Associations between self-reported fitness and self-rated health, life-satisfaction and health-related quality of life among adolescents

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ABSTRACT

Background/objective: In recent years, there has been an increased interest in the associations between physical fitness (PF) and psychosocial aspects of health. This study aimed to analyse the associations between self-reported PF and self-rated health (SRH), life-satisfaction (LS), and quality of life (QoL).
Methods: This is a cross-sectional study of 3554 adolescents (1652 boys), aged 13—18, from the HBSC Portuguese survey. PF, health, LS and OoL were self-rated.
Results: SRH, LS, and health-related OoL (HRQoL) were significantly and positively correlated with all PF components. From regression model, overall fitness was significantly related with SRH (boys: $\beta = 0.18$, $p < 0.001$; girls: $\beta = 0.16$, $p < 0.001$), LS (boys: $\beta = 0.36$, $p < 0.001$; girls: $\beta = 0.43$, $p < 0.001$), and HRQoL (boys: $\beta = 2.26$, $p < 0.001$; girls: $\beta = 2.54$, $p < 0.001$). Cardiorespiratory fitness was also positively and significantly related with SRH (boys: $\beta = 0.17$, $p < 0.001$; girls: $\beta = 0.11$, $p < 0.001$), LS (boys: $\beta = 0.13$, $p < 0.05$; girls: $\beta = 0.31$, $p < 0.001$), and HRQoL (boys: $\beta = 1.74$, $p < 0.001$; girls: $\beta = 1.57$, $p < 0.001$).
Conclusion: These findings suggest that perceived PF is associated with a better SRH, LS, and perceived HRQoL. A few implications regarding public policies were highlighted.

1. Introduction

Physical fitness (PF) is associated with health benefits in young people[1] and it is considered an important health status marker that predicts cardiovascular disease and mortality.[2—4] However, aside from the effects on biological parameters, the consideration of associations with psychosocial aspects of health has gained interest in recent years. Constructs such as health perception, life satisfaction (LS), and quality of life (QoL) are included in a broader domain as they pertain to positive health.[5,6]

Beyond the objective measures, perceptions that one can have about their own health and life may add value to further decisions regarding lifestyle behaviour, such as physical activity and nutrition.[5] For instance, self-rated health (SRH) was suggested as a health indicator among adolescents[7] since SRH appears to be a function of adolescents' overall sense of functioning[8] and adolescent's health-related QoL (HRQoL).[9]

Previously, it was suggested that an accurate self-reported measure of fitness could be used to identify low-fit adolescents for targeted physical activity and obesity prevention interventions.[10] However, to the best of our knowledge there is no study addressing the use of self-reported measures of PF with positive health variables such as SRH, LS and QoL. We hypothesized that those who reported higher PF are those who not only perceived better health, but also reported better LS as well as QL. Therefore this study aimed to analyse the associations between self-reported fitness and SRH, LS, and HRQoL among a representative sample of Portuguese adolescents of both sexes.

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2. Methods

2.1. Participants and procedures

This study is based on data from Health Behaviour in School-Aged Children (HBSC) Portuguese survey.[11] HBSC Portugal is one of 43 countries and regions that make up the HBSC Network.[12] The HBSC is a school-based survey of adolescents' health behaviours, carried out every 4 years. Collected data is used for policy and by decision makers to gain new insight into young people's health and well-being, to understand the social and psychological determinants of health, and to incorporate policies to improve young people's lives. The Portuguese HBSC 2014 survey included a representative sample of 6026 students (2872 boys) from 125 public schools, with weighted distributions reflecting the distribution of Portuguese students in grades 6, 8, and 10. For the present study only students from grades 8 and 10 were selected, because they had better awareness of their physical fitness. Students from grade 6 were excluded (n = 2157). In addition, 71 students did not report weight and/or height, 95 did not report their health perception, 149 did not self-report their fitness, and were removed from the sample. The result was a final sample size of 3554 adolescents (1652 boys, 1902 girls), aged 13-18 years (14.75 ± 1.18).

The administration of the surveys was conducted according to standard guidelines from the HBSC survey protocol[13]; the survey was carried out online with the assistance of trained teachers (experts in informatics) during class time. Questionnaires were administered between January and February in 2014. Participation was voluntary and questionnaires were answered anonymously. The questionnaire application took approximately 60 minute. Research was in accordance with the Ethical Committee of OPorto Medical School, and the National Data Protection System, and had the approval of the Ministry of Education. All school administrators gave their consent, legal guardians gave written informed consent, and students provided assent.

2.2. Measures

Actual weight (to the nearest 0.5 kg) and height (to the nearest 0.5 cm) were also self-reported. Body mass index (BMI) was then calculated based on mass (kilograms) divided by height (square metres). Adolescents were classified into normal weight, overweight, and obese categories according to age- and sex-specific cut-off points proposed by the International Obesity Task Force.[14]

The perception of adolescents about their health was collected through the question, "You would say your health is … ?" Answers were given, through selection, on a 4-point scale (poor, fair, good, and excellent).[15]

To identify the opinions about LS, the Cantril Self-Anchoring Striving Scale[16] was used. Adolescents indicated where they stood on a 10-point ladder, with zero being the 'worst possible life' and ten being the 'best possible life'.

HRQoL was assessed by KIDSCREEN-10. It contains 10 items regarding family life, peers, and school life. The items result in one global score. This one-dimensional measure represents a global score adequate for use in large (epidemiological) surveys, as described elsewhere.[17,18]

PF was measured using the international fitness scale (IFIS), which is a self-administered scale to assess PF. The IFIS is composed of 5 questions about the perceived adolescents' overall fitness, cardiorespiratory fitness (CRF), muscular fitness, speed and agility, and flexibility in comparison with their friends' PF. Each response was given on a 5-point scale (very poor, poor, average, good and very good). It has been shown that the IFIS is reliable in

adolescents,[10] and for the present data the reliability was good, with an alpha of 0.86.

2.3. Statistical analyses

Descriptive statistics (means, standard deviation and percentages) were calculated for the entire sample, and according to sex. Ordinal variables were treated as continuous.[19] All variables were tested for normality prior to any analyses. The normality of the variables were tested by Kolmogorov-Smirnov test, and homogeneity of variance were tested by Levene's test. Chi square and Student t-test were used to assess the differences between sexes in BMI, SRH, LS, HRQoL, and PF components. Pearson product-moment correlation coefficient was used to examine the relationship between SRH, LS and HRQoL with the different components of PF. To analyse the effect of the PF components on SRH, LS, and HRQoL several linear regression analyses were conducted. Assumptions of linearity were verified and multicollinearity was checked using the variance inflation factor (VIF). VIF values were less than 5 in all analysis, indicating that there was no multicollinearity. All analyses were adjusted for age and BMI zscore, and were run separately for boys and girls because it was observed that there were significant differences between sexes on all variables under study. All statistical analyses were performed using IBM SPSS Statistics 22.0. The level of significance was set at 0.05.

3. Results

Table 1 shows the sample characteristics, and results of BMI zscore, BMI category, SRH, LS, HRQoL, as well as PF components. The proportion of overweight and obese boys was significantly higher in boys than girls ($\chi^2(2) = 8.542$, $p = 0.014$). Moreover, boys presented a significantly higher value in SRH (t (3552) = 13.653, $p < 0.001$), LS (t (3552) = 7.167, $p < 0.001$), and HRQoL (t (3552) = 13.310, $p < 0.001$). Likewise, boys reported better overall PF (t (3552) = 16.897, $p < 0.001$), CRF (t (3552 = 18.473, $p < 0.001$), muscular fitness (t (3552) = 20.289, $p < 0.001$), speed-agility (t (3552) = 20.271, $p < 0.001$), and flexibility (t (3552) = 7.167, $p < 0.001$) than girls did.

The correlation between SRH, LS, HRQoL, with PF is shown in Table 2. The data showed that all variables were significant and positively correlated with PF components, although some sex differences were seen. For boys, the strongest correlations were between overall fitness and SRH (r = 0.43, $p < 0.001$), as well as between CRF and SRH (r = 0.42, $p < 0.001$). For girls the data showed that the strongest correlations were found between overall fitness and HRQoL (r = 0.43, $p < 0.001$), as well as SRH (r = 0.34, $p < 0.001$).

Results of the multivariate linear regression for the relationship between physical fitness components and SRH, LS, and HRQoL are shown in Table 3. For boys and girls, overall fitness was significantly related to SRH (boys: β = 0.18, $p < 0.001$; girls: β = 0.16, $p < 0.001$), LS (boys: β = 0.36, $p < 0.001$; girls: β = 0.43, $p < 0.001$), and HRQoL (boys: β = 2.26, $p < 0.001$; girls: β = 2.54, $p < 0.001$). CRF was also positively and significantly related to SRH (boys: β = 0.17, $p < 0.001$; girls: β = 0.11, $p < 0.001$), LS (boys: β = 0.13, $p < 0.05$; girls: β = 0.31, $p < 0.001$), and HRQoL (boys: β = 1.74, $p < 0.001$; girls: β = 1.57, $p < 0.001$). Is it clear that the strongest relationships were between overall fitness, CRF, and HRQoL.

4. Discussion

Based on a representative sample of Portuguese adolescents, this study aimed to examine the associations between PF perceptions (self-reported) and SRH, LS, and HQoL. To the best of our

Table 1
Sample characteristics.

	Total (n = 3554)	Boys (n = 1652)	Girls (n = 1902)	*p*
	n (%) or M±SD	n (%) or M±SD	n (%) or M±SD	
Age	14.75 ± 1.18	14.73 ± 1.17	14.77 ± 1.18	0.349
School grade				0.002
Grade 8	2130 (59.93)	1036 (62.71)	1094 (57.52)	
Grade 10	1424 (40.07)	616 (37.29)	808 (42.48)	
BMI zscore	0.00 ± 0.98	0.00 ± 0.97	−0.01 ± 0.98	0.650
BMI category				0.014
Normal weight	2954 (83.12)	1350 (81.72)	1604 (84.33)	
Overweight	505 (14.21)	245 (14.83)	260 (13.67)	
Obese	95 (2.67)	57 (3.45)	38 (2.00)	
Self-rated health	3.18 ± 0.69	3.34 ± 0.67	3.03 ± 0.68	<0.001
Life satisfaction	7.17 ± 1.89	7.41 ± 1.82	6.96 ± 1.93	<0.001
HRQoL	50.00 ± 10.00	52.34 ± 958	47.97 ± 9.91	<0.001
Self-reported fitness				
Overall fitness	3.68 ± 0.90	3.95 ± 0.88	3.45 ± 0.85	
Cardiorespiratory fitness	3.56 ± 0.98	3.87 ± 0.93	3.29 ± 0.93	<0.001
Muscular fitness	3.63 ± 0.89	3.94 ± 0.86	3.36 ± 0.83	<0.001
Speed—agility	3.63 ± 0.93	3.95 ± 0.88	3.35 ± 0.89	<0.001
Flexibility	3.45 ± 0.98	3.52 ± 0.99	3.39 ± 0.97	<0.001

BMI, body mass index.
Differences between sexes were tested by Chi-square and Independent Sample T Test.

Table 2
Correlations between self-rated health, life satisfaction, health-related quality of life, and self-reported fitness components.

Boys	Boys			Girls		
	Self-rated health	Life satisfaction	HRQoL	Self-rated health	Life satisfaction	HRQoL
Overall fitness	0.43	0.23	0.39	0.34	0.25	0.35
Cardiorespiratory fitness	0.42	0.20	0.37	0.31	0.23	0.32
Muscular fitness	0.26	0.19	0.28	0.18	0.11	0.22
Speed—agility	0.34	0.15	0.32	0.26	0.15	0.27
Flexibility	0.26	0.13	0.23	0.20	0.13	0.18

Correlation tested by Pearson product-moment correlation coefficient.
All variables were significantly correlated at *p* < 0.001.

Table 3
Multivariate linear regression model predicting self-rated health, life satisfaction, and quality of life by physical fitness components.

Self-reported fitness	Self-rated health		Life satisfaction		HRQoL	
	Boys β (95% CI)	Girls β (95% CI)	Boys β (95% CI)	Girls β (95% CI)	Boys β (95% CI)	Girls β (95% CI)
Overall fitness	0.18 (0.13 to 0.24)***	0.16 (0.11 to 0.20)***	0.36 (0.20 to 0.52)***	0.43 (0.29 to 0.58)***	2.26 (1.47 to 3.06)***	2.54 (1.84 to 3.25)***
Cardiorespiratory fitness	0.17 (0.12 to 0.21)***	0.11 (0.07 to 0.15)***	0.13 (0.00 to 0.27)*	0.31 (0.19 to 0.43)***	1.74 (1.07 to 2.40)***	1.57 (0.98 to 2.16)***
Muscular fitness	0.00 (−0.05 to 0.04)	−0.01 (−0.06 to 0.03)	0.11 (−0.03 to 0.24)	−0.10 (−0.23 to 0.03)	0.31 (−0.36 to 0.98)	0.30 (−0.35 to 0.95)
Speed—agility	0.00 (−0.06 to 0.05)	0.01 (−0.04 to 0.06)	−0.07 (−0.22 to 0.09)	−0.11 (−0.25 to 0.03)	0.69 (−0.06 to 1.44)	0.16 (−0.52 to 0.84)
Flexibility	0.02 (−0.01 to 0.06)	0.03 (−0.01 to 0.06)	0.05 (−0.06 to 0.16)	0.05 (−0.06 to 0.15)	0.16 (−0.37 to 0.68)	−0.10 (−0.60 to 0.40)

Analysis was adjusted for age and body mass index zscore.
p < 0.05, ***p* < 0.01, *p* < 0.001.

knowledge, this is the first study to examine these variables among Portuguese adolescents. Although objective measures may give deeper information regarding one's fitness status, perceptions of their PF condition are reliable to assess PF.[10] Giving information related to overall quality of life, and positive or subjective well-being, is central to healthy youth development (Forste and Moore, 2012).

The most important finding is that, regardless of sex, perception of overall fitness and perceived CRF were significantly and positively associated with adolescents' perception of their health, LS, and HRQoL.

Although the fitness measures utilized were self-reported, the findings are in line with other studies showing an association between PF and CRF with good SRH.[20,21] In a similar population, it was found that unfit adolescents were more likely to self-rated negative

health compared to their fit peers.[22] The same authors also found that CRF mediates the association between BMI and SRH. Thus, because of its association with a better metabolic profile and good SRH, CRF may improve psychological wellbeing, making it of great value to public health, and an important objective for research. As CRF is positively and strongly associated with physical activity (PA),[23] intervention programs to enhance PA levels of the youth population may benefit their CRF and consequently improve their health perception and wellbeing.

The relationship between self-reported PF and LS and HRQoL is less studied, which hampers further comparisons. Nonetheless, overall PF and CRF were positively associated with LS,[5,24] while it has been suggested that perceived fitness is a more important mediator for perceived health than psychological state.[25] Given the fact that overall fitness and CFR were related to HRQoL, our data

emphasises the importance of perceived fitness; particularly the perceived CRF in adolescents' wellbeing. Despite other dimensions of fitness, such as muscular fitness which has also been found to be closely related to HRQoL,[26] our outcomes only showed a correlation between muscular fitness and HRQoL that was no longer significant when analyses were adjusted for age and BMI, regardless of sex.

Considering that PF is the most important health status markers that predicts cardiovascular disease and mortality[2] and that self-report PF is reliable for estimating fitness in adolescent populations, self-reported PF can be used in large surveys as an indicator of health, because can be completed within 1-5 minute. Because CRF is positively related with SRH, LF, and HRQoL, it means that CRF may improve well-being, making it of great value to public health and an important objective for future research.

Some limitations and strengths of this study should be considered. First, its cross-sectional nature does not permit inferences about causality. It is plausible that increased CRF improves SRH, LS, and HRQoL, but it is also likely that adolescents with optimal SRH, LS, and HRQoL have tended to improve their overall fitness and CRF by being active. Second, data were self-reported. This means that it is possible that some adolescents may have misreported, either intentionally or inadvertently, on any question asked. Nonetheless, intentional misreporting was minimized by the fact that adolescents completed the questionnaires anonymously, and that the HBSC questionnaire is considered reliable and valid.[12,13] Also, self-reported PF by IFIS is a reliable method to be used with adolescents.[10] Furthermore, the analysis were not adjusted for pubertal stage of adolescents. Although analyses were adjusted for age, adolescents of the same chronological age might show different sexual maturation stages, and those who are in more advanced biological maturation stages tend to have different fitness characteristics from the others.[27]

The study's strengths are: 1) the use of a representative sample of Portuguese adolescents, allowing for the generalization of results for the entire adolescent population, 2) the simple structure and content of the IFIS, which enables it to be completed within 5 minutes and makes it appropriate for epidemiologic studies.

5. Conclusion

The present study suggests a link between perceptions of overall fitness and CRF with positive SRH, LF, and HRQoL, suggesting that improving CRF and overall fitness could exert a favourable effect on positive health perceptions which are health indicators. Therefore, public health promotion activities to foster physical activity and CRF may benefit adolescents by improving their health perception, which is linked to overall health and wellbeing.

Conflicts of interest

The authors have no conflicts of interest relevant to this article.

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References

1. Janssen I, Leblanc AG. Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *Int J Behav Nutr Phys Act.* 2010;7:40. http://dx.doi.org/10.1186/1479-5868-7-40.

2. Ortega FB, Ruiz JR, Castillo MJ, et al. Physical fitness in childhood and adolescence: a powerful marker of health. *Int J Obes Lond.* 2008;32:1–11. http://dx.doi.org/10.1038/sj.ijo.0803774.

3. Moreira C, Santos R, de Farias Junior JC, et al. Metabolic risk factors, physical activity and physical fitness in Azorean adolescents: a cross-sectional study. *BMC Public Health.* 2011;11:214. http://dx.doi.org/10.1186/1471-2458-11-214.

4. Silva P, Lott R, Mota J, et al. Direct and indirect effects of social support on youth physical activity behavior. *Pediatr Exerc Sci.* 2014;26:86–94. http://dx.doi.org/10.1123/pes.2012-0207.

5. Grao-Cruces A, Fernandez-Martinez A, Nuviala A. Association of fitness with life satisfaction, health risk behaviors, and adherence to the Mediterranean diet in Spanish adolescents. *J Strength Cond Res.* 2014;28:2164–2172. http://dx.doi.org/10.1519/JSC.0000000000000363.

6. Riiser K, Ommundsen Y, Smastuen MC, et al. The relationship between fitness and health-related quality of life and the mediating role of self-determined motivation in overweight adolescents. *Scand J Public Health.* 2014;42:766–772. http://dx.doi.org/10.1177/1403494814550517.

7. Wade TJ, Pevalin DJ, Vingilis E. Revisiting student self-rated physical health. *J Adolesc.* 2000;23:785–791. http://dx.doi.org/10.1006/jado.2000.0359.

8. Zullig KJ, Valois RF, Huebner ES, et al. Adolescent health-related quality of life and perceived satisfaction with life. *Qual Life Res.* 2005;14:1573–1584.

9. Garcia-Rubio J, Olivares PR, Lopez-Legarrea P, et al. Association between health related quality of life, bodyweight status (BMI) and physical activity and fitness levels in Chilean adolescents. *Nutr Hosp.* 2015;32:1695–1702. http://dx.doi.org/10.3305/nh.2015.32.4.9182.

10. Ortega FB, Ruiz JR, Espana-Romero V, et al. The International Fitness Scale (IFIS): usefulness of self-reported fitness in youth. *Int J Epidemiol.* 2011;40:701–711. http://dx.doi.org/10.1093/ije/dyr039.

11. Matos MG, Simões C, Camacho I, et al. *Equipa Aventura Social. The Health of Portuguese Adolescents in Times of Recession. HBSC 2014 National Data.* Lisboa: Centro de Malária e Outras Doenças Tropicais/IHMT/UNL, FMH/Universidade de Lisboa; 2015.

12. WHO. *Social Determinants of Health and Well-being Among Young People : Health Behaviour in School-aged Children (HBSC) Study : International Report from the 2009/2010 Survey.* Copenhagen: World Health Organization; 2012.

13. Roberts C, Freeman J, Samdal O, et al. The Health Behaviour in School-aged Children (HBSC) study: methodological developments and current tensions. *Int J Public Health.* 2009;54(suppl 2):140–150. http://dx.doi.org/10.1007/s00038-009-5405-9.

14. Cole TJ, Bellizzi MC, Flegal KM, et al. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ.* 2000;320:1240–1243. http://dx.doi.org/10.1136/bmj.320.7244.1240.

15. Idler EL, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. *J Health Soc Behav.* 1997;38:21–37.

16. Cantril H. *The Pattern of Human Concerns.* New Brunswick, NJ: Rutgers University Press; 1965.

17. Ravens-Sieberer U, Erhart M, Rajmil L, et al. Reliability, construct and criterion validity of the KIDSCREEN-10 score: a short measure for children and adolescents' well-being and health-related quality of life. *Qual Life Res.* 2010;19:1487–1500. http://dx.doi.org/10.1007/s11136-010-9706-5.

18. Matos MG, Gaspar T, Simoes C. Health-related quality of life in Portuguese children and adolescents. *Psicol Reflex Crit.* 2012;25:230–237. http://dx.doi.org/10.1590/S0102-79722012000200004.

19. Field A. *Discovering Statistics Using IBM SPSS Statistics.* London: Sage; 2013.

20. Eriksen L, Curtis T, Gronbaek M, et al. The association between physical activity, cardiorespiratory fitness and self-rated health. *Prev Med.* 2013;57:900–902. http://dx.doi.org/10.1016/j.ypmed.2013.09.024.

21. Kantomaa MT, Tammelin T, Ebeling H, et al. High levels of physical activity and cardiorespiratory fitness are associated with good self-rated health in adolescents. *J Phys Act Health.* 2015;12:266–272. http://dx.doi.org/10.1123/jpah.2013-0062.

22. Mota J, Santos RM, Silva P, et al. Associations between self-rated health with cardiorespiratory fitness and obesity status among adolescent girls. *J Phys Act Health.* 2012;9:378–381.

23. Marques A, Santos R, Ekelund U, et al. Association between physical activity, sedentary time, and healthy fitness in youth. *Med Sci Sports Exerc.* 2015;47:575–580. http://dx.doi.org/10.1249/MSS.0000000000000426.

24. Padilla-Moledo C, Castro-Pinero J, Ortega FB, et al. Positive health, cardiorespiratory fitness and fatness in children and adolescents. *Eur J Public Health.* 2012;22:52–56. http://dx.doi.org/10.1093/eurpub/ckr005.

25. Pastor Y, Balaguer I, Pons D, et al. Testing direct and indirect effects of sports participation on perceived health in Spanish adolescents between 15 and 18 years of age. *J Adolesc.* 2003;26:717–730. http://dx.doi.org/10.1016/j.adolescence.2003.07.001.

26. Morales PF, Sanchez-Lopez M, Moya-Martinez P, et al. Health-related quality of life, obesity, and fitness in schoolchildren: the Cuenca study. *Qual Life Res.* 2013;22:1515–1523. http://dx.doi.org/10.1007/s11136-012-0282-8.

27. Ortega FB, Ruiz JR, Castillo MJ, et al. Health-related physical fitness according to chronological and biological age in adolescents. The AVENA study. *J Sports Med Phys Fitness.* 2008;48:371–379.