Epidemiology

Prevalence of responders of a school intervention at physical fitness and mental health of children: a quasi-experimental study

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Abstract - Aim: to verify the effect of a physical education program at school on physical fitness and mental health in children and to determine the individual prevalence of responders. **Methods:** This is a quasi-experimental study, developed with 67 children aged between 6 and 11 years old. (8.09 ± 1.81). A 21-week intervention was performed, that intervention condition (IC) consisted of sports and circuit training, and nutritional education. For the control condition (CC) classes followed to the Common Curricular National Base. The following variables were evaluated at baseline and post-intervention: physical fitness and mental health through the strength and difficulties questionnaire. Mixed analysis of variance and the prevalence of responders were used for statistical analysis. **Results:** The main results indicate that there were improvements in the IC in the components of physical fitness (cardiorespiratory fitness, speed, and agility) and mental health indicators (total difficulties, emotional symptoms, problems with peers, and prosocial behavior) after a school physical education program in comparison with the CC. Concerning the prevalence of responders between groups, it was found differences in cardiorespiratory fitness (CC: 33.33%; IC: 65.38%), agility (CC: 36.66%; IC: 73.07%), speed (CC: 43.33%; IC: 79.16%), emotional symptoms (CC: 28.57%; IC: 50.00%), and prosocial behavior (CC: 17.14%; IC: 46.87%). **Conclusion:** It is reinforced that well-planned physical education classes and simple intervention programs can be adopted at the school level and are capable of promoting children's physical and mental health.

Keywords: physical education, physical exercise, food and nutrition education.

Introduction

The adoption of a new lifestyle characterized by the decrease on the quality of food intake, along with the restriction of opportunities to be active physically, impacted in the children and adolescent's health directly and might be considered the main factors associated with higher rates of overweight and obesity[1], cardiometabolic diseases[2], as well as mental health problems[3].

Based on the aforementioned, and in agreement with the World Health Organization[4], several studies have shown the association between lifestyle factors with psychological aspects, indicating that physical activity and healthy eating may exert a positive influence on internalizing and externalizing symptoms[5-7]. The beneficial effects of intervention programs involving these variables on children's mental health indicators are also described in the literature, although in a lesser extent[8,9]. For instance, data from obese Chinese children showed that a school-based intervention focused on physical activity and eating habits had a positive impact on anxiety[10]. In addition, a systematic review pointed out significant small to moderate effects of interventions with physical activity on externalizing and internalizing problems and on self-concept[11].

When thinking about health in childhood, the components of physical fitness are suggested as important predictors of total and abdominal adiposity, risk factors for cardiovascular diseases, skeletal health, and mental health[12]. Besides, appropriate levels of cardiorespiratory fitness and muscular strength during childhood is associated with a lower risk of developing cardiometabolic disease and obesity in adulthood[13,14]. However, evidence has shown a decline in the physical fitness of the child

population in recent years[15]. This detrimental panorama is due to several factors, and among them, the carelessness with the targeting of Physical Education classes[16]. A systematic review shown that interventions performed in this sort of environment were only effective in improving physical fitness when designed for this purpose[17], reinforcing the importance of planning classes with well-defined objectives. However, it is still necessary to find interventions at school that are effective in preventing and treating the mental health of schoolchildren.

Based on this scenario, World Health Organization developed an action plan to increase the number of active people by 2030, and the main suggested approach in childhood and adolescence is to reinforce physical education classes and the promotion of physical exercise at school[18]. However, to promote a positive effect on health and physical fitness, teachers must prioritize the quality of classes[16]. Thus, a planned and organized intervention aimed to achieve moderate to high intensities in order to promote physical fitness must be adopted when the goal is children's health promotion.

The favorable effects of physical exercise on health have been extensively described[19,20]. However, the available literature is mainly focused on analyzes that consider general "mean" values. On the other hand, studies have shown that the effects of intervention programs with physical exercise have inter-individual variability in some health outcomes[21,22]. Medrano et al.[23] showed that even though the subjects are exposed to an equal stimulus, the responses may vary. While an individual could improve in one or more aspects (responders), others do not or even get worse (non-responders). This is due to the human condition, characterized by biological diversity, directly reflecting on genetic diversity and the response to stimuli[21].

Some studies have already been conducted in this perspective, however the literature on inter-individual variability in responses to exercise in health outcomes is limited in children and points mainly to metabolic variables[22-24]. Thus, to the best of our knowledge this is the first study that considers the inter-individual effect of an intervention that includes physical exercise and eating habits on the mental health and physical fitness of children. Therefore, the aim of the study was to verify the effect of a physical education program at school on physical fitness and mental health, and to determine the individual prevalence of responders in children.

Methods

This is a quasi-experimental study, part of the "Sport and Health at School Project", developed with children aged between 6 and 11 years old (1st to 5th grades of elementary school) from a public school in the city of Porto Alegre, Brazil. The physical education classes were not developed by a physical education teacher. Therefore, the aim of the project was to verify the effect of an intervention with moderate to vigorous physical activity and eating habits on several health outcomes. This program was approved by the Education Department of the State of Rio Grande do Sul and Research Ethics Committee of the Federal University of Rio Grande do Sul, under the number 2.611.180.

Participants and procedures

The program was applied by a group of PE teachers and a nutritionist who previously participated in weekly meetings to develop the methodology and discuss the progress of the intervention program. The school in which the intervention took place and the allocation of control and intervention conditions were carried out for convenience.

All schoolchildren and their parents were invited to participate, with the morning shift assigned to the intervention condition (IC, n = 150) and the afternoon shift to the control condition (CC, n = 200). The ones who were interested attended meetings at which they were informed about the procedures adopted in the interventions and evaluations. The potential participants were screened for inclusion criteria, defined as be enrolled in the intervention school; aged between six and 11 years; present more than 75% of attendance in the physical education programs. Parents who agreed to participate signed the consent form and completed some questionnaires, such as the one used for mental health assessment. For ethical reasons, all school children participated in physical education classes and physical fitness assessments. The other measures were performed only with the parents and children who signed the term. At the end of the evaluations, all children received an individual report with their data and explanations about the implications of each indicator for health. The final sample was composed by the children who completed all evaluations at baseline and follow-up and attended to a minimum of 75% in the classes. Then, in the IC 32 children were included and 35 in the CC, as shown in Figure 1.

Intervention condition

Physical exercise intervention

The exercise sessions aimed to improve global physical fitness profile were applied twice a week, and (60 min of duration) throughout the school year (21 weeks). The classes were organized into 5 moments: 10 min of warm-up, 15 min of circuit training (ProFit), 15 min of gymnastic components and rhythmic activities, 15 min of motor skills, and pre-sport games and 5 min of resting activities and feedback. The warm-up included recreational aerobic activities. The ProFit is a training circuit characterized by four stations composed by exercises aimed to develop physical fitness components

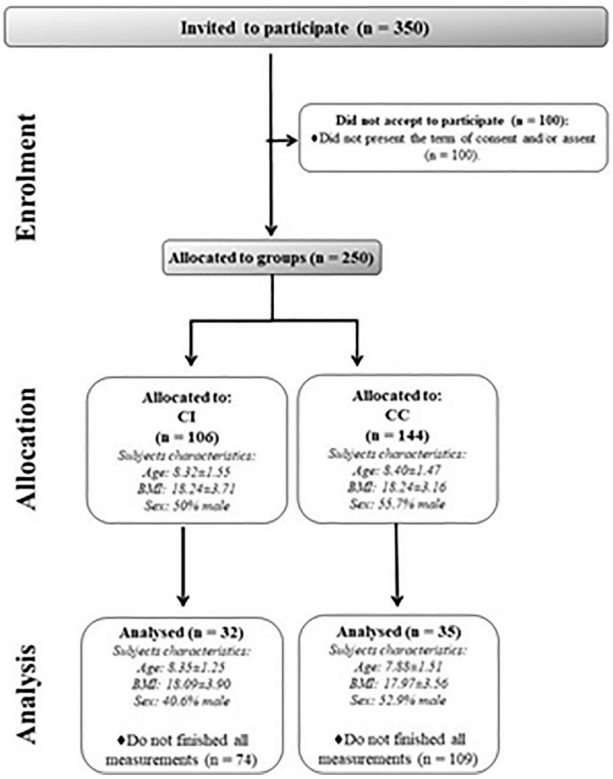

Figure 1 - Sample's flow diagram.

(cardiorespiratory fitness, muscular strength, agility, and speed). The children performed the circuit twice, staying in each station for one minute, with 30 s break between them. For progression, the load and complexity of the exercises were changed according to the age group (for example: jumping over a small cone and half squat; jumping over a large cone and half squat; sinking: alternating the support foot on the 1st and 2nd lap; alternate single stride ("stopped"); bilateral squat with 2 kg medicine ball). In the gymnastic components and rhythmic activities, several aspects were worked on, such as dissociation of limbs; coordinates, bearings, projections, time, rhythm, and compass. For the development of motor skills, activities were composed, for example, by pitches, bounces, kicks, standing, and moving receptions. Finally, pre-sports games consisted of handball, volleyball, frisbee, fights, among others.

Before the beginning of the intervention, the cardiorespiratory fitness test was performed and, according to the results, the students were divided into four groups that had similar conditioning to compose the stations. Children should achieve higher than 75% of the maximum heart rate, to allow a moderate to vigorous intensity throughout the class. Then, one participant from each group randomly selected used a portable (polar) heart rate monitor (Polar Team2 Pro, Polar, Finland) to monitor the intensity of the class.

Nutritional intervention

The nutritional intervention was developed by a nutritionist and consisted of actions developed once a month for the children and their parents. The activities were carried out at the school, during approximately 45 min and consisted of challenges and nutritional information transmitted in a playful manner. For the parents, materials were sent on the topics worked with the children and nutritional education content. For example, one of the proposals was that in one of the physical education classes, they would take fruit for snacks. Thus, the challenge was launched to the children and the parents were communicated to offer support. As an incentive, a ranking was made during the following months and the child who had brought more fruit would receive a prize (supplementary material).

Control condition

Control students were attended by interns from the Physical Education course at the Federal University of Rio Grande do Sul, who taught according to the Common Curricular National Base[25]. Classes were developed twice a week, with 60 min of duration, during the school year (21 weeks). This curriculum suggests that six didactic units be worked throughout Elementary School: games, dances, fights, gymnastics, sports and adventure bodily practices. The content and classes were documented in class diaries and supervised by the teacher responsible for the discipline of the Internship. According to the classes planning and observation, they were not developed in moderate to high intensity. The classes were organized in warm-up, main part to develop the didactic units proposed by Common Curricular National Base, and resting activities.

Measures

Baseline measurements were carried out by physical education teachers, psychologists, and nutritionists over a 2 months period, for both groups, in their respective schools. In the initial two weeks, physical fitness assessments were applied. To complete the questionnaires, two meetings were held with parents or guardians and for those who were unable to attend, individualized meetings were scheduled. Also, upon prior arrangement, some questionnaires were sent to the parents with an explanatory attachment on how to proceed with the completion. In the post-intervention period, the same procedures were followed.

Physical fitness

All physical fitness measures were evaluated following the procedures suggested by Proesp-Br[26]. The 6-min running and walking test was performed to verify cardiorespiratory fitness. The children were divided into

small groups according to the dimensions of the sports court (usually 10 children group at time). Before the start of the test, it was stressed the importance of running as long as possible, maintaining a constant pace, avoiding walks, and running peaks. During the test, the passage of time at 3 and 5 min was reported. By means of signs, at the end of the test, the students remained in the place where they were, so that the distance covered during the 6 min (in meters) was recorded (number of laps multiplied by the size of the court, added to the meters in the last return).

To determine the abdominal resistance, the Sit-up was used. In this test, the child must perform the most sit-ups in one minute. For this, the children were asked to position themselves in the supine position, with their knees flexed at 45º and their arms crossed over their chest. At the audible signal, the children moved the trunk to its flexion, touching the elbows on the thighs and returning to the starting position. The evaluator remained to hold the child's ankles throughout the test[27].

The lower limbs strength was determined by the horizontal jump test. A measuring tape was fixed to the floor, perpendicular to the starting line, and the child was instructed to remain to stand and with feet parallel, behind this mark. At the signal, they jumped as far as possible with both feet simultaneously. Each child had two attempts and the longest distance was recorded in centimeters[27].

Upper limb strength was assessed using the medicine ball. A measuring tape was fixed to the floor perpendicular to the wall, the zero point of the measuring tape being fixed to the wall. Then, the child was instructed to sit with his back fully supported on the wall, with his legs together and his knees extended. After flexing his arms, the goal was to throw the ball as far as possible, keeping his back against the wall. The distance was recorded in centimeters from the zero point to the place where the ball hit the ground for the first time in two attempts, the best of which was noted.

To assess agility, the square test was used. For this, a square measuring 4 m on a side was measured, with a cone arranged at each angle. At the signal, the students moved as quickly as possible, diagonally, then to the left (or right), going to the other diagonal, and finished towards the initial cone, always touching the cones with their hands. The children had two opportunities and the best moment was noted[26].

The 20-m running test was used to determine speed. At the signal, the children moved as quickly as possible, passing through three parallel lines previously marked: one starting line, one 20 m from the first (timeline), and another 21 m from the start (finish line). The third line served as a reference for the child not to slow down before crossing the 20 m. Time was recorded in seconds with two decimal scales[26].

Mental health

Mental health was evaluated using the “Strengths and Difficulties Questionnaire” (SDQ), which consists of a tool for the behavioral screening of children, and its psychometric properties are established in the literature[28]. It addresses behavioral issues in children aged 3 to 12 years and presents three versions that can be answered by children, teachers and, in this case, by the children's parents/guardians. It contains 25 items, which are organized into five domains: emotional symptoms, conduct problems, hyperactivity-inattention; peer problems and prosocial behavior. In our case, parents/guardians should consider the children's last six months to mark “True”, “More or less true” and “False” for certain sentences. For the final analysis, scores were generated for the domains used in this study (pro-social behavior, emotional symptoms, conduct problems, hyperactivity-inattention; peer problems), in addition to the sum of the last four indicators (total difficulties).

Statistical analysis

Descriptive data were presented through mean and standard deviation for all variables. To verify the difference between control and intervention conditions at baseline and post-intervention, the independent T- test was used. All variables were tested for normality through the Shapiro-Wilk test and the assumptions were met ($p > 0.05$). The intervention effect on time, condition, and interaction (time x condition) were verified through mixed ANOVA, adjusted for age and sex.

The prevalence of responders was realized in accordance with *Cohen's d* standardization (post-baseline/SD_{pooled}). The calculation consists of individual delta divided by the standard deviation of the group, adjusted for age and sex: $SD_{pooled} = (\sqrt{((SD_{baseline}^2 + SD_{post}^2)/2)}$ for each variable. As a cutoff point, we use the one suggested by Medrano et al.[22], $d > 0.20$ to consider the child responsive.

Finally, to verify the difference in the prevalence of responders between IC and CC, Poisson regression was applied, adjusted for age and sex. All the analyses were carried out using the IBM SPSS 21 (SPSS, Inc., Chicago, Illinois, USA). The level of statistical significance was established as $p \leq 0.05$.

Results

Table 1 shows the characteristics of the sample, by intervention and control condition. For the components of physical fitness, the IC was composed of 31 children (12 boys), and the CC by 32 (16 boys). For the mental health variables, the IC had 32 students (13 boys) and 35 in the CC (19 boys). Differences were observed between the intervention and control conditions after the physical education programs in physical fitness components, including

Table 1 - Descriptive characteristics of sample at baseline and post-intervention programs of physical education, according to intervention and control condition.

Characteristics of sample	Baseline		Post-intervention	
	IC (n = 31)	CC (n = 32)	IC (n = 31)	CC (n = 32)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Cardiorespiratory fitness (m)	673.29 (134.71)	750.63 (153.19)†	724.92 (114.06)	750.10 (130.33)*
Abdominal resistance (rep/1 min)	23.55 (11.97)	23.19 (10.91)	26.96 (11.95)	29.40 (10.38)
Lower limb strength (cm)	109.96 (23.92)	109.43 (23.16)	113.86 (21.02)	115.13 (22.33)
Upper limb strength (cm)	178.35 (65.81)	191.00 (33.38)	206.04 (51.72)	193.97 (30.92)*
Agility (seconds)	7.63 (0.89)	7.74 (1.13)	6.98 (0.81)	7.70 (0.80)*
Speed (seconds)	4.85 (0.64)	4.47 (0.61) †	4.39 (0.87)	4.40 (0.58)*
Total difficulties (points)	13.47 (9.01)	11.37 (5.31)	9.72 (4.75)	11.63 (6.21)*
Emotional symptoms (points)	4.03 (3.31)	3.26 (2.07)	2.66 (1.84)	3.69 (2.28)*
Peer problems (points)	3.03 (2.75)	2.00 (1.43)	1.44 (1.41)	1.54 (1.61)*
Conduct problems (points)	1.78 (1.68)	2.03 (1.88)	1.62 (1.60)	2.09 (1.88)
Hyperactivity-inattention (points)	4.62 (2.69)	4.09 (2.29)	4.00 (2.03)	4.31 (2.50)
Prosocial behavior (points)	7.28 (2.28)	8.57 (2.09) †	8.44 (1.74)	8.37 (2.01)*
Age (years)	8.35 (1.25)	7.88 (1.51)	8.94 (1.31)	8.47 (1.63)
BMI	18.09(3.90)	17.97 (3.56)	18.43 (4.16)	18.33 (3.49)

IC: intervention condition; CC: control condition.
*Statistically significant difference between intervention and control conditions in post-intervention for independent t-test ($p \leq 0.05$).
†Statistically significant difference between intervention and compare conditions in baseline for independent t-test ($p \leq 0.05$).

cardiorespiratory fitness, upper limb strength, agility, and speed as well as in mental health indicators such as total difficulties, emotional symptoms and prosocial behavior.

Table 2 indicates the effect of time, condition, and interaction of time and condition on physical fitness and mental health. It was found a significant interaction (time x condition) on cardiorespiratory fitness, upper limb strength, agility, speed, total difficulties, emotional symptoms, peer problems, hyperactivity-inattention, and prosocial behavior.

Figure 2 shows the prevalence of responders in physical fitness after intervention programs at school. The IC had a higher proportion of responders in relation to the CC, in the following components of physical fitness: car-

Table 2 - Physical education Programs effect in time, condition and interaction on physical fitness and mental health.

	Mixed Anova*								
	Time			Condition			Time x Condition		
Variables	F	p	Eta	F	p	Eta	F	p	Eta
Cardiorespiratory fitness (m)	0.11	0.73	0.002	4.74	0.03	0.08	4.54	0.038	0.08
Abdominal resistance (rep/1min)	0.73	0.39	0.01	0.06	0.80	0.001	0.47	0.496	0.009
Lower limb strength (cm)	0.19	0.65	0.004	0.05	0.81	0.001	0.25	0.619	0.005
Upper limb strength (cm)	2.75	0.10	0.05	0.52	0.47	0.01	9.58	0.003	0.15
Agility (seconds)	1.04	0.31	0.02	4.05	0.04	0.07	5.51	0.023	0.09
Speed (seconds)	0.68	0.41	0.01	4.35	0.04	0.08	5.06	0.029	0.09
Total difficulties (points)	1.73	0.19	0.02	3.62	0.06	0.05	6.28	0.015	0.09
Emotional symptoms (points)	0.79	0.37	0.01	0.04	0.83	0.001	9.18	0.004	0.13
Peer problems (points)	1.71	0.19	0.02	1.84	0.18	0.03	5.36	0.024	0.08
Conduct problems (points)	0.78	0.38	0.01	0.06	0.79	0.001	0.38	0.538	0.006
Hyperactivity-inattention (points)	0.85	0.36	0.01	0.83	0.36	0.01	2.39	0.127	0.03
Prosocial behavior (points)	2.40	0.12	0.03	1.86	0.17	0.03	6.11	0.016	0.09

F: Mixed Anova; p: significance level ≤ 0.05; Eta: partial eta squared effect;
*Adjusted for sex and age.

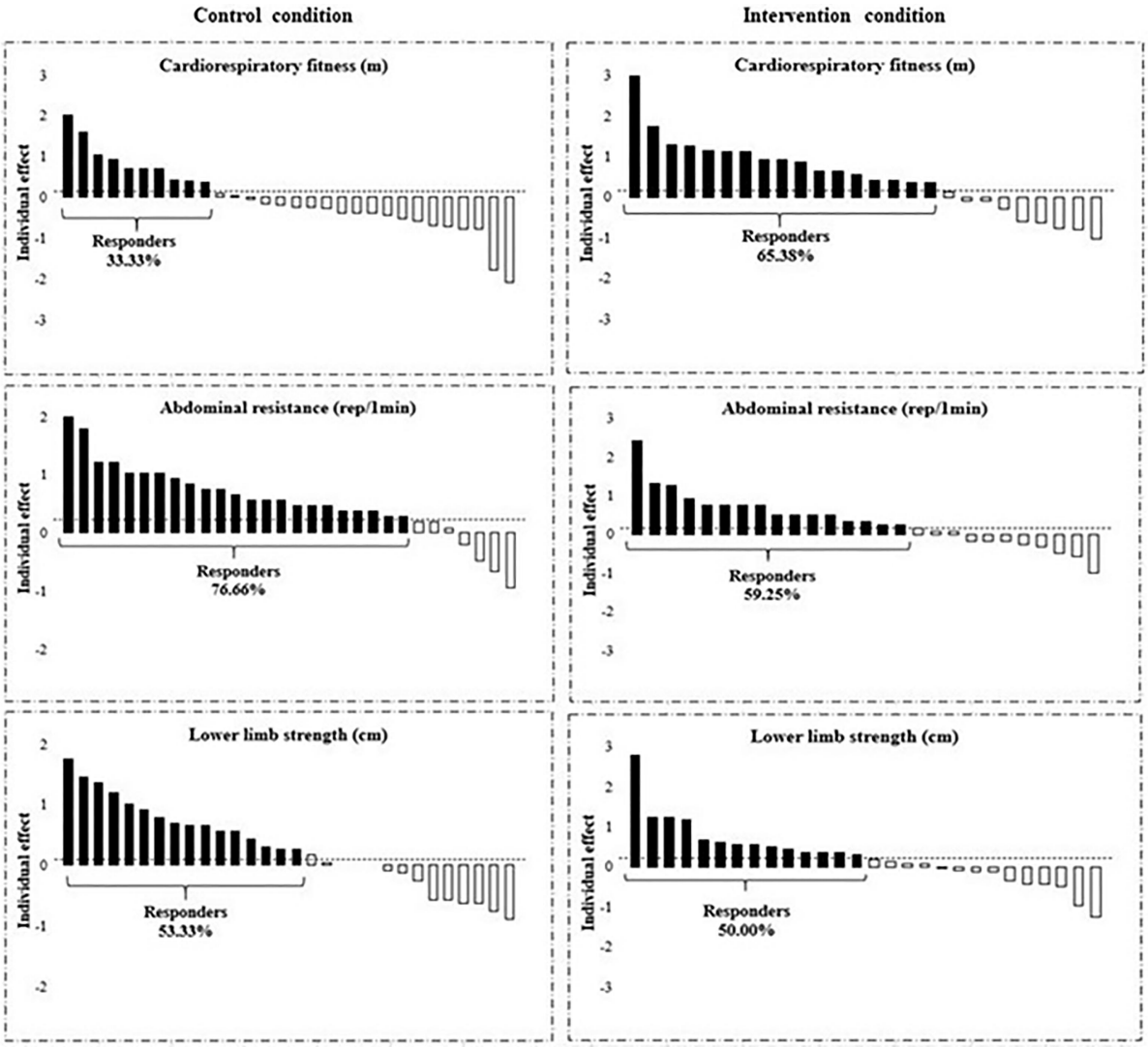

Figure 2 - Prevalence of responders in intervention and control conditions after physical education programs at school in physical fitness.

diorespiratory fitness (IC: 65.38% and CC: 33.33%), upper limb strength (IC: 60.71% and CC: 58.62%), agility (IC: 73.07% and CC: 36.66%) and speed (IC: 79.16% and CC: 43.33%). While abdominal resistance (IC: 59.25% and CC: 76.66%), and lower limb strength (IC: 50.00% and CC: 53.33%) presented higher values in the CC. It was found a difference in the prevalence of responders between CI and CC in cardiorespiratory fitness (PR (prevalence ratio) = 1.22; p = 0.02), agility (PR = 1.25; p = 0.008) and speed (PR = 1.23; p = 0.009).

The prevalence of responders in mental health after intervention programs at school presented in Figures 3 and 4. The IC had a higher proportion of responders in all components of mental health in relation to the CC (Total mental health = IC: 50.00% and CC: 37.14%; Emotional symptoms = IC: 50.00% and CC: 28.57%; Conduct problems = IC: 37.50% and CC: 25.71%; Attention deficit and hyperactivity disorder = IC: 50.00% and CC: 40.00%; Peer problems = IC: 59.37% and CC: 42.85%; Prosocial behavior = IC: 46.87% and CC: 17.14%). It was found a difference in the prevalence of responders between CI and CC in emotional symptoms (PR (prevalence ratio) = 1.19; p = 0.04) and prosocial behavior (PR = 1.30; p = 0.001).

Discussion

The main results of the present study indicate that there were improvements in the IC in the components of physical fitness (cardiorespiratory fitness, speed, and agility) and mental health indicators (total difficulties, emotional symptoms, problems with peers, and prosocial behavior) after a school physical education program. Additionally, the IC had a greater number of responders in most components of physical fitness (cardiorespiratory fitness, upper limb strength, agility, speed) and all components of mental health in relation to the CC. Concerning

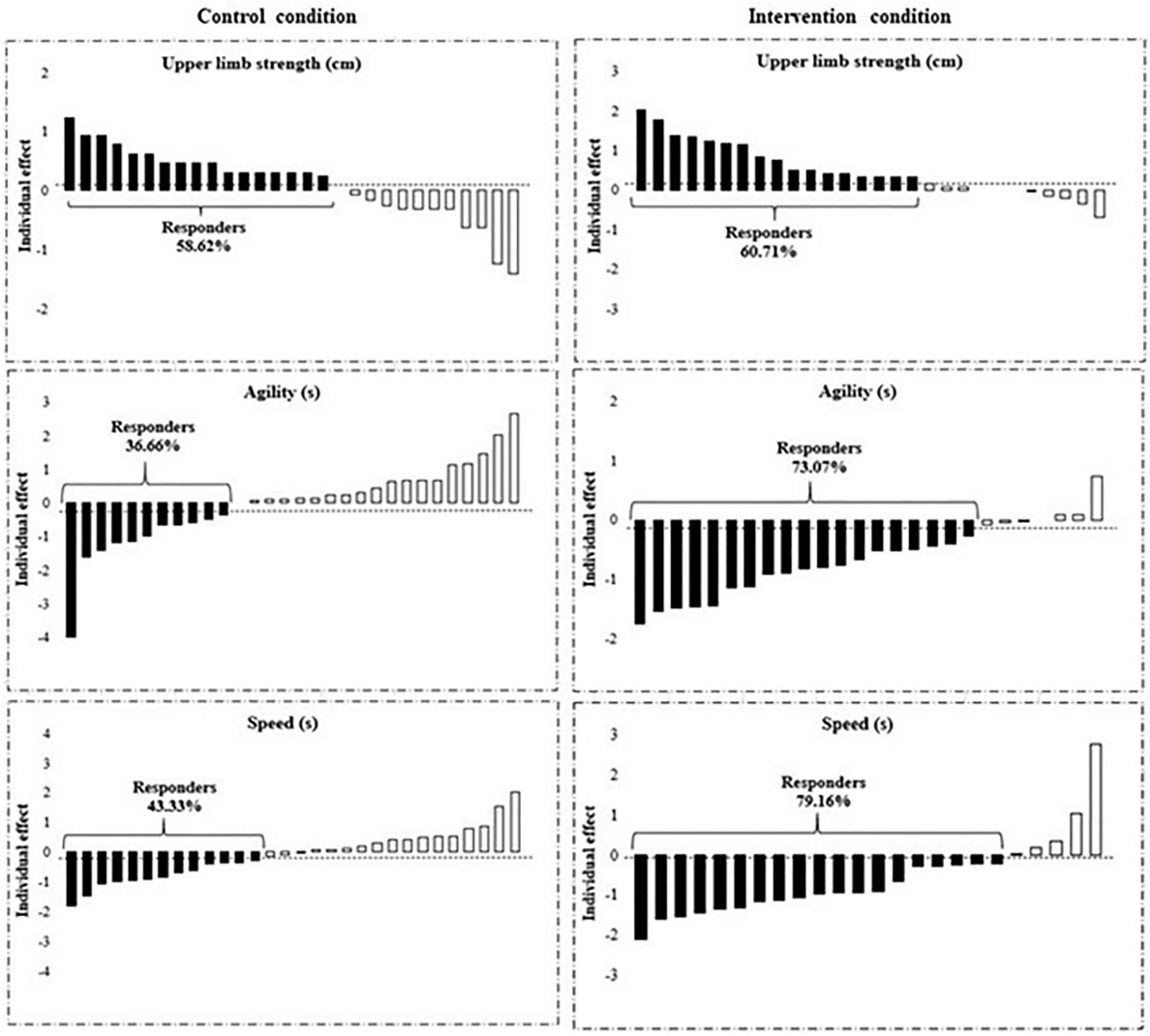

Figure 2 (cont.) - Prevalence of responders in intervention and control conditions after physical education programs at school in physical fitness.

the prevalence of responders between groups, it was found differences in cardiorespiratory fitness (CC: 33.33%; IC: 65.38%), agility (CC: 36.66%; IC: 73.07%), speed (CC: 43.33%; IC: 79.16%), emotional symptoms (CC: 28.57%; IC: 50.00%), and prosocial behavior (CC: 17.14%; IC: 46.87%). According to our knowledge, this is the first study to verify inter-individual variability after an intervention program with physical exercise and nutritional habits in children's mental health and physical fitness.

Considering physical fitness, the intervention had an effect on the lower limb strength, cardiorespiratory fitness, agility, and speed. Concerning average values, the literature shows similar results[27]. developed an intervention similar to ours, and found significant improvements in cardiorespiratory fitness. In addition, a study of obese children showed positive effects on cardiorespiratory and muscle fitness after an intervention with physical exercise and nutrition[20]. Still corroborating with our findings, a systematic review demonstrated that interventions in the school environment are capable of bringing improvements in physical fitness, when they dedicate attention to content, quality, duration, and prioritize physical activity[29].

Likewise, the mean values of the mental health indicators showed improvements after the intervention in the total of difficulties, problems with peers, in addition to the variables that showed differences in the prevalence of responders between the groups (emotional symptoms and prosocial behavior). Data from the literature with interventions similar to ours are in line with our results, indicating that the first moment of physical education class with high-intensity training can bring benefits to well-being, perceived appearance and sociability[30]. In addition, an intervention focused on sports was able to improve subjective well-being and the emotional intelligence trait[31]. On the other hand, an intervention focused on games did not show improvements in mental health parameters. The possible

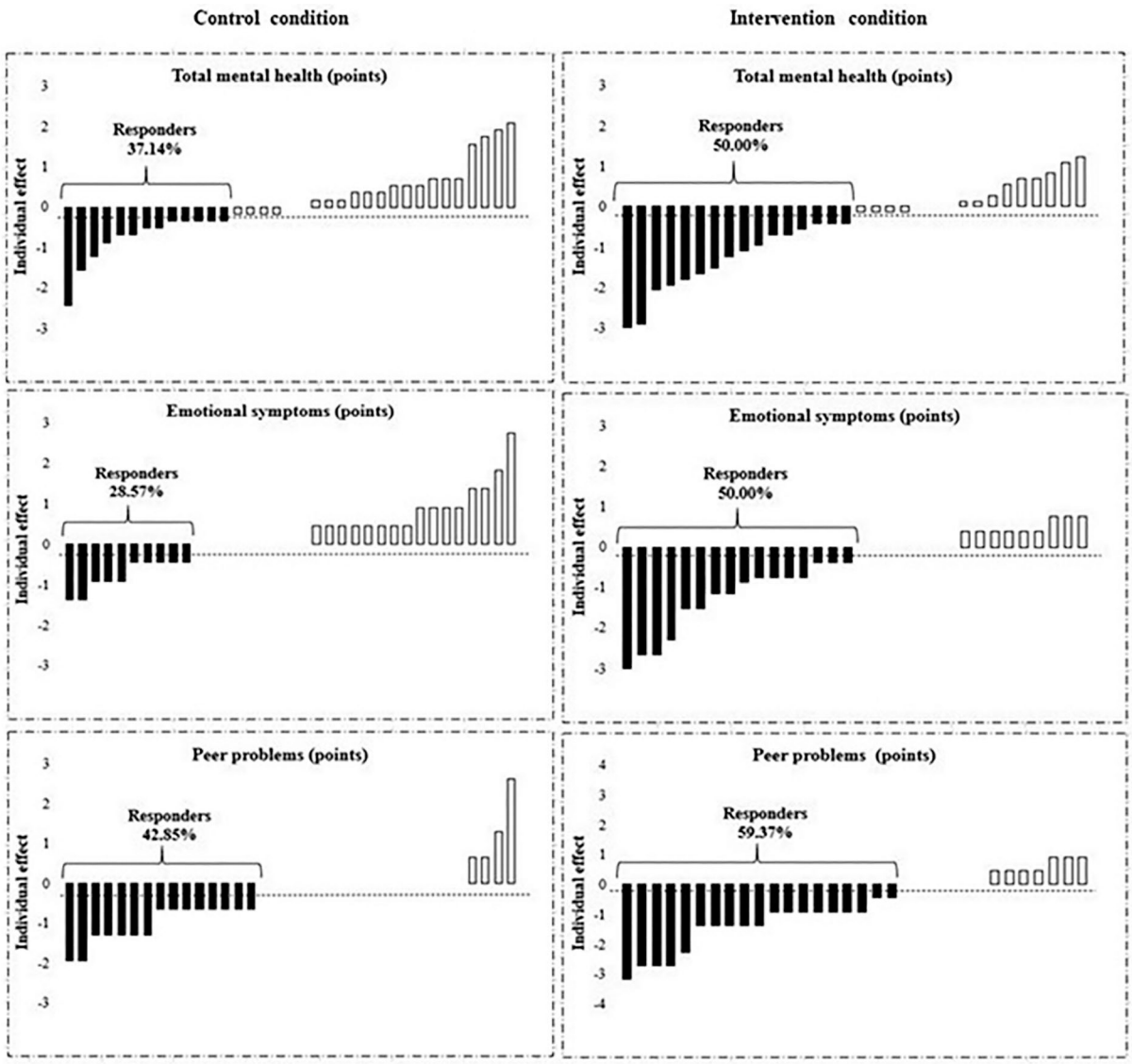

Figure 3 - Prevalence of responders in intervention and control conditions after physical education programs at school in the total mental health and scale internalizing.

explanations suggested were that children presented a high level of mental health in the pre-intervention, which would have made it difficult to find strategies to achieve significant changes[31]. However, in the same study control group also carried out activities aimed at the improvement of physical fitness and this characteristic may have been decisive in the final result. From that, there are some hypotheses as to how physical exercise can benefit mental health. A systematic review that investigated the mechanisms by which this effect occurs raised issues such as neurogenesis, increased brain volume, the release of neurotrophins, social connections, improved self-esteem, quality of sleep, and coping skills[32].

Due to the individuality of the response to physical exercise, which causes great inter-individual variability in adaptations to the stimulus, in addition to the diversity of factors involved, we also determine the individual prevalence of responsiveness in physical fitness and mental health after the intervention program. The results showed a difference in the prevalence of respondents between the groups in cardiorespiratory fitness, agility, speed, emotional symptoms, and prosocial behavior. According to our knowledge, there is no evidence related to these outcomes to be able to compare with our findings. However, we reinforce the importance of addressing this type of analysis, in addition to average values, since individuals exposed to the same exercise program may experience adverse responses. The causes of this phenomenon are still unknown[21] and, therefore, the need to consider these approaches is evident in order to develop more specific intervention programs for the promotion of children's health.

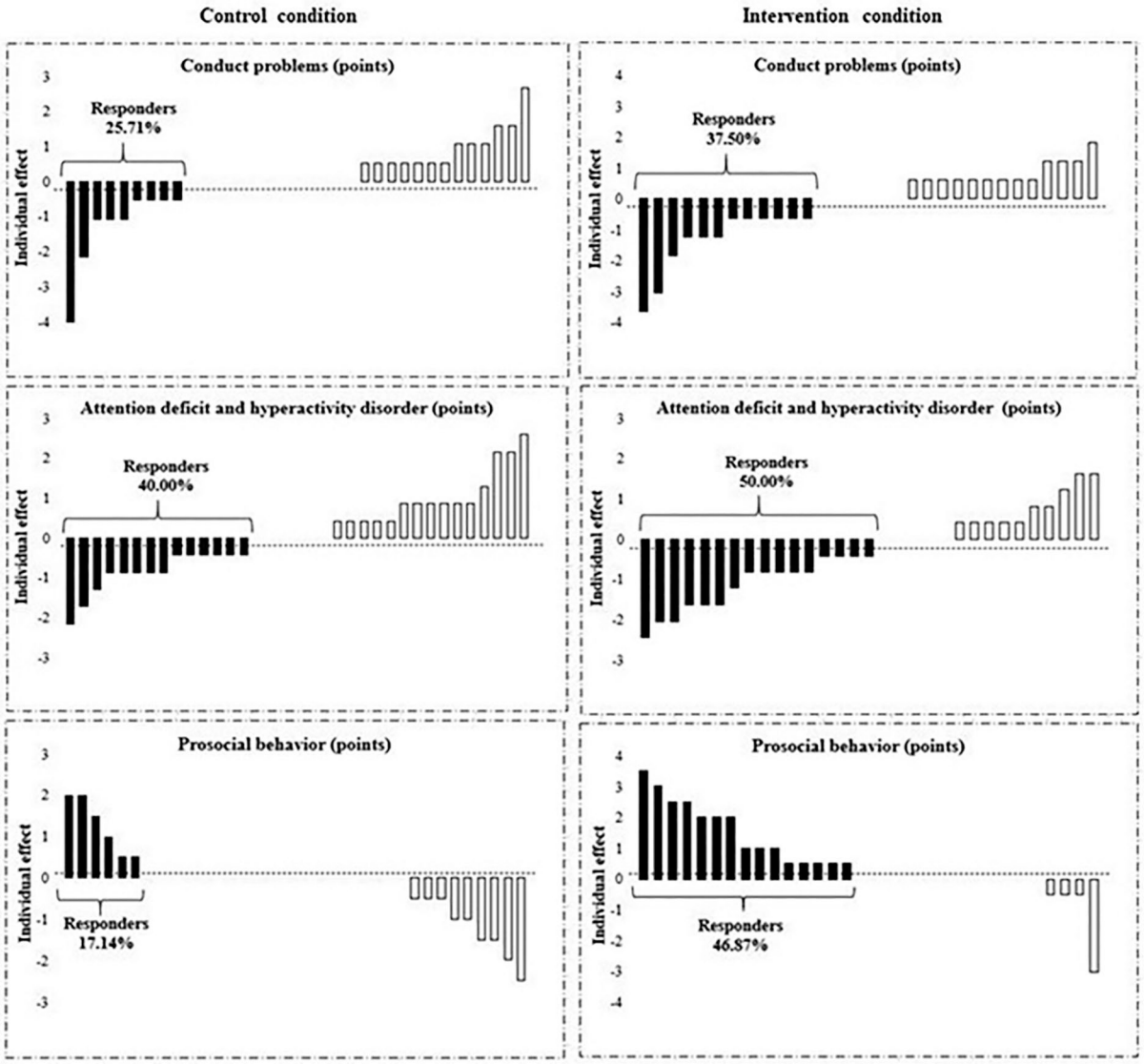

Figure 4 - Prevalence of responders in intervention and control conditions after physical education programs at school in scale externalizing.

Indeed, our findings indicated that an intervention program aimed to improve physical fitness through moderate to vigorous physical activity may exert a positive effect on both, physical and mental health in children. Therefore, this kind of intervention, composed by a well-planned and organized approach and developed in the school setting could serve as model for physical education teachers in order to promote health. The CC also exert some beneficial results, however, they were much more pronounced in the IC, which we believed was due to the moderate to vigorous intensity of physical activity based in sports and aimed at improving physical fitness[16,33].

From this, some strength of the present study must be highlighted. First, interventions with physical exercise aimed to exert an effect on mental health are scarce in the studied population, mainly in Brazil. In addition, we verified the effect of an intervention with physical exercise and nutrition, both in terms of mean and inter-individual variability in children's physical fitness and mental health. On the other hand, limitations must be pointed out, such as the sample size, the group's distribution in IC and CC was intentional, characterizing a quasi-experimental design, which requires caution in extrapolating the results. Some variables that could exert an influence on mental health, such as family environment, socioeconomic level, exposure to psychological stressors, were not evaluated. In addition, being engaged in leisure physical activity and sports were not considered as covariates. This aspect could have an impact in the observed results, once the development of motor skills and improvement of physical fitness can be fundamental for children to seek to occupy their free time with the practice of active play and sports together with their peers[34].

Conclusions

Our results show a positive effect of an intervention with physical exercise and nutritional habits on children's physical fitness and mental health. In addition, there were differences between the individual prevalence of respondents in cardiorespiratory fitness, agility, speed, emotional symptoms, and prosocial behavior. Thus, it is possible to reinforce the importance of well-planned physical education classes and how simple programs that can be adopted at the school level are capable of promoting children's physical and mental health.

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Supplementary material

Supplementary material 1 - Organization of intervention. HR_{max}: maximum heart rate.

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