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## Social support provided by the best friend and vigorous-intensity physical activity in the relationship between perceived benefits and global self-worth of adolescents<sup>☆</sup>

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### ABSTRACT

The present study explored the associations between perceived benefits of physical activity, social support provided by the best friend, vigorous-intensity physical activity, and global self-worth in male and female adolescents. In total, 462 adolescents (female = 259), aged between 12–18 years ( $M = 16.16$ ,  $SD = 1.60$ ) from different middle and secondary schools participated in this study. Confirmatory factor analysis and structural equation modelling analysis were performed to evaluate the proposed associations. Self-reported instruments were used to collect both vigorous-intensity physical activity and psychosocial variables under analysis. The hypothesized model provided acceptable fit to the data in all samples under analysis. Significant associations were found between variables, namely: Perceived benefits displayed a significant association with social support provided by the best friend; social support provided by the best friend was significantly associated with vigorous-intensity physical activity; and, vigorous-intensity physical activity displayed a significant association with global self-worth. The indirect regression paths showed the mediation role of social support provided by the best friend and vigorous-intensity physical activity in the interaction between perceived benefits and global self-worth. These associations were displayed in both male and female adolescents. Perceived benefits of physical activity, social support provided by the best friend and vigorous-intensity physical activity appears to be important antecedents of global self-worth in male and female adolescents. It seems that the social support provided by the best friend and vigorous-intensity physical activity play a mediation role in the association between perceived benefits of physical activity and global self-worth.

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## El apoyo proporcionado por mejor amigo y actividad física de alta intensidad en relación con los beneficios y la autoestima global en adolescentes

### RESUMEN

El presente estudio analiza las relaciones entre los beneficios percibidos de la actividad física, el apoyo social proporcionado por el/la mejor amigo/a, la actividad física de alta intensidad y la autoestima global en adolescentes de ambos sexos. Participan en el estudio un total de 462 adolescentes (mujeres = 259), con edades comprendidas entre 12 y 18 años ( $M = 16.16$ ,  $DT = 1.60$ ), de distintos colegios de educación media y secundaria. Se han llevado a cabo análisis factoriales confirmatorios y análisis de ecuaciones estructurales para obtener relaciones entre las variables. Se han utilizado instrumentos de autoinforme para recopilar información sobre la actividad física de alta intensidad, así como de las variables psicosociales analizadas. El modelo hipotético propuesto muestra un ajuste aceptable a los datos en todas las muestras bajo análisis. Se encuentran relaciones significativas entre las

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variables, a saber: los beneficios percibidos muestran una relación significativa con el apoyo social proporcionado por el mejor amigo; el apoyo social proporcionado por el mejor amigo se asocia de forma significativa con la actividad física de alta intensidad; y la actividad física de alta intensidad muestra una relación significativa con la autoestima global. Las trayectorias de regresión indirecta muestran el rol mediador del apoyo social proporcionado por el mejor amigo y la actividad física de alta intensidad en la relación entre los beneficios percibidos y la autoestima global. Estas asociaciones se muestran tanto en adolescentes de sexo masculino como femenino. Los beneficios percibidos de la actividad física, el apoyo social proporcionado por el mejor amigo y la actividad física de alta intensidad parecen ser importantes antecedentes de la autoestima global en adolescentes. Además, parece que el apoyo social proporcionado por el mejor amigo y la actividad física de alta intensidad juegan un papel mediador en la asociación entre los beneficios percibidos de la actividad física y la autoestima global.

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## Introduction

According to the [World Health Organization \(2017\)](#), mental health problems seem to impact approximately 300 million people worldwide and across adolescents, the prevalence of this issue seems to be growing ([Kandola et al., 2020](#)). As a mean to understand what mental health is, several studies have been conducted ([Gallego Zumaquero et al., 2015](#); [Goodwin, 2003](#); [Hansen et al., 2001](#); [Haugen et al., 2011](#); [Martín-Martínez et al., 2015](#)) studying several psychological and emotional factors such as anxiety, depression, anger, tension, reaction to stress, self-efficacy, self-esteem, and global self-worth (GSW). While previously mentioned determinants seem to be related to mental health, GSW stands out as one of the most important aspects of mental health, since it is an essential factor related to psychological health and growth, specifically in children and adolescents ([Christiansen et al., 2018](#); [Tolman et al., 2006](#)).

While a large amount of research has focused on the relationship between physical activity and mental health ([Biddle & Asare, 2011](#)), there are still some gaps in the literature related to the association between vigorous-intensity physical activity and global self-worth, outlined as an important indicator of mental health ([Erdvik et al., 2020](#)), and how the social support provided by the best friend and specific benefits of engaging in physical activity can be associated with global self-worth. While [Horn \(2019\)](#) has explored the association between benefits and barriers and physical activity, other determinants such as the social support from the best friend, and a critical aspect of mental health such as GSW are still under-researched. Some studies have examined the relationship between physical activity and GSW ([Ekeland et al., 2005](#); [Liu et al., 2015](#)), but research exploring the pathways through which perceived benefits of physical activity, physical activity intensity, and social support translate into GSW is limited. Our primary goal in this study is to explore the possibility that the social support provided by the best friend and vigorous-intensity physical activity have, in part, a mediation role between the perceived benefits of engaging in physical activity and GSW. The social support provided by the best friend matters since there is evidence that higher levels of perceived social support provided by significant others (such as the best friend) are associated with higher levels of physical activity ([Lopes et al., 2015](#)). In addition, engaging in sufficient physical activity is essential for mental health ([Biddle & Asare, 2011](#)), and thus, the social support provided by the best friend and regular physical activity seems to be of utmost importance for increasing GSW. We hypothesize that the social support provided by the best friend translates into high intensities of physical activity, explaining consequently how male and female adolescents feel about themselves.

### *Conceptualization of general self-worth and correlates*

GSW is conceptualized as the average general satisfaction with oneself across several personal domains (e.g., physical, social, and

intellectual). Researchers have frequently adopted terms as self-esteem or self-concept as a means to define individuals' sense of own worth ([Marsh et al., 2012](#)). Although GSW seems to be significantly related to psychological development in adolescents ([Liu et al., 2015](#)), it appears that GSW can decline during the lifespan, specifically during the early stages of adolescence ([Robins & Trzesniewski, 2005](#)). In this regard, researchers have argued the need to better understand the determinants of GSW, and how professionals can intervene in promoting mental health ([Erdvik et al., 2020](#)).

Existing studies have provided some crucial insights related to the factors associated with GSW. For example, [Haugen et al. \(2011\)](#) have found consistent relationship between physical activity and GSW, arguing the importance of promoting regular participation as a means to increase mental health. Consistent with this assumption, an increase in physical activity has also been associated with lower symptoms of depression and anxiety among both adults and adolescents ([Warburton & Bredin, 2017](#)). The processes explaining this association include the development of positive self-worth, self-esteem, social support systems, and self-efficacy as well as physiological mechanisms ([Reddon et al., 2017](#)). However, the intensity of how physical activity is practiced and how it translated into ones' self-worth has received little attention in the literature ([Howie et al., 2018](#)). Important determinants like perceived benefits of physical activity, social support provided by important others such as family members and peers, could have their significant association with physical activity as described by [Haugen et al. \(2011\)](#), consequently explaining the levels of self-worth.

The social support provided by significant others is a construct that has been included in different theoretical frameworks (e.g., Social Cognitive theory; ([Bandura, 1986, 2004](#))). It is described as an action or cluster of actions that help a person adopt or maintain a specific practice, which can occur in different ways: (a) instrumental or direct support (e.g., sharing sports equipment, facilitating transport to local practices, and engaging in physical activities together); (b) psychological/emotional support (e.g., personal incentives, motivation, and encouragement for practices); and (c) informative support (e.g., acts of orientation, counseling, and talks about the importance and appropriate ways of engaging in physical activity). This mechanism suggests that the role of social support may partly explain the enhancement of self-efficacy, which in turn could influence the willingness to engage and maintain physical activity ([Sheridan et al., 2014](#)). Thus, while adolescents tend to spend a lot of time with their friends and best friends, sharing common contextual environments (e.g., school or sports clubs), it is theoretically expected that friends who engage in physical activity will endorse this behavior with others within their circle of friends. In fact, there seems to be a tendency for adolescents to adopt behaviors similar to those of their friends as advocated by the social cognitive theory ([Bandura, 1986, 2004](#)), meaning that adolescents who practice physical activity could provide social support for other friends to adopt this behavior in their daily lives.

Although some studies have examined the association between physical activity and GSW (Ekeland et al., 2005; Liu et al., 2015), the direction is somewhat unclear. Davison et al. (2007) stated that GSW is associated with improved physical activity, while others (e.g., Schmalz et al., 2007) evidenced that increased levels of physical activity are a significant determinant of GSW. Recently, a study developed by Reddon et al. (2017) showed that increased physical activity was associated with greater GSW, explaining that the psychological and physical process of physical exercise could have its basis on explaining why and how someone feels about the self. That is, greater feelings of positive evaluations of the self could be contingent on the type and quality of physical exercise (Reddon et al., 2017). Considering these statements, this study intends to explore the association of physical activity and GSW, considering vigorous-intensity activity as the determinant of how adolescents feel about themselves.

Looking at what promotes physical activity, specifically vigorous-intensity activity, defined as an activity done with a large amount of effort, resulting in a substantially higher heart rate and energy expenditure, some studies (e.g., Haugen et al., 2011; Liu et al., 2015) have highlighted the social support provided by significant others as an important determinant. This association is somewhat expected since adolescents and young adults are influenced by others to engage (or not) in physical activity. This holds since competitive sports and games (e.g., swimming, football) and physical education grades are influenced by significant others (Monteiro et al., 2018; Rodrigues et al., 2020). That is, favorable attitudes towards vigorous physical activity provided by peers and friends can be a determinant for the actual action on the behavior. Hence, understanding the association between social support provided by significant others, vigorous-intensity physical activity, and GSW is of utmost interest (Lopes et al., 2015). Recently, Kandola et al. (2019) have called for more studies examining the processes in which the cognitive processes determine GSW. Literature has identified an extensive variety of psychosocial variables that may be associated with both physical activity and self-worth, including the perception of physical competence, social support, and perceived benefits towards physical activity (Howie et al., 2018; Kandola et al., 2019; King et al., 2008). All in all, it is consensual that perceived benefits of physical activity and social support are two essential determinants, both associated with adolescents' engagement in physical activity (Roth et al., 2019) and feelings of self-worth (Kandola et al., 2019; King et al., 2008).

Perceived benefits of physical activity refer to the perception of the positive outcomes that are caused by the constant engagement in physical exercise. Outcomes such as higher mood, better sleep, less distress, and greater experience of mental health are some of the perceived benefits associated with physical exercise (Warburton & Bredin, 2017). Thus, perceived benefits of physical activity and the socio-cultural context (i.e., the interactions with parents, friends, and peers) are seen as important variables for youth involvement in physical activity, which is ultimately related to higher levels of self-worth (Kandola et al., 2019). Related to social support, literature has highlighted that the social support provided by friends, especially from the best friend, could have an important role in physical activity participation and mental health, including self-esteem and physical self-worth (Lopes et al., 2015). For instance, a study developed by Stearns et al. (2019) found that female best friends exhibited more similar levels of overall physical activity than non-friends, and males reciprocated with best friends had more levels of physical activity compared to unreciprocated friendships. All in all, it seems that the social support provided by significant others, in this study from the best friend, can have a positive and significant association with vigorous-intensity physical activity.

While previous studies have revealed consistent results showing that overall physical activity has a positive effect on self-esteem and self-worth in adolescents (Kandola et al., 2019; Liu et al., 2015; Schmalz et al., 2007), little is known about the specific intensity in which physical activity is engaged and how it is associated with GSW. In fact, most of the previous literature has focused on the effect of the total amount of physical activity on GSW (e.g., Haugen et al., 2011; Sani et al., 2016) rather on the specific type practiced by adolescents which are normally characterized by vigorous-intensity physical activity (e.g., running, competitive sports, physical education activities). In this study, we intend to focus on vigorous-intensity physical activity, since it the most common intensity in which adolescents are involved (Liu et al., 2015), and previous studies have shown vigorous-intensity physical activity to display greater association compared to moderate and low-intensity physical activity with mental health indicators (Reddon et al., 2017).

In a recent review study conducted by Owens et al. (2016), analyzing the effect of vigorous-intensity physical activity on well-being in youth, results showed that vigorous-intensity physical activity displayed the greatest effect on well-being compared to moderate or low-intensity physical activity. Additionally, in a study conducted by Parfitt et al. (2009), only vigorous-intensity physical activity had a positive association with self-worth, while low-intensity physical activity had a positive association with anxiety, depression, and a negative correlation with self-worth. Although the study performed by Parfitt et al. (2009) was conducted using a sample of 9–10 year-old children, they provided preliminary evidence of the crucial aspect of physical activity intensity on self-worth.

All in all, it seems that there are few studies that have examined the associations between perceived benefits, social support provided by the best friend, vigorous-intensity physical activity and global self-worth of adolescents. Specifically, the possible mediation role of the social support provided by the best friend and vigorous-intensity physical activity in the relationship between perceived benefits and GSW is still unknown. Additionally, little is known about the possible differences between genders considering previously mentioned associations (Lopes et al., 2015). Existing studies have analyzed the outcomes of perceived benefits of physical activity and their relationship with social support provided by the best friend and physical activity (Howie et al., 2018; Lopes et al., 2015) showing promising results on the positive and significant association between these variables. Other studies have explored the associations between social support provided by the best friend and physical activity (Stearns et al., 2019) and the relationship between physical activity and GSW (Haugen et al., 2011). However, to the best of our knowledge, no study has been conducted in the past considering all previously mentioned factors. In addition, possible gender difference has not been explored in the past as stated by Lopes et al. (2015), suggesting the need to assess which factors contribute the most to GSW in male and female adolescents.

### *The present study*

The aim of present study was to analyze the association between perceived benefits of physical activity, social support provided by the best friend, vigorous-intensity physical activity and GSW in adolescents. Specifically, we explored the mediation role of social support provided by the best friend and vigorous-intensity physical activity in the relationship between perceived benefits and GSW. It is hypothesized that: (a) perceived benefits of physical activity are positively associated with the social support provided by the best friend (Kandola et al., 2019); (b) the social support provided by the best friend is positively associated with vigorous-intensity physical activity (Stearns et al., 2019); (c) vigorous-intensity phys-

ical activity is positively associated with GSW (Haugen et al., 2011); and, (d) the social support provided by the best friend and vigorous-intensity physical activity mediates the association between perceived benefits of physical activity and GSW. Related to the last hypothesis, while previous literature has not examined social support provided by the best friend and vigorous-intensity physical activity as mediators in the proposed relationships, some researchers (e.g., Kandola et al., 2019; King et al., 2008), have provided preliminary evidence suggesting the importance of these factors in the relationship between perceived benefits and GSW.

## Method

### Participants

This study had a cross-sectional design since its implementation included the extensive screen application of surveys and fast data collection (Campbell et al., 2007). A total of 462 adolescents (female = 259) aged between 12–18 years ( $M = 16.16$ ,  $SD = 1.60$ ) from different middle and secondary schools in the north region of Portugal were recruited to participate voluntarily in this study. To be eligible for this study, potential participants needed to be aged 18 years or younger, provide informed consent to participate, and engage in regular vigorous-intensity physical activity.

### Instruments

The *International Physical Activity Questionnaire short form* (Craig et al., 2003; Hagströmer et al., 2008) Portuguese version (Ferro-Lebres et al., 2017) was used to assess vigorous-intensity physical activity. This variable was calculated considering leisure time, household, school-related physical (including activity during physical education classes and breaks), and commuting activities. Frequency and duration were measured in days per week and time per day, respectively. Then, metabolic equivalent of task for vigorous-intensity physical activity was calculated considering the following equation:  $MET = 8.0 \times \text{vigorous-intensity activity minutes} \times \text{vigorous-intensity days}$ .

Perceived benefits of physical activity was measured using the *Exercise Benefits-Barriers Scale Questionnaire* (Sechrist et al., 1987), Portuguese version (Lopes et al., 2015). For the purpose of this study, we only considered the perceived *benefits dimension* (29 items; e.g., “better sleep”, “decreased fatigue”), in which participants responded to each item using a 4-point scale ranging from 1 = strongly disagree to 4 = strongly agree.

The social support from the best friend was assessed using the *Friend Support Scale* Portuguese version (Jago et al., 2012). For this study, the item stem was adapted to the following: “how often does your best friend...”. Participants responded to four items to evaluate their perception of social support provided from the *best friend*: (1) “encourages you to exercise or play sports?”; (2) “exercises or play sports with you?”; (3) “tells you that you are doing well in exercise or sports?”; and, (4) “watches you take part in exercise or sports?”, using a 6-point scale anchored from 0 = never to 5 = everyday.

The *Physical Self-Perception Profile for Children and Youth* Portuguese version (Bernardo & Matos, 2003) was used to measure GSW. Participants responded to 6 items (e.g., “I am very happy being the way I am”) and were asked whether the description they select were true for them based on a 4-point scale ranging from 1 = sort of true to 4 = really true.

### Procedures

All procedures were in accordance with the Helsinki declaration (World Medical Association, 2013) and its later amendments. Ethical approval was obtained by the Ethical Committee before data

collection. Following ethical institutional approval (reference number: UID/DTP/04045/2019) school principals gave their permission to conduct this research in their institutions. Afterwards, parents and tutors were contacted, and objectives were explained. Written informed consent was obtained individually from each parent or tutor who agreed to participate voluntarily in this study. Adolescents who agreed to participate in this study completed the paper-and-pencil survey during class.

### Data analysis

The required sample size was determined using the G\* Power 3.1 software (Faul et al., 2009) considering the following input parameters: effect size  $f^2 = .10$ ,  $\alpha = .05$ , statistical power = .95, and, three predictors. Results showed that  $n = 119$  would be the minimum required sample size, which was respected in the present study for all samples under analysis. For transparency and latent factor validity, the factors under analysis (except vigorous-intensity physical activity, which is a one indicator variable) were psychometrically tested, performing a Confirmatory Factor Analysis (CFA). Full Information robust Maximum Likelihood (FIML) was used to handle the small amount of missing data at the item level (missing at random = 3%) as proposed by Enders (2010). Then, descriptive statistics and bivariate correlations were calculated for all variables under analysis.

Regarding the analysis of the hypothesized model, a two-step approach following the recommendations proposed by Kline (2016) was performed in IBM SPSS Amos v23. In the first step, a CFA using the maximum likelihood estimator was performed to test the psychometric properties of the measurement model. Additionally, convergent and discriminant validity analysis were conducted, where constructs are identified as distinct when the square root of each Average Variance Extracted (AVE) value is larger than the correlation between the two constructs and when the AVE for each construct is above 0.50 (Hair et al., 2019). We analyzed internal consistency through composite reliability (CR) coefficients, calculated using Raykov (1997) formula, adopting .70 as the cutoff value (Hair et al., 2019). In the second step, a Structural Equation Model (SEM) to analyze structural model fit and to examine the associations between variables was performed. Standardized direct and indirect effects on the outcome variable were analyzed, considering coefficients significant if the 95% Confidence Intervals (CI) would not include zero (Williams & MacKinnon, 2008). The Bootstrap resampling (1000 samples) considering a bias corrected 95%CI was used to assess the significance of the direct and indirect effects.

For model fit assessment, the following traditional incremental and absolute goodness-of-fit indexes were considered: Comparative Fit Index (CFI); Tucker-Lewis Index (TLI); Standardized Root Mean Square Residual (SRMR); and, Root Mean Square Error of Approximation (RMSEA) and its respective confidence interval (90%). Scores of CFI and TLI  $\geq 0.90$ , and RMSEA  $\leq 0.80$  were indicative of acceptable fit, as proposed by several authors (Byrne, 2016; Hair et al., 2019). The chi-square test ( $\chi^2$ ) and the degrees of freedom will be reported for visualization purposes but not examined, as they are both affected by model complexity and sample size (Hair et al., 2019).

## Results

The CFA analysis on the measurement models of each latent factor displayed adequate fit to the data, as seen in Table 1 (see model 1, 2, and 3). Specifically, CFI and TLI were above and SRMR and RMSEA were below previously reported cutoffs. The FIML was used to handle the small amount of missing data at the item level (missing at random = 2–3%) in each measurement model. Hence,

**Table 1**  
Goodness-of-fit indexes

Model	$\chi^2$	df	$\chi^2/df$	B-Sp	CFI	TLI	SRMR	RMSEA	CI90%
1. Perceived Benefits	68.61	377	.018	.006	.986	.955	.037	.070	.052 - .088
2. SSBF	5.22	2	2.61	.243	.995	.986	.017	.059	.000 - .124
3. GSW	6.94	9	0.77	.031	.961	.948	.037	.080	.064 - .083
4. CFA - Total Sample	1812.27	739	2.45	.071	.920	.904	.071	.068	.049 - .083
5. CFA - Male Sample	1734.53	739	2.35	.461	.969	.962	.051	.040	.015 - .059
6. CFA - Female Sample	1839.02	739	2.49	.023	.953	.942	.047	.050	.034 - .064
7. SEM - Total Sample	2246.81	738	3.04	<.001	.939	.927	.071	.057	.048 - .067
8. SEM - Male Sample	1613.27	738	2.18	<.001	.921	.906	.080	.068	.048 - .086
9. SEM - Female Sample	1862.37	738	2.52	.002	.922	.907	.077	.063	.050 - .076

Notes. CFA = Confirmatory Factor Analysis; SEM = Structural Equation Modelling;  $\chi^2$  = Chi-square; df = degrees of freedom;  $\chi^2/df$  = normalized chi-square; B-Sp = Bollen-Stine level of significance; CFI = Comparative Fit Index; TLI = Tucker Lewis Index; SRMR = Standardized Root Mean Square Residual; RMSEA = Root Mean Square Error of Approximation; CI90% = Confidence Interval at 90% for RMSEA; SSBF = Social Support provided by the Best Friend; GSW = Global Self-Worth.

we moved forward on analyzing descriptive statistics and bivariate correlations.

Descriptive statistics showed that the participants presented scores above midpoint for perceived *benefits*, social support provided by the *best friend*, and GSW. Male participants reported higher scores on *vigorous-intensity physical activity* compared to female participants as seen in Table 2. Looking at bivariate correlations, positive and significant associations were found between all variables under analysis, specifically: (a) *perceived benefits* were positively associated with the social support provided by the *best friend*, *vigorous-intensity physical activity*, and GSW; (b) social support provided by the *best friend* was positively related with *vigorous-intensity physical activity* and GSW; and, (c) *vigorous-intensity physical activity* was positively and significantly associated with GSW. These associations were consistent across samples (i.e., total sample, male and female samples).

The measurement model including the factors perceived benefits, social support provided by the *best friend*, *vigorous-intensity physical activity*, and GSW variables displayed adequate fit to the data in each sample (see models 4, 5, and 6 in Table 1). Looking at the CR coefficients, each factor showed scores above the cut-off (> .70) displaying adequate internal consistency. Based on the results of the measurement model and reliability analysis, convergent and discriminant validity were examined in each sample. Convergent validity was achieved as the AVE scores were above acceptable as seen in Table 2. According to the squared correlations and AVE scores, all factors demonstrated adequate discriminant validity since the squared correlations rooted in each latent variable were lower against the AVE scores in each latent variable. The results provide preliminary support to conduct SEM analysis in each sample and examine the direct and indirect effect between variables under analysis.

The results from the SEM analysis showed that the structural model in each sample provided an acceptable fit to the data as seen in Table 1 (see models 7, 8, and 9). Positive and significant associations were observed among variables under analysis, specifically: (a) perceived benefits displayed a significant association with social support provided by the *best friend*; (b) social support provided by the *best friend* was significantly associated with *vigorous-intensity physical activity*; and, (c) *vigorous-intensity physical activity* displayed a significant association with GSW. Similar patterns were observed across samples, in which the female sample displayed the highest coefficients related to the direct paths compared to the male sample and total sample.

The indirect regression paths showed that perceived benefits for *physical activity* displayed a positive association with *vigorous-intensity physical activity*, considering the social support provided by the *best friend* as mediator. Perceived benefits also showed a positive and significant association with GSW, considering social support provided by the *best friend* and *vigorous-intensity physical activity* as mediators in this relationship. Furthermore, social sup-

port provided by the *best friend* was positively associated with GSW considering *vigorous-intensity physical activity* as a mediator. These associations were found in all samples as seen in Table 3.

## Discussion

This study aimed to analyze the mediation role of the social support provided by the best friend and vigorous-intensity physical activity in the relationship between perceived benefits and global self-worth in adolescents. All in all, the hypotheses were confirmed and will be discussed according to existing literature.

Current results showed that the perceived benefits of physical activity was positively associated with the social support provided by the best friend in both male and female adolescents. In this regard, adolescents who perceived the benefits of engaging in physical activity, such as enjoyment, social interaction, positive experiences are closer to present higher values of perceived social support, including those provided by the best friend. These results are consistent with previous literature (e.g.; Lopes et al., 2015; Roth et al., 2019) meaning that the benefits inherent of physical activity are positively related to how adolescents will perceive the social support from important others, such as the meaning attributed to the best friend.

As shown in the results, the association between social support provided by the best friend and vigorous-intensity physical activity was found to be positive and significant in male and female adolescents. It appears that adolescents who have best friends that encourage them to exercise or play sports, who exercise or play sports with them, who tells them that they are doing well, and that invest time watching them taking part in exercise or sports are able to engage in more with vigorous-intensity physical activity. These results are consistent with those reported by Howie et al. (2018), explaining that significant peer interaction is crucial for the promotion of vigorous-intensity physical activity of adolescents. In fact, the social support provided by the best friend or important peers in general has more impact in both vigorous and moderate-intensity physical activity compared to low-intensity physical activity (King et al., 2008). Thus, is reasonable to assume that best friends and important peers are crucial determinants of physical activity in adolescent life, since physical activity has been shown to be modeled by significant others, and these significant others may also provide approval and opportunities for maintaining physical activity (Horn, 2019).

While the association between physical activity and GSW seems to be well documented in the literature (e.g., Liu et al., 2015), the specific association between vigorous-intensity physical activity and GSW was still under-research to date. Our results showed a positive and significant association between vigorous-intensity physical activity and GSW in both male and female adolescents. While there are considerable differences between levels of physi-

**Table 2**  
Descriptive statistics, bivariate correlations, average variance extracted values, and composite reliability coefficients

Variables	M	SD	1	2	3	4	AVE	CR
<i>Total Sample</i>								
1. Benefits	3.28	.46	-	.14	.02	.13	.67	.87
2. SSBF	3.12	.64	.37**	-	.02	.07	.62	.74
3. VPA	1842.49	1529.23	.13**	.14**	-	.03	-	-
4. GSW	2.70	.59	.36**	.27**	.17**	-	.58	.74
<i>Male Sample</i>								
1. Benefits	3.39	.46	-	.10	.05	.09	.68	.86
2. SSBF	3.21	.64	.32**	-	.03	.03	.61	.73
3. VPA	2268.73	2041.69	.22**	.18**	-	.02	-	-
4. GSW	2.95	.57	.30**	.16**	.15*	-	.57	.72
<i>Female Sample</i>								
1. Benefits	3.19	.44	-	.15	.04	.10	.67	.87
2. SSBF	3.05	.64	.39**	-	.04	.10	.61	.74
3. VPA	1508.42	812.321	.21**	.21**	-	.03	-	-
4. GSW	2.51	.56	.32**	.32**	.18**	-	.59	.75

Notes. M = Mean; SD = Standard Deviation; SSBF = Social Support provided by the Best Friend; VPA = Vigorous Physical Activity; GSW = Global Self-Worth; below diagonal line = latent correlations; above diagonal line = squared correlations; \*  $p < .05$ ; \*\*  $p < .01$

**Table 3**  
Direct and indirect regression paths

Regression path	Direct			Indirect			
	$\beta$	CI95%	$p$	$\beta$	CI95%	$p$	
<i>Total Sample</i>							
Benefits → SSBF	.45	.351 - .542	.001	Benefits → VPA	.07	.017 - .118	.006
SSBF → VPA	.15	.030 - .241	.008	Benefits → SSBF	.04	.003 - .032	.004
VPA → GSW	.20	.088 - .308	.001	VPA → SSBF	.03	.007 - .065	.005
<i>Male Sample</i>							
Benefits → SSBF	.37	.212 - .528	.001	Benefits → VPA	.08	.023 - .156	.002
SSBF → VPA	.20	.067 - .349	.005	Benefits → SSBF	.02	.002 - .042	.016
VPA → GSW	.17	.009 - .353	.036	VPA → SSBF	.04	.003 - .104	.022
<i>Female Sample</i>							
Benefits → SSBF	.47	.355 - .592	.001	Benefits → VPA	.11	.056 - .187	.001
SSBF → VPA	.24	.117 - .351	.001	Benefits → SSBF	.03	.004 - .066	.006
VPA → GSW	.22	.051 - .394	.010	VPA → SSBF	.05	.009 - .125	.008

Notes. SSBF = Social Support provided by the Best Friend; VPA = Vigorous Physical Activity; GSW = Global Self-Worth;  $\beta$  = standardized coefficient; CI95% = Confidence Interval at 95%;  $p$  = level of significance.

cal activity intensity and psychological health (Owens et al., 2016), current results provide consistent support on the association of physical activity as an important determinant of mental health. Current evidence also adds up on the importance of vigorous-intensity physical activity in adolescents for mental health, since previous studies have only provided evidence of the behavior and not on the intensity (Reddon et al., 2017). All in all, current results are consistent with the association of physical activity and several health benefits, including GSW, which is recognized as an important indicator of positive mental health and well-being, specifically in children and adolescents (Biddle & Asare, 2011).

As for the indirect effects, all regression coefficients were significant in all samples, meaning that the social support provided by the best friend and vigorous-intensity physical activity seem to operate as mediators in the relationship between perceived benefits and global self-worth in adolescents. The indirect regression path analysis provided additional information that supports our hypotheses. In addition, some new insights that could be important to promote mental health in terms of GSW in adolescents were identified.

Current results support the significant role of social support provided by the best friend and vigorous-intensity physical activity in the interaction between perceived benefits of physical activity and mental health in male and female adolescents. Social support refers to the quality of support from social relationships as perceived by each one of us, available from significant others such as family members, friends, and peers (Väänänen et al., 2014). In a study conducted by Bum and Jeon (2016), the authors highlighted the importance of social support and high self-worth as

determinants of positive emotions in adolescents. Besides that, during adolescence, changes towards lower self-worth can influence pubertal fluctuations, an incipient ability to think about one's self, misperception and changes in different roles and responsibilities, as well as personality development (Harter & Whitesell, 2003). In this regard, physical activity, specifically those types that are perceived as vigorous, could be grasped as one factor that functions to normalize and increase self-worth throughout adolescence (Harter & Whitesell, 2003). Overall, it appears that the interaction between social support provided by the best friend and vigorous-intensity physical activity could act as protective determinants against different psychological changes during adolescence and increase mental health through self-worth, avoiding possible psychological problems such as depression in the adolescent life (Kandola et al., 2020).

While the present study contributes with new insights on the mediation role of social support provided by the best friend and vigorous-intensity physical activity in the relationship between perceived benefits and global self-worth in male and female adolescents, this study has some limitations that should be addressed. First, the data was collected from a convenience sample and the study had a cross-sectional design, which precludes us from determining causality. Experimental studies are needed to examine the effects of perceived benefits, social support, and physical activity on GSW. Second, the data from this study was limited to a Portuguese sample which limits generalizability. Hence, forthcoming studies should collect stratified samples from other countries and cultures and compare their results with the current study. Third, since this

was the first study to consider the social support, specifically provided the best friend, and vigorous-intensity physical activity as mediators in the previous-mentioned relationship, more studies are warranted to examine the cultural aspects of these determinants on GSW. Fourth, vigorous-intensity physical activity was measured using self-reported instruments. Therefore, we suggest future studies to measure physical activity using equipment such as accelerometer or pedometer to test if the results would be the same. Last, other socio-demographic variables (e.g., age, household) should be assessed and tested in future studies, and their interaction as mediators or moderators between perceived benefits of physical activity and GSW should be considered.

As future avenues, we suggest more studies considering the relationship between physical activity and GSW. In this study, GSW was considered as the dependent variable. However, more studies are paramount since the association between physical activity and GSW is still under-researched and somewhat unclear as previously mentioned. While there are reports considering the predictor role of GSW and increased physical activity (e.g., Davison et al., 2007), other studies claim that physical activity promotes GSW (e.g., Schmalz et al., 2007). Forthcoming studies should also explore in more detail the possible bidirectional association between social support provided by significant others and GSW. For instance, a study developed by Marshall et al. (2014), analyzing two models (self-esteem as antecedent; and self-esteem as an outcome) concluded that the association between self-esteem and social support was bidirectional; while other studies (e.g., Bum & Jeon, 2016; Haugen et al., 2011) have found self-esteem to be the outcome and not the determinant. This limited literature indicates a need for more research on the overarching association between social support provided by significant others and GSW.

In sum, the current results showed the significant mediation role of social support provided by the best friend and vigorous-intensity physical activity in the relationship between perceived benefits and GSW in both male and female adolescents. When adolescents perceive favorable benefits towards physical activity, such as feeling more energized, being more socially connected (e.g., a sense of tribe with peers), they tend to show higher levels of social support provided by the best friend and, consequently, engage in more vigorous-intensity physical activity. In turn, higher levels of vigorous-intensity physical activity are indicative of greater GSW.

One of the major strengths of the current study is the large sample size in both male and female adolescents from which we were able to assess the relationships between variables of interest. In addition, the use of psychometrically valid and reliable measures to assess variables of interest is the strength of this study. The use of such instruments allows for comparisons that are more reliable across studies. Implications of this study include the importance of applied interventions in future studies which considers the benefits of physical activity as a determinant factor on the promotion of mental health. Interventions could help decrease the perceived barriers of physical activity by removing or diminishing feelings of 'unpleasantness' of physical exertion during physical activity (e.g., coping strategies) in male and female adolescents and increasing the perception of benefits. In addition, interventions could also further highlight the benefits and emphasize the paybacks of vigorous-intensity physical activity in adolescents to promote adherence over lifespan.

The results of this study also suggest that different approaches to increasing vigorous-intensity physical activity in adolescents may be necessary to maintain GSW when transitioning to adulthood. Because there were no differences related to perceived benefits between gender, our data suggest that tailored strategies can focus on perceived benefits and vigorous-intensity physical activity as mean to increase GSW, an important aspect of mental health in both genders. Specifically, increasing the perceptions of the bene-

fits of physical activity, particularly vigorous-intensity activities, in male and female adolescents may encourage more participation in the long-term.

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## Ethical approval and consent to participate

All data collection procedures were in accordance with the ethical standards of the institutional research committee and with the 2013 Helsinki declaration and its later amendments or comparable ethical standards. Approval for this study was granted by the Research Center in Sports Sciences, Health Sciences and Human Development (CIDESD), institution that is registered in the Portuguese National Science Foundation (FCT) under the reference UID/DTP/04045/2019. Written informed consent from adolescents and their parent or legal guardian was obtained prior to participation in the study.

## Conflict of interest

The authors declare no conflict of interests.

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