaluated in the present study, it seems to us that the most important thing in relation to the social support offered for the practice of physical activity is the way in which the child perceives it<sup>4</sup> and consequently, uses it to increase their physical activity and thus reach the recommended levels of MVPA. Network centrality measures are useful to understand the role of each variable. The variables of social support for the provision of transportation, assisting the child to be physically active and MVPA presented the highest values of betweenness. These variables are the most sensitive to changes from future interventions, that is to say, reinforcing these variables can improve all variables in the network.

This result endorses recent recommendations, such as the World Health Organization physical activity recommendations<sup>1</sup>, which suggests an increase in the time spent in MVPA for children aged 5 to 17 years. In our study, parents' support for transportation and for assisting children to be active are essential to improve the variables of the analysed network. The importance of parental support in children up to 12 years of age is recognized in the literature.

The provision of transportation directly influences

the child's physical activity and is also associated with physical fitness and changes over time. In addition, authors have shown that parents' perception of support for transportation directly predicts a higher level of MVPA in children<sup>29</sup>. In relation to assisting the child to be active, parents who participate in physical activity with their children influence the increase in children's physical activity levels and, consequently, in the sedentary time observed when compared to children who practiced physical activity alone and/or when only parents observed them<sup>29</sup>. In this sense, it is suggested that in addition to observing, parents become aware of the importance of practicing PA together with their child.

To the best of our knowledge, this is the first study in Brazil evaluating the association between different types of Social Support for physical activity, BMI, socioeconomic status, gender and MVPA levels, measured with accelerometers from a network perspective in children aged 6 to 11 years. Our results, although quite consistent, still need to be analyzed considering the limitations of the study. We used a validated questionnaire, but not specifically for the Brazilian population, which could be a bias factor. Furthermore, we did not carry out a study with a representative sample, which implies that the chance of bias is always greater. Finally, we are always clear that the subjective assessment of some social factors is complex and in itself has an interpretation bias.

However, our study has strengths that deserve to be highlighted. The assessment of physical activity with gold-standard equipment leads us to data very close to reality, in addition to the fact that when studying the subjective variables of social support, we took care to let adults (theoretically more enlightened than children) respond. Finally, we apply a statistical technique that considers the complexity of human behaviour, moreover, being characterized as innovative in the area.

Thus, our results collectively demonstrate that MVPA has a negative correlation with SES, BMI, and parents observe their children sometimes being physically active. We also concluded that there is a positive correlation between MVPA, gender and parents who provide a lot of transportation for their children to practice physical activity. Furthermore, we observed two other important relationships: parents who provide lots of transportation for their children to practice physical activity are related to SES and gender; And parents who observe their children sometimes being physically active with SES. We also suggest that fu-

ture research and evaluations consider the difference between mothers' and fathers' MVPA support.

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## Author's contributions

Silva NS participated in the design of the manuscript, wrote the manuscript, analyzed and interpreted the data, discussed and concluded. Mello JB, participated in the analysis and interpretation of data, discussion, conclusion and carried out the writing of the manuscript and critical review of the content. Bandeira PFR, participated in the analysis and interpretation of data, discussion and conclusion and critical review of the content. Mota J participated in the analysis and interpretation of data, discussion, conclusion and critical review of the content. Gaya ACA, participated in the manuscript design and critical review of the content. Gaya AR, participated in the manuscript conception, data analysis and interpretation, discussion, conclusion and critical review of the content and critical review of the content.

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