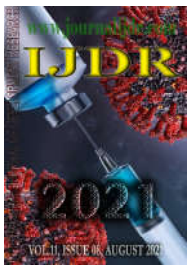
ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 11, Issue, 08, pp. 49528-49531, August, 2021
https://doi.org/10.37118/ijdr.22580.08.2021



RESEARCH ARTICLE OPEN ACCESS

THE IMPACT OF LOGICAL REASONING GAMES IN THE FIGHT AGAINST CHILDHOODHOOD OBESITY: EVALUATION OF A POST-INTERVENTION FOLLOW-UP STUDY

Ariane Q. Sousa*[1], Amanda Moreno Santos[2], Aranin Q. S. Santos[3], Luciana S. Lirani[4] and Ricardo A. Ramos[5]

[1]Master in Health and Biological Sciences. Federal University of Vale do São Francisco Valley (UNIVASF). Petrolina, PE, Brazil; [2]Master in Health and Biological Sciences, Federal University of São Francisco Valley (UNIVASF). Petrolina, PE, Brazil; [3]Master in Health and Biological Sciences, Federal University of São Francisco Valley (UNIVASF). Petrolina, PE, Brazil; [4]PhD in Physical Education; State University of the North of Paraná (UENP). Petrolina, PE, Brazil; [5]PhD in Computer Science; Federal University of São Francisco Valley (UNIVASF). Petrolina, PE, Brazil

ARTICLE INFO

Article History:
Received 28th May, 2021
Received in revised form
19th June, 2021
Accepted 26th July, 2021
Published online 29th August, 2021

Key Words:
Pediatric Obesity. Experimental Games. Follow-Up Studies.

***Corresponding author:**
Carlos Tadeu Bandeira de Lavor

ABSTRACT

Follow-up studies are needed to evaluate the results obtained after an intervention. The objective of this study was to evaluate the impact of an intervention with logical reasoning games on sedentary lifestyles and childhood obesity, six months after its completion. This is an interdisciplinary, retrospective, longitudinal, applied, exploratory research involving schoolchildren. The variable studied was the level of physical activity (PA) using as instrument the Physical Activity Questionnaire for Older Children (PAQ-C). From the original sample of 115 children (8 to 10 years old), 70 were followed (n = 45, case; n = 25, control). There was a reduction in PA practice in the case group (-0.78; $p<0.001$). That is, the increase in PA practice obtained after the application of the games was not maintained, indicating the importance of continuing interventions to combat childhood obesity to maintain the results.

Copyright © 2021, Ariane Q. Sousa et al. *This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.*

Citation: ***Ariane Q. Sousa, Amanda Moreno Santos, Aranin Q. S. Santos, Luciana S. Lirani and Ricardo A. Ramos.*** "The impact of logical reasoning games in the fight against childhoodhood obesity: evaluation of a post-intervention follow-up study*", International Journal of Development Research*, 11, (08), 49528-49531.

INTRODUCTION

Obesity has been prevalent and is growing every day, being characterized as a serious public health problem (Wharton *et al.*, 2020). It has largely affected the child population, and in the last 50 years there has been a nearly fourfold increase in rates (Llabre *et al.,* 2018). In 1975 there were 11 million obese children and adolescents, and in 2016 this amount reached 124 million. If overweight is included, there is an increase of 213 million in this number (NCD Risk Factor Collaboration, 2017). This data is worse in low and middle income countries, where obesity reaches alarming proportions. Brazil is no exception to the world scenario, 33.5% of Brazilian children are overweight for their respective ages (Brasil, 2010). According to the World Health Organization (2016), the aggravating factor is the comorbidities secondary to obesity, such as hypertension and diabetes; diseases that used to be considered adult diseases, andthat, increasingly, have manifested themselves in younger age groups. In addition to these complications, other consequences extend such as developing gastrointestinal, musculoskelet al, orthopedic (World Health Organization, 2016) and psychological (World Health Organization, 2018) problems that can last into adulthood. Furthermore, obese children are highly likely to remain obese in adulthood and are at increased risk of developing chronic diseases. Although obesity is multifactorial, in childhood obesity, the cause usually predominates in exogenous factors, arising from the behavior and environment to which children are exposed (Vicenzi *et al*., 2015). As an example, one can cite an unbalanced diet and a sedentary lifestyle. Thus, the change in lifestyle and eating habits of children have been instrumental in the construction of childhood obesity (Vasconcellos *et al.*, 2013). Given the magnitude of this problem, it is necessary and urgent to adopt strategies that focus on health

promotion and disease prevention, in addition to early diagnosis and immediate intervention, with actions that seek to prevent childhood obesity (Viveiro *et al.*, 2016). It is necessary to implement differentiated strategies that can serve children, so that the goal of health education is achieved presenting good results (Dias *et al.*, 2017). One of these strategies are games. According to Piaget (1971), these have two functions: to provide children with the mental consolidation of learning, and to give pleasure while playing, which motivates learning. When it comes to the use of games for health promotion, we can talk about serious games, which are games that have education as their main goal. These games stimulate learning, besides promoting behavioral changes (Machado *et al.*, 2011). In order to promote nutritional knowledge and the adoption of healthy habits, Santos *et al.* (2019) proposed a strategy that used off-line Logical Reasoning (LR) games, using programming logic, as a strategy for fixing the concepts presented. After twelve weeks of intervention, one of the results that the research revealed was that the group exposed to the games increased their physical activity practice. However, how to know if the results presented during and immediately after the intervention were sustained even after the intervention ended?. An answer to this question may come by conducting a follow-up study, as it is possible to verify the effectiveness and permanence, over time, of the intervention carried out. In this context, the objective of this work is to evaluate the impact of an intervention to combat sedentarism and childhood obesity with LR games six months after its completion.

METHODS

This is a retrospective, longitudinal, applied, exploratory, case-control study. The research was carried out in the city of Petrolina/PE, in two municipal schools. The case and control schools were chosen by lottery. Six months after the intervention, the children were measured again and the questionnaires were reapplied. The research was approved by the Ethics and Research Deontology Committee of the Federal University of Vale do São Francisco, under opinion number 2.815.854. Only children who signed the Consent Form and parents who signed the Free and Informed Consent Term participated in the study. The population consisted of students aged 8 to 10 years old, of both genders, regularly enrolled in the participating schools, attending the 3rd and 4th grades of elementary school I.

To participate in the study, the inclusion criterion was having participated in the intervention project, and the exclusion criteria were not attending any of the stages of the research, and children who left the schools studied during the study. It is worth noting that the nutritional status of the child was not considered as an inclusion or exclusion criterion, because the objective of the study was to evaluate the impact of LR games in changing habits, aiming to prevent childhood obesity in children who do not present obesity/overweight or in treating those who do. The PA level of the children was measured using the Physical Activity Questionnaire for Older Children - PAQ-C (Crocker*et al.*, 1997). All questions are about PA practice in the last seven days. The result of the questionnaire is obtained by calculating three averages and the final average. Mean 1 gathers information about PA practice during the week. Mean 2 evaluates PA during leisure time, and Mean 3 measures the frequency of activities during the week. The final average is calculated from averages 1, 2 and 3. According to Silva and Malina (2000), it is possible to define whether the child is active or sedentary from the scores. These go from 1 to 5 and mean, respectively, very sedentary, sedentary, moderately active, active, and very active.

Statistical Analysis: The analysis was performed using IBM® SPSS - Statistical Package for the Social Sciences 22.0 Mac (SPSS 22.0 Mac, SPSS Inc., Chicago, Illinois, USA) statistical software, considering $p<0.05$ significant for all analyses. Both descriptive and univariate and multivariate statistics were used. Quantitative variables were described as mean and standard deviation. Qualitative/categorical variables were described by absolute and relative frequencies. To test data normality the Shapiro Wilk test was applied. One-way analysis of variance (ANOVA) was used to evaluate the differences between the groups. Each ANOVA condition was followed by a Bonferroni mean comparison test to determine where significant differences occurred.

Intervention: In summary, the intervention consisted of the creation of LR games, through the elaboration of 12 lesson plans taken from off-line lessons on the code.org website, and adapted to the theme of childhood obesity. The lesson plans generated the applied games. These games included programming logic concepts and stimulus for behavioral change regarding eating habits and PA practice. The research was implemented over a period of twelve weeks in two schools. In one, the intervention with the games was made (case school), and in the other, the control school, no intervention was made. Two games per week lasting 30 minutes each were applied. A full description and the evaluation immediately after the intervention can be found in the study by Santos *et al.* (2019) who applied the games.

RESULTS AND DISCUSSION

From the original sample of 115 children, 70 were followed, 52.9% male and 47.1% female. Of these 70 children, 45 were from the case school and 25 from the control school. There was a sample loss of 45 participants due to the disengagement of the children from the schools studied.

Table 1. Comparison of changes in physical activity level (PAC-C) of the sample, in the years 2017 and 2018, in Petrolina, PE

SubjectiveVariables	GROUP 01 Post Control	GROUP 02 Follow. Control	GROUP 03 Post Case	GROUP 04 Follow. Control	ANOVA ONE WAY
	Mean (±)SD	Mean (±) SD	Mean (±) SD	Mean (±) SD	Valueof p
MEAN 1 (PA practice during the week)	2.25±0.88	1.68±0.86[3]	2.63±0.84[2.4]	1.88±0.55[3]	<0.001
MEAN 2 (PA practice during free time)	1.72±1.34	1.04±1.40	1.96±1.43	1.33±1.61	0.063
MEAN 3 (Frequency of PA during the week)	2.62±1.33[2]	1.30±0.98[1.3]	2.73±1.37[2.4]	1.84±1.03[3]	<0.001
FINAL MEAN (Level of PA)	2.25±0.88[2]	1.38±0.88[1.3]	2.51±0.87[2.4]	1.73±0.83[3]	<0.001

Source: The author (2019).
Key: Post = post-intervention with the games, Follow-up = 6-month follow-up after intervention
Note: Anova One Way.
[1]Significant difference with Group 01 (*Anova one-way pos hoc Bonferroni*).
[2]Significant difference with Group 02 (*Anova one-way pos hoc Bonferroni*).
[3]Significant difference with Group 03 (*Anova one-way pos hoc Bonferroni*).
[4]Significant difference with Group 04 (*Anova one-way pos hoc Bonferroni*).

To evaluate the variables, the participants were divided into four groups, as follows:

- Group 01 (post-exposure control): mean age 7.64±0.76;
- Group 02 (follow-up control): mean age 8.64±0.76;
- Group 03 (post-exposure case): mean age 8.29±0.63
- Group 04 (follow-up case): mean age 9.29±0.64,

As can be seen in Table 01, at follow-up, in mean 1 (PA practice during the week), there was a significant drop in the score of the case group compared to the post-intervention (-0.75; $p<0.001$). While the control group did not show significant. In mean 3 (PA frequency during the week), there was a reduction both in the case group (-0.89;

p<0.001) and in the control group (-1.32; p<0.001). The final mean (PA level) also decreased significantly in both groups, case (-0.78; p<0.001) and control (-0.87; p<0.001). Mean 2 (PA practice during free time) had no significant result in any group. In the final average (physical activity level) of the post-intervention, it was observed that the control group became more sedentary at the end of the study, while the case group had no significant results (Santos *et al.*, 2019). The follow-up showed that not only did the control group further reduce their physical activity level, but also, the case group had significant reduction. The groups went from the classification "sedentary" to "very sedentary". It can be seen that when the intervention stopped, the positive results obtained in the case group did not remain, and there was a significant worsening in the scores. And that, without intervention and as time went by, the control group became increasingly sedentary. It can be seen, therefore, that not doing an intervention worsens the sedentary rate among the children over time. Different results were found by Viggiano*et al.* (2018), who after a 20-week intervention with a board game, obtained an increase in PA frequency and duration in the case group compared to the control. And at follow-up, this result was sustained.

The methodological approaches of each game may have contributed to the results. Since this study used the same board game that went through several stages (Viggiano *et al.*, 2018), and the one used by Santos *et al.* (2019) applied a different game at each meeting, but always with the theme focused on obesity prevention, and used RL for its construction. Possibly, the problem is not with the game itself, since significant results were achieved post-intervention. But perhaps, in the short time of application (12 weeks), to enable the construction of knowledge about healthy habits in children that could last longer. Often it is not the failure of the initial intervention that causes results to not be sustained over time, but the lack of maintenance interventions (Mead *et al.*, 2017). However, more work needs to be done to identify what factors are needed to build these maintenance into studies to ensure that the benefits gained can be sustained over time (Mead *et al.*, 2017). With the analysis of these results, it can be seen that children, both in the case and control groups, do not meet the World Health Organization's recommendation for children and adolescents aged 5 to 17 years (World Health Organization, 2011). This recommendation states that to improve cardio respiratory and muscular fitness, bone health, and prevent cardiovascular and metabolic diseases, children should do at least 60 minutes of moderate to vigorous intensity PA daily. If children are sedentary, a progressive increase in activity is recommended. Therefore, it is extremely important that there are more and more activities that encourage a more active lifestyle and that discourage the use of prolonged time at screens (TV, videogames, computer), in order to reduce sedentarism and, consequently, the increase in childhood obesity (Dutra *et al.*, 2015). This further reinforces the importance of school-based interventions and their maintenance in the children's daily lives. With this in mind, and as children spend much of their day in schools; it is a good opportunity to encourage the practice of PA in this environment. This stimulus can happen through play, games, sports, physical education, planned exercises, among others (World Health Organization, 2011).

CONCLUSION

The effect obtained at the twelve-week post-intervention was not maintained at follow-up. Although the intervention found good results immediately after its application, it is necessary that frequent interventions be made in a continuous manner, aiming at the maintenance of good results. Thus, it proves the importance of follow-up studies, because they allow an analysis of what can be restructured for more expressive results to happen and be sustained over time. The limitation of this study is the sample loss that occurred six months after the intervention. Although this is something that commonly occurs in longitudinal studies, as the "n" was small, this may have impacted the analysis of the results. However, the results pointed to valuable clues. It is concluded, therefore, that LR games can be a tool that can be used in the prevention of childhood obesity. However, more studies are needed to identify the intensity of intervention needed to significantly impact children's weight and PA practice and its permanence over time.

REFERENCES

Brasil. (2010). *Pesquisa de orçamentos familiares 2008-2009: antropometria e estado nutricional de crianças, adolescentes e adultos no Brasil*. Rio de Janeiro: IBGE. http://189.28.128.100/nutricao/docs/evento/reuniao_nacional/2010/dia30/pesquisa_orcamento_familiar.pdf

Crocker, P. R., Bailey, D. A., Faulkner, R. A., Kowalski, K. C., & McGrath, R. (1997). Measuring general levels of physical activity: preliminary evidence for the Physical Activity Questionnaire for Older Children. *Medicine and Science in Sports and Exercise, 29*(10):1344-1349. https://doi.org/10.1097/00005768-199710000-00011

Dias, P. C., Henriques, P., Anjos, L. A., & Burlandy, L. (2017). Obesity and public policies: the Brazilian government's definitions and strategies. *Cadernos de Saúde Pública,* 33(7), : e00006016.https://doi.org/10.1590/0102-311X00006016

Dutra, G. F., Kaufmann, C. C., Pretto, A. D. B., & Albernaz, E. P. (2015). Television viewing habits and their influence on physical activity and childhood overweight. *Jornal de Pediatria, 91*(4), 346-351. https://doi.org/10.1016/j.jpedp.2015.04.007

Food insecurity and overweight in first grade students in the municipal school system in São Leopoldo, Rio Grande do Sul State, Brazil. *Cadernos de Saúde Pública, 31*(5), 1084-1094. https://doi.org/10.1590/0102-311X00055914

Llabre, M. M., Ard, J. D., Bennett, G., Brantley, P. J., Fiese, B., Gray, J., Nece, P., Polfuss, M., Raynor, H., West, D., Wilfley, D., Bufka, L., Halfond, R., & Kurtzman, H. (2018). *Clinical practice guideline for multicomponent behavioral treatment of obesity and overweight in children and adolescents: current state of the evidence and research needs.* Washington: APA. 2018.https://www.apa.org/about/offices/directorates/guidelines/obesity-clinical-practice-guideline.pdf

Machado, L. S., Moraes, R. M., Nunes, F. L. S., & Costa, R. M. E. M. (2011).Serious games based on virtual reality in medical education. *Revista Brasileira de Educação Médica, 35*(2), 254-262. https://doi.org/10.1590/S0100-55022011000200015

Mead, E., Brown, T., Rees, K., Azevedo, L. B., Whittaker, V., Jones, D., Olajide, J., Mainardi, G. M., Corpeleijn, E., O'Malley, E., Beardsmore, E., Al-Khudairy, L., Baur, L., Metzendorf, M.-I., Demaio, A., & Ells, L. J. (2017). Diet, physical activity and behavioural interventions for the treatment of overweight or obese children from the age of 6 to 11 years. *Cochrane Database of Systematic Reviews*, 6, CD012651 https://doi.org/10.1002/14651858.CD012651

NCD Risk Factor Collaboration. (2017). Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128·9 million children, adolescents, and adults. *Lancet*, *390*(10113), 2627–2642. https://doi.org/10.1016/S0140-6736(17)32129-3

Piaget, J. (1971). *A formação do símbolo na criança: imitação, jogo e sonho, imagem e representação*. 3a. ed. Rio de Janeiro: Zahar Editores.

Santos, A. Q. S., Sousa, A. Q., Lirani, L. S., & Ramos, R. A. (2019). The effects of logical reasoning games on sedentarism in children from 7 to 9 years of age in combatting obesity. *Revista Interdisciplinar de Estudos em Saúde, 9*(2), 131-147. https://doi.org/10.33362/ries.v8i2.1596

Silva, R. C. R., & Malina, R. M. (2000). Level of physical activity in adolescents from Niterói, Rio de Janeiro, Brazil. *Cadernos de Saúde Pública, 16*(4), 1091-1097. https://doi.org/10.1590/S0102-311X2000000400027

Vasconcellos, M. B., Anjos, L. A., & Vasconcellos, M. T. L. (2013). Nutritional status and screen time among public school students in Niterói, Rio de Janeiro State, Brazil. *Cadernos de Saúde*

Pública, 29(4), 713-722. https://doi.org/10.1590/S0102-311X2013000400009

Vicenzi, K., Henn, R. L., Weber, A. P., Backes, V., Paniz, V. M. V., Donatti, T., & Olinto, M. T. A. (2015).

Viggiano, E., Viggiano, A., Di Costanzo, A., Viggiano, A., Viggiano, A., Andreozzi, E., Romano, V., Vicidomini, C., Di Tuoro, D., Gargano, G., Incarnato, L., Fevola, C., Volta, P., Tolomeo, C., Scianni, G., Santangelo, C., Apicella, M., Battista, R., Raia, M., ("..."), & Amaro, S. (2018). Healthy lifestyle promotion in primary schools through the board game Kaledo: a pilot cluster randomized trial. *European Journal of Pediatrics, 177*(9), 1371-1375, 2018. https://doi.org/10.1007/s00431-018-3091-4

Viveiro, C., Brito, S., & Moleiro, P. (2016). Pediatric overweight and obesity: the Portuguese reality *Revista Portuguesa de Saúde Pública, 34*(1), 30-37. https://doi.org/10.1016/j.rpsp.2015.07.004

Wharton, S., Lau, D. C. W., Vallis, M., Sharma, A. M., Biertho, L., Campbell-Scherer, D., Adamo, K., Alberga, A., Bell, Rhonda, Boulé, N., Boyling, E., Brown, J., Calam, B., Clarke, C., Crowshoe, L., Divalentino, D., Forhan, M., Freedhoff, Y., Gagner, M.,Glazer, S., ("...") Wicklum, S. (2020). Obesity in adults: a clinical practice guideline. *CMAJ, 192*(31), E875-E891. https://doi.org/10.1503/cmaj.191707

World Health Organization. (2011). *Global recommendations on physical activity for health 5-17 years old*. Geneva: WHO. https://www.OMS.int/ncds/prevention/physical-activity/recommendations5_17years/en/

World Health Organization. (2016). *Report of the Commission on Ending Childhood Obesity*. Geneva: WHO. https://www.oms.int/end-childhood-obesity/publications/echo-report/en/

World Health Organization. (2018). *Taking Action on Childhood Obesity*. Geneva: WHO. http://apps.OMS.int/iris/bitstream/handle/10665/274792/OMS-NMH-PND-ECHO-18.1-eng.pdf?ua=1

****