

Portuguese adolescents' cognitive well-being and basic psychological needs during the COVID-19 outbreak: A longitudinal study

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Abstract

Confinements and social distancing measures during COVID-19 pandemic were particularly challenging to adolescents, impacting significantly their life and routines. Following a longitudinal design, this study sought to compare adolescents' cognitive well-being—satisfaction with life, social support, and quality of life—before (T1) and during (T2) the COVID-19 pandemic. Additionally, it aimed to clarify the predictive value of the three dimensions of the cognitive well-being to the satisfaction of basic psychological needs of adolescents at school at T2. One thousand ninety-nine Portuguese adolescents participated, showing generally increased scores in satisfaction with life, social support, and quality of life at T2. Even so, girls revealed lower changes in cognitive well-being components compared with boys, between T1 and T2. In addition, satisfaction with life and quality of life were predictive of satisfaction of basic psychological needs at T2. This work highlights the relevance of cognitive well-being as a dispositional dimension in determining the satisfaction of basic psychological needs in adolescence, during a worldwide catastrophic event.

Ana Meireles and Sofia Marques should be considered joint first authors as they have contributed equally to this study.

KEYWORDS

adolescence, cognitive well-being, COVID-19, quality of life, satisfaction with life, social support

INTRODUCTION**Influences of the COVID-19 pandemic on adolescents' well-being**

Because of the new coronavirus outbreak, governments and health care organizations have imposed lockdowns and severe restrictions on social life. As a result, people around the world are facing various challenges to maintain their well-being (Šakan et al., 2020). Dealing with the COVID-19 pandemic and the associated containment measures appear to be particularly challenging for young people, affecting their learning process, routines and social interactions, and, consequently, their well-being and mental health (Ellis et al., 2020; Holzer et al., 2021; Ravens-Sieberer et al., 2021).

A large percentage of children and adolescents reported being severely stressed by the COVID-19 pandemic and experiencing significantly lower health-related quality of life, more mental health problems, and increased anxiety than before (Ravens-Sieberer et al., 2021). This impacts the satisfaction of their basic psychological needs (BPN) and their subjective well-being (Šakan et al., 2020).

Subjective well-being has been described in terms of positive and negative affect, markers of emotional well-being, which map the individual's affective experiences (Galinha et al., 2014). However, subjective well-being is a more complex construct, as it also includes a more cognitive-judgmental dimension, which is usually defined as non-affective (Cloninger & Zohar, 2011) or cognitive well-being, derived from its three theoretically equivalent indicators: individual's satisfaction with life, satisfaction with social support, and health-related quality of life (Moreira et al., 2015). Life satisfaction refers to a comparative process in which individuals evaluate their lives against their own self-imposed standards (Pavot & Diener, 1993). It includes different dimensions, such as family, friends, and school (Huebner et al., 2004), and tends to decline during adolescence, suggesting that adolescents perceive relatively less life satisfaction, as they mature (Goldbeck et al., 2007; Park, 2005), both in general and at specific domains. Social support refers to the structural (presence of social relationships) and functional (type of resources) support provided by the social environment (Helgeson, 2003). Contributions from the individual's social network (e.g., emotional, recreational, or informational) promote perceived well-being (Boosman et al., 2002; Pedrosa et al., 2020). Specifically, adolescents' perceived social support affects their emotional and social development and appears to be a protective factor in coping with stressful events (Boosman et al., 2002). Finally, quality of life refers to adolescents' functioning in various domains (e.g., physical, emotional, social, and school) and appears to be influenced by personal factors (e.g., self-esteem), social factors (e.g., family and peer groups; Gaspar et al., 2009; Matos et al., 2012), and sociodemographic factors (e.g., age, gender, education, and income; Sabbah et al., 2003; Samak, 2017). Indeed, older people tend to report higher quality of life than younger people (Sabbah et al., 2003), excepting for physical functioning domain (Samak, 2017).

During the COVID-19 pandemic, the various dimensions that contribute to cognitive well-being appeared to be impaired in adolescents (Pizarro-Ruiz & Ordóñez-Cambor, 2021). They

reported lower life satisfaction, which was most likely related to the constraints (e.g., school closure or lack of social contact) associated with preventing the spread of COVID-19 (Soest et al., 2020). In addition, adolescents reported changes in their social support during the pandemic, showing more conflicts with their parents and spending less time with peers (Kapetanovic et al., 2021). Changes were observed in perceptions of social support (both emotional and functional) from family, peers, and institutions (Pacheco et al., 2021). Similarly, adolescents reported lower health-related quality of life during the COVID-19, especially girls (Ravens-Sieberer et al., 2021), and experienced more mental health problems, as well as elevated anxiety scores, than before the pandemic outbreak (Jones et al., 2021; Ravens-Sieberer et al., 2021).

The satisfaction of BPN during COVID-19 outbreak

The domains related to cognitive well-being appear to be theoretically intertwined with self-determination theory (e.g., Eryilmaz, 2012), in which the satisfaction of BPN (Deci & Ryan, 1985; Ryan & Deci, 2000)—autonomy, competence, and relatedness—contribute to adolescent functioning and well-being (Tian, Chen, & Huebner, 2014; Vansteenkiste et al., 2020).

During the COVID-19, challenges related to autonomy, competence, and relatedness appear to undermine psychological well-being (Cantarero et al., 2020). Results suggest that feelings of autonomy, in particular, were negatively affected by the pandemic. Women and younger adults also reported lower levels of competence during the pandemic outbreak (Antunes et al., 2020). Interestingly, feelings of connectedness increased during the COVID-19 outbreak, possibly due to indirect communication with family, friends, and acquaintances via the Internet or telephone (Cantarero et al., 2020).

Acute stress symptoms, associated with poorer well-being and mental health status, also decreased significantly when social support helped meet BPN and provided a sense of control (Zhou & Yao, 2020). Cantarero et al. (2020) also observed that a greater sense of connectedness was associated with increased reported well-being. Also, a recent study enrolling university students from two European countries, who were home schooling during the pandemic, showed that they exhibited more positive emotions when their need for competence was satisfied (Holzer et al., 2021).

In adolescence, BPN satisfaction appears to be associated with well-being (Eryilmaz, 2012), especially in the school setting, which is significant, given the importance of this context in adolescents' lives (Tian, Chen, & Huebner, 2014). Indeed, the satisfaction of BPN improves adolescents' school-related subjective well-being (Tian et al., 2016), as well as their life satisfaction (Leversen et al., 2012). It also contributes to increasing adolescents' emotional well-being (Reis et al., 2000) and reducing anxiety (Quested et al., 2011). Although most studies have reported this relationship in a unidirectional manner, where the satisfaction (or frustration) of BPN influences individuals' subjective well-being, some (but few) have also examined the existence of a reverse or bidirectional relationship (Tian, Chen, & Huebner, 2014). Studies have showed that adolescents' satisfaction with their school experiences was associated with feelings of belonging, autonomy, and competence (Connell, 1990; Roeser et al., 2001). Longitudinal evidence have showed that adolescents' increased school satisfaction predicted, 6 weeks later, feelings of greater connectedness, trust, and autonomy in relation to school (Tian, Chen, & Huebner, 2014).

Research questions and hypotheses

Considering that the cognitive component of subjective well-being seems to be less studied in the context of the COVID-19 pandemic (Cantarero et al., 2020; Ravens-Sieberer et al., 2021), the present study aimed to contribute to fill this gap, following a longitudinal design. Therefore, it examined adolescents' satisfaction with life, social support, and quality of life, comparing these constructs before (T1) and during (T2) the COVID-19 outbreak. We expect levels of life satisfaction, health-related quality of life, and social support satisfaction to be lower during the pandemic period, compared with the period prior to the COVID-19 outbreak (Hypothesis 1). In addition, this study aimed to clarify how cognitive well-being contributes to the satisfaction of BPN related to school, during the COVID-19 pandemic, in adolescents. We expect students who report greater levels of life satisfaction, social support, and quality of life at T2 to present increased levels of satisfaction with BPN related to the school context during the COVID-19 pandemic. Thus, we hypothesized that increased life satisfaction, health-related quality of life, and social support would be predictive of higher levels of satisfaction of BPN at school (Hypothesis 2).

MATERIALS AND METHODS

Participants

Participants were 1099 adolescents (517 boys and 582 girls), aged between 12 and 16 years, with a mean age of 12.80 years ($SD = 0.73$). The adolescents attended schools in the north of Portugal—61.1% attended the 7th grade and 38.5% attended the 8th grade. Table 1 illustrates the characterization of the sample.

Participants were recruited as part of a larger research project on students' engagement with sustainable development, between April and July 2019, before the outbreak of the COVID-19. One year later, during the COVID-19 pandemic, between May and June 2020, participants were invited to participate in the second moment of the study.

For the purposes of this study, only the adolescents who answered the questionnaires in the first assessment moment (before the COVID-19 outbreak) were invited to participate in the second assessment moment (during the COVID-19 pandemic).

Measures

Satisfaction with life

The Portuguese version of Brief Life Satisfaction Scale (BLSS; Costa et al., 2021; Huebner, 1997) is a self-report measure constituted by six items, answered according to a 7-point Likert scale (0 = *terrible*; 6 = *delighted*), which allows assessing life satisfaction in adolescents. Each of the six questions focuses on a specific dimension of adolescents' life deemed appropriate for this developmental range (e.g., family, friends, or school; "I would describe my satisfaction with my family life as"). The mean of the six items was calculated to obtain the total score of adolescents' satisfaction with life. Higher scores reflect greater life satisfaction. Cronbach's alpha yielded good consistency results for the total score of BLSS for both Moments 1 ($\alpha = .89$) and 2 ($\alpha = .81$).

TABLE 1 Sociodemographic characteristics of the sample ($N = 1099$)

	Total sample ($N = 1099$)	Boys sample ($n = 517$)	Girls sample ($n = 582$)
Age (in years)	M (SD) 12.80 (0.73)	M (SD) 12.83 (0.80)	M (SD) 12.77 (0.67)
	n (%)	n (%)	n (%)
Grade at school			
7th	672 (61.1)	320 (61.9)	352 (60.5)
8th	424 (38.5)	195 (37.7)	228 (39.2)
Missing	4 (0.4)	2 (0.4)	2 (0.3)
Type of school			
Public	1023 (93.1)	473 (91.5)	550 (94.5)
Private	49 (4.5)	25 (4.8)	24 (4.1)
Professional	15 (1.4)	13 (2.5)	2 (0.3)
Missing	12 (1.1)	6 (1.2)	6 (1.0)
Being retained at school			
Yes	146 (13.3)	82 (15.9)	64 (11.0)
No	951 (86.5)	433 (83.8)	518 (89.0)
Missing	2 (0.2)	2 (0.4)	0 (0.0)

Satisfaction with social support

The Portuguese version of the Scale of Satisfaction with Social Support (SSSS; Gaspar et al., 2009) is a self-report measure comprising 12 items, aiming to assess adolescent's satisfaction with social support. The SSSS allows measuring the perceived needs or sense of social support and the relation of these perception with children and adolescents' health and well-being. Answers were given according to a 5-point Likert scale (1 = *strongly disagree*; 5 = *strongly agree*), where adolescents reported to which degree they agree with the affirmation. The items are organized in two dimensions: Satisfaction with Social Support (six items) (e.g., "I am satisfied with the number of friends I have") and Need for Activities connected to Social Support (six items) (e.g., "I would like to participate in more activities developed by organizations (e.g., sport clubs, scouts)"). The mean of the 12 items was computed to obtain the total score of adolescents' satisfaction with social support. Cronbach's alpha yielded acceptable consistency results for the total score of the SSSS for both Moments 1 ($\alpha = .74$) and 2 ($\alpha = .72$).

Quality of life

The Portuguese version of the KIDSCREEN-10 Index (Matos et al., 2012; Ravens-Sieberer et al., 2005) is a self-report measure allowing to assess adolescents' perceptions about their quality of life. The scale comprises 10 items, assessed in 7-point Likert scale (0 = *nothing*; 6 = *totally*) (e.g., "Did you have fun with your friends?"; "Did you feel able to concentrate?"). The total score is obtained by summing all the items. Higher scores reflect a perception of

greater quality of life. Cronbach's alpha yielded acceptable consistency results for the total score of KIDSCREEN-10 Index for both T1 ($\alpha = .79$) and T2 ($\alpha = .75$).

Basic psychological needs

The Portuguese version of the Adolescent Students' Basic Psychological Needs at School Scale (ASBPNSS; Moreira et al., 2021; Tian, Han, & Huebner, 2014) is a self-report measure constituted by 15 items, answered according to a 5-point Likert scale (1 = *strongly disagree*; 5 = *strongly agree*). The scale allows assessing three dimensions: Need for Autonomy (e.g., "I can decide for myself how to do things at school"), Need for Relatedness (e.g., "Teachers and classmates care about me at school"), and Need for Competence (e.g., "I am capable of learning new knowledge at school"), assessed in five items each. The total score was computed by calculating the mean of the 15 items. Higher scores reflect increased levels of satisfaction of the needs at school. Cronbach's alpha of the ASBPNSS in the current study was .88, as data were only collected at T2.

Procedure

This study was approved by the authors' affiliation institution ethics committee. After the approval, the Portuguese General Education Direction was contacted to authorize data collection from Portuguese schools. A total of 200 schools were contacted by e-mail or telephone. Of these, 48 schools enrolled in this study, as adolescents were required to have answered the questionnaires in the two assessment moments—before and during the COVID-19 pandemic.

One teacher per school was selected to be in direct contact with the research team and was responsible for inviting students to participate and ensuring the communication with the adolescents' legal guardians. The research team e-mailed the consent form and questionnaires to the schools. Then, the guardians of the adolescents received detailed information about the study objectives and procedures and the consent form via e-mail from the schools. The guardians who accepted the invitation gave their written informed consent for the adolescents' participation in accordance with the Declaration of Helsinki.

Data were collected at two time points: (i) T1, between April and June 2019, before the outbreak of the COVID-19 pandemic, and (ii) T2, 1 year later, between May and June 2020, during the COVID-19 pandemic.

At T1, the selected teacher at each school gave the questionnaires directly to the students and instructed them to answer the questionnaires at home when they were alone. The same teacher collected them after the adolescents returned the questionnaires answered. At T1, the adolescents answered the BLSS, SSSS, and KIDSCREEN-10 questionnaires. At T2, an online version of the questionnaires was created in *Google Forms*. Then, the schools that participated in the first moment were contacted again by e-mail or phone and declared their participation in this time point of the study. The *Google Forms* link was sent to the selected teachers at each school who accepted to resume their participation. The teacher then shared the link with the students so that they could answer, online, the questionnaires. In this moment (T2), in addition to the questionnaires administered in T1, students answered the ASBPNSS.

By this time, the world was facing the COVID-19 challenges, and Portugal was no exception. On March 18, 2020, after the WHO considered COVID-19 as a pandemic, and with all schools

already closed since March 16, the President of the Portuguese Republic decreed a state of emergency. Mandatory confinement and severe movement restrictions were imposed, except for specific health-related and essential goods and services. These measures brought an emotional burden to adolescents and their families, due to the stress and fears posed by the COVID-19 threaten, along with the related economic, social, and psychological concerns. Students from different educational levels experienced online classes since April 14 (even though several limitations and inequities occurred). On May 2, the state of emergency ended, leading to a gradual deconfinement, and, on May 18, child care centers reopened and face-to-face classes for the 11th and 12th grades partially began. By this time, restrictions to cultural, sport, or recreational activities and to traveling, and imposed curfews were progressively lightened, although sanitary measures as physical distance, mandatory use of mask, and frequent hand washing prevailed.

Data analysis

Descriptive analyses were conducted to determine means, standard deviations, and range intervals for the variables in the study. Preliminary multivariate analyses of variance were conducted to test for gender differences for all variables in the study. Therefore, as gender differences were found, for assessing Hypothesis 1, univariate analyses for repeated measures were conducted to test differences in the variables in the study between T1 and T2, for boys and girls, separately. Accordingly, to examine the effects of gender, a multivariate analysis of the covariance (MANCOVA) of the change scores (CS = T2 scores minus T1 scores) obtained by the life satisfaction, social support, and quality of life as the dependent variables was performed, controlling the scores obtained in the T1. Effect sizes for all analyses were estimated with partial eta squared statistic (η^2), considering $\eta^2 < .01$ as a low effect, $.01 < \eta^2 < .06$ as a medium effect, and $.06 < \eta^2 < .14$ as a large effect (Cohen, 1992). Finally, for testing Hypothesis 2, a hierarchical regression analysis was conducted to assess if satisfaction with life, social support, and quality of life (T2) were significant predictors of BPN in school (T2), controlling for gender, being retained at school, and satisfaction with life, social support, and quality of life at T1.

RESULTS

Preliminary analysis: Satisfaction with life, social support, quality of life, and BPN at school

Means, standard deviations, and range interval of all scales are presented in Table 2, considering the global sample, and then boys and girls, separately, as a significant main effects were found on preliminary analysis for gender, both at T1, Wilks' lambda = 0.98, $F(3, 1096) = 9.35$, $p < .001$, partial $\eta^2 = .025$, and at T2, Wilks' lambda = 0.97, $F(4, 1095) = 9.71$, $p < .001$, partial $\eta^2 = .034$.

For T1, the univariate analysis indicated significant main effects of gender for satisfaction with life, $F(1, 1098) = 10.37$, $p = .001$, partial $\eta^2 = .01$, with girls scoring higher ($M = 4.78$; $SD = 0.94$) compared with boys ($M = 4.58$; $SD = 1.02$). Also, significant main effects were observed for social support, $F(1, 1098) = 7.79$, $p < .001$, partial $\eta^2 = .02$, with girls reporting higher levels of social support ($M = 3.51$; $SD = 0.61$) compared with boys ($M = 3.35$; $SD = 0.58$). No significant effects were found for quality of life, $F(1, 1098) = 2.55$, $p = .111$, partial $\eta^2 = .002$.

TABLE 2 Means, standard deviations, and range of variables in study ($N = 1099$)

Variables	Total sample ($N = 1099$)			Boys sample ($n = 517$)			Girls sample ($n = 582$)					
	Moment 1		Moment 2		Moment 1		Moment 2		Moment 1		Moment 2	
	M (SD)	Min- leftmax	M (SD)	Min- max	M (SD)	Min- max	M (SD)	Min- max	M (SD)	Min- max	M (SD)	Min- max
SSSS	3.44 (0.60)	1.75–5.00	3.76 (0.54)	2.00–5.00	3.35 (0.58)	1.75–4.92	3.78 (0.53)	2.17–5.00	3.52 (0.61)	1.92–5.00	3.75 (0.54)	2.00–5.00
BLSS	4.69 (0.98)	0.00–6.00	5.03 (0.76)	1.17–6.00	4.58 (1.02)	1.00–6.00	5.08 (0.74)	2.00–6.00	4.78 (0.94)	0.00–6.00	4.99 (0.76)	1.17–6.00
KIDSCREEN-10	3.72 (0.61)	1.80–5.00	3.80 (0.56)	1.80–5.00	3.69 (0.61)	2.00–5.00	3.88 (0.56)	1.80–5.00	3.75 (0.61)	1.80–5.00	3.73 (0.55)	2.00–5.00
ASBPNSS	-	-	3.92 (0.52)	1.00–5.00	-	-	3.88 (0.55)	1.67–5.00	-	-	3.95 (0.50)	1.00–5.00

Abbreviations: ASBPNSS, Adolescent Students' Basic Psychological Needs at School Scale; BLSS, Brief Life Satisfaction Scale; KIDSCREEN-10, Adolescents Quality of Life; SSSS, Scale of Satisfaction with Social Support.

Likewise, at T2, the univariate analysis suggested significant main effects for satisfaction with life, $F(1, 1098) = 4.44, p = .035$, partial $\eta^2 = .004$, with boys scoring higher ($M = 5.09; SD = 0.03$) compared with girls ($M = 4.99; SD = 0.03$). Furthermore, significant main effects were observed for quality of life, $F(1, 1098) = 18.93, p < .001$, partial $\eta^2 = .017$, again with boys scoring higher ($M = 3.88; SD = 0.56$) compared with girls ($M = 3.73; SD = 0.55$). Also, significant main effects were verified for BPN at school, $F(1, 1098) = 3.85, p = .05$, partial $\eta^2 = .003$, with girls scoring higher ($M = 3.95; SD = 0.50$) compared with boys ($M = 3.88; SD = 0.55$). No significant effects were found for gender on social support, $F(1, 1098) = 1.91, p = .275$, partial $\eta^2 = .001$.

H1: Differences between T1 and T2 regarding satisfaction with life, social support, and quality of life

Considering satisfaction with life, a significant effect of time was found, $F(1, 1098) = 128.01, p < .001$, partial $\eta^2 = .104$, with participants scoring higher at T2 ($M = 5.03; SD = 0.76$), compared with T1 ($M = 4.69; SD = 0.98$). Also, in regard to social support, a significant effect of time was observed, $F(1, 1098) = 188.56, p < .001$, partial $\eta^2 = .147$, with participants scoring, again, higher at T2 ($M = 3.76; SD = 0.54$), compared with T1 ($M = 3.44; SD = 0.60$). Additionally, a significant effect of time was found for quality of life, $F(1, 1098) = 40.62, p < .001$, partial $\eta^2 = .036$, with participants scoring higher at T2 ($M = 3.80; SD = 0.56$), compared with T1 ($M = 3.72; SD = 0.61$).

As gender differences were found in the preliminary analysis, univariate analyses for repeated measures were also conducted to test differences in the variables between T1 and T2, for boys and girls, separately.

Differences between T1 and T2 regarding satisfaction with life, social support, and quality of life for boys

In what concerns to Hypothesis 1 for the boys sample, considering satisfaction with life, a significant effect of time was observed, $F(1, 516) = 117.38, p < .001$, partial $\eta^2 = .185$, with participants scoring higher at T2 ($M = 5.08; SD = 0.75$), compared with T1 ($M = 4.58; SD = 1.02$). Also, in regard to social support, a significant effect of time was found, $F(1, 516) = 195.82, p < .001$, partial $\eta^2 = .275$, with participants scoring higher at T2 ($M = 3.78; SD = 0.53$), compared with T1 ($M = 3.35; SD = 0.58$). Additionally, a significant effect of time was found for quality of life, $F(1, 516) = 38.86, p < .001$, partial $\eta^2 = .700$, with participants scoring higher at T2 ($M = 3.87; SD = 0.56$), compared with T1 ($M = 3.69; SD = 0.61$).

Differences between T1 and T2 regarding satisfaction with life, social support, and quality of life for girls

Still related to Hypothesis 1, but for the girls sample, a significant effect of time on satisfaction with life was observed, $F(1, 516) = 13.09, p < .001$, partial $\eta^2 = .046$, with participants scoring, again, higher at T2 ($M = 4.99; SD = 0.76$), compared with T1 ($M = 4.78; SD = 0.94$). Also, in regard to social support, a significant effect of time was found, $F(1, 581) = 56.67, p < .001$, partial $\eta^2 = .089$, with participants scoring higher at T2 ($M = 3.75; SD = 0.54$), compared with T1

($M = 3.52$; $SD = 0.61$). For quality of life, no significant effect of time was found, $F(1, 516) = 38.86$, $p = .596$, partial $\eta^2 < .001$.

Effects of gender on the change scores of the satisfaction with life, social support, and quality of life, controlling for T1 scores

To further examining Hypothesis 1, a MANCOVA of the change scores obtained by satisfaction with life, social support, and quality of life as the dependent variables was performed to examine the effects of gender, controlling for the scores of satisfaction with life, social support, and quality of life obtained in the T1. Significant main effects were found for gender, Wilks' lambda = 0.97, $F(3, 1092) = 10.031$, $p < .001$, partial $\eta^2 = .027$. In addition, significant main effects were found for life satisfaction T1, Wilks' lambda = 0.40, $F(3, 1092) = 546.61$, $p < .001$, partial $\eta^2 = .600$; for social support T1, Wilks' lambda = 0.48, $F(3, 1092) = 401.57$, $p < .001$, partial $\eta^2 = .525$; and for quality of life T1, Wilks' lambda = 0.51, $F(3, 1092) = 349.23$, $p < .001$, partial $\eta^2 = .490$.

The univariate analysis indicated significant main effects for changes in satisfaction with life, $F(1, 1098) = 12.46$, $p < .001$, partial $\eta^2 = .011$, with girls scoring lower ($M = 0.21$; $SD = 0.97$) compared with boys ($M = 0.50$; $SD = 1.06$). In addition, significant main effects for changes in social support were also found, $F(1, 1098) = 4.54$, $p = .033$, partial $\eta^2 = .004$, with girls scoring lower ($M = 0.23$; $SD = 0.73$) compared with boys ($M = 0.43$; $SD = 0.70$). Finally, significant main effects for changes in quality of life were found, $F(1, 1098) = 29.86$, $p < .001$, partial $\eta^2 = .027$, with girls scoring lower ($M = -0.01$; $SD = 0.67$) compared with boys ($M = 0.19$; $SD = 0.68$).

H2: Components of cognitive well-being as predictors of BPN at school during T2

Finally, for testing Hypothesis 2, a hierarchical regression analysis was conducted to examine which variables constituting cognitive well-being—satisfaction with life, social support, and quality of life—represent the strongest predictor of adolescent's BPN at school, during the outbreak of the COVID-19 (T2). The first step in the hierarchical regression included the variable gender and being retained at school as predictors, the second step in the hierarchical regression included the satisfaction with life, social support, and quality of life at T1, and the third step in the hierarchical regression included the satisfaction with life, social support, and quality of life at T2 as predictors (see Table 3). When all variables were entered in the regression equation, 29.1% of variance of satisfaction of BPN at school at T2 was explained, with satisfaction with life at T2 ($\beta = .32$, $p < .001$) and quality of life at T2 ($\beta = .19$, $p < .001$), emerging as significantly predicting the satisfaction of BPN at school during the COVID-19 pandemic, after controlling for gender ($\beta = .09$, $p < .001$), for being retained at school ($\beta = .00$, $p = .926$), for quality of life at T1 ($\beta = .12$, $p = .001$), for social support at T1 ($\beta = .06$, $p = .045$), and for satisfaction with life at T1 ($\beta = .04$, $p = .238$).

DISCUSSION

The study aim was twofold: (i) to compare adolescents' cognitive well-being—satisfaction with life, social support, and quality of life—before the COVID-19 outbreak (T1) and during the

TABLE 3 Hierarchical regression for quality of life, social support, and life satisfaction as predictors of basic psychological needs at school, controlling for gender and being retained at school ($N = 1099$)

	β	95% CI	t	R^2	ΔR^2
Step 1				.006	.006*
Gender	.06	-.00 to .12	1.82		
Being retained at school	-.05	-.17 to .02	-1.57		
Step 2				.123	.117***
Gender	.03	-.03 to .09	0.88		
Being retained at school	-.01	-.10 to .08	-0.18		
Quality of life at T1	.19***	.10 to .23	4.93		
Social support at T1	.07*	.01 to .12	2.16		
Life satisfaction at T1	.15***	.04 to .12	4.11		
Step 3				.296	.174***
Gender	.09**	.06 to .17	3.29		
Being retained at school	.00	-.07 to .08	0.09		
Quality of life at T1	.12**	.04 to .17	3.38		
Social support at T1	.06*	.00 to .10	2.01		
Life satisfaction at T1	.04	-.04 to .06	1.18		
Quality of life at T2	.19***	.11 to .24	5.22		
Social support at T2	-.03	-.08 to .03	-0.85		
Life satisfaction at T2	.32***	.17 to .27	8.84		

Abbreviation: CI, confidence interval.

* $p < .05$. ** $p < .01$. *** $p < .0019$.

COVID-19 pandemic (T2); and (ii) to contribute to clarify the role of cognitive well-being in adolescents' perceptions of the satisfaction of their BPN at school, during the pandemic.

Influences of the COVID-19 pandemic on adolescents' cognitive well-being and on the satisfaction of BPN

When comparing measures of cognitive well-being before and during the COVID-19 outbreak, interesting differences were found, with higher scores observed for satisfaction with life, social support, and perceived quality of life during the pandemic period (T2). This was somehow unexpected, due to the abundant evidence of the negative impact of the pandemic on well-being and mental health (Coelho et al., 2020; Fernández-Abascal & Martín-Díaz, 2021; Morgado et al., 2021; Paulino et al., 2021; Rajkumar, 2020; Soest et al., 2020). However, one must consider the time data were collected (T2): between May and June 2020, by the end of the first confinement period in Portugal. At this time, most services had re-opened and older adolescents have returned to face-to-face classes, which sparked the hope that students of other age ranges (who were still attending online classes) may also return. Additionally, they were allowed to leave home during the day time. The greater cognitive well-being scores at this time may suggest that the relief of restrictions and the return to some normality may have acted both as a

buffer against the negative consequences they had experienced in the previous months and as a lever to compensate for the well-being experienced before the outbreak.

A decrease in SARS-CoV-2 infections and associated container measures during the data collection period could also explain this result. In fact, during confinement, the proportion of adolescents reporting high life satisfaction decreased significantly (Soest et al., 2020), as adolescents reported spending less time with friends and more time with family after the COVID-19 outbreak than before. During this period, an increase in conflicts with parents was observed, impacting the quality of time in family and their ability to in sync with tasks at school (Kapetanovic et al., 2021). Moreover, worries related with the effect of online learning and academic achievement, along with COVID-19-related worries, predicted mental health problems (Magson et al., 2021) and lower life satisfaction in adolescents (Ellis et al., 2020).

It is possible that, even if the COVID-19 pandemic might drastically affect adolescents' life conditions and mental health, the second time data were collected corresponded to ending of the first confinement in Portugal, and the population was allowed to return to the streets and go to restaurants and coffee shops, without the imposition of a severe curfew. This could explain the unexpected increase in well-being at the second assessment, as it may be, possibly, that the ability to somehow return to everyday life substantially impacted adolescents' well-being. Additionally, and as the pandemic context already lasted for a few months, adolescents may have progressively developed coping strategies to more effectively deal with the adversities associated with that context. This might have reinforced the adolescents' sense of self-efficacy, which possibly led to increased levels of cognitive well-being. Sønderskov et al. (2020) also found an increase in psychological well-being from the first to the second wave of the COVID-19, with boys scoring higher in every assessment. These findings are consistent with our results and suggest that cognitive well-being was enhanced after the first confinement (T2), possibly indicating post-traumatic growth and a positive impact on the adolescents' subjective evaluation of their lives. Thus, even if objectively life conditions were maintained or even deteriorated as it was observed (Patrick et al., 2020), daily routines appear to assume a new meaning and are most valued, improving subjective evaluation of their lives after the first confinement (T2).

It is noteworthy that, after the confinement period (T2), both satisfaction with life and quality of life were perceived differently by boys and girls. Boys reported being more satisfied with their life and scored higher in quality of life than girls. This is consistent with the findings from Magson et al. (2021), who observed a significant decrease in life satisfaction after the COVID-19-related lockdown, particularly among girls. Indeed, in our study, although adolescents presented gains from T1 to T2, these gains were smaller for girls than for boys. In fact, girls' cognitive well-being was more stable from T1 and T2, particularly in what concerns their quality of life where no significant changes were observed.

Actually, a gender effect was observed, not only on cognitive well-being variables both before and during the COVID-19 outbreak but also on their change scores (from T1 to T2), suggesting that the pandemic's impact on adolescents' cognitive well-being is affected by their gender, being stronger, wider, and more positive for boys than for girls, who evidence less changes from T1 to T2 on their life satisfaction, social support, and quality of life. This gender effect was observed even after T1 scores on these same variables were controlled. However, pre-pandemic cognitive well-being values seemed to exert a stronger effect on change scores than gender itself, suggesting that previous—and maybe more structural—conditions may have a wider impact on changes on cognitive well-being after such a dramatic event. Though, the impact of the COVID-19 outbreak on adolescents' cognitive well-being may be strongly determined by pre-existent life and personal conditions, probably associated to adolescents'

psychosocial available resources. This strong effect of adolescents pre-pandemic cognitive well-being components on the impact of this dramatic life event reinforces the power of the cognitive subjective evaluation on the individual's impact of life events and his/her development paths. Though, adolescents existing life satisfaction, social support, and/or quality of life explain their cognitive evaluation of upcoming life events, which in turn influences their developmental trajectories and outcomes.

Anyhow, even when controlling for the pre-pandemic values of these variables (T1), gender shows a significant effect on change scores of life satisfaction (moderate effect), social support (weak effect), and quality of life (moderate effect) from T1 to T2. In this sense, girls globally present smaller changes in the levels of satisfaction with life, social support, and quality of life than boys, with this effect being weak to moderate.

Thus, even with an overall improvement in the levels of cognitive well-being in adolescents surveyed from the pre- to post-pandemic period echoed in both boys (with a strong effect in terms of life satisfaction, social support, and quality of life) and girls (strong and moderate effect for social support and life satisfaction, respectively, but not for quality of life, which does not seem to have changed significantly between T1 and T2 for girls), this (positive) effect is influenced by gender, appearing as more marked in boys than in girls.

Interestingly, adolescent girls reported more satisfaction of their BPN than boys (weak effect), which is in accordance with Tian, Chen, and Huebner (2014). This may have occurred because of the core role school assumes, especially for girls, as a unique context where competence, autonomy, and relatedness emerge. After a period of adaptation to online classes, by the time of data collection (May and June), schools may have strengthened its role and endorsed adolescents some normality on this new reality.

The role of cognitive well-being on the satisfaction of BPN

Finally, perceiving a good quality of life and being satisfied with one's life during the outbreak of the COVID-19 were predictive of satisfying BPN at school, after controlling for gender, for being retained at school, and for pre-pandemic levels of quality of life, social support, and satisfaction with life. Although cognitive well-being is mainly conceptualized as a psychosocial outcome in the literature, the school-related well-being was recently considered a meaningful contribution to adaptive outcomes and to the satisfaction of BPN (Huebner & Gilman, 2006; Tian, Chen, & Huebner, 2014). Other studies have also pointed to a relationship with the satisfaction of BPN in each domain (e.g., sport and work; Gagne, 2003; Vansteenkiste et al., 2020). Our data add the school context to this empirical framework and support its key role within the satisfaction of BPN. Moreover, the overall model explained 29.1% of variance of satisfaction of BPN at school, supporting the relevance of cognitive well-being as a dispositional dimension in determining the satisfaction of the need for autonomy, competence, and relatedness in adolescence. As Cantarero et al. (2020) referred, changes in perception may help individuals maintain their sense of autonomy, relatedness, and competence.

Contrarily to other cognitive well-being dimensions, social support did not emerge as a significant predictor of adolescents' satisfaction of BPN at school. This was somewhat unexpected as social and relational factors had been highlighted to explain differences in adolescents' well-being following the COVID-19-related confinement. Considering the social distancing constraints, it is possible that adolescents perceived social support was unrelated to the satisfaction

of BPN at school. Adolescents are regular users of social media networks, which may have helped them to mitigate the impact of confinement in cognitive well-being.

Limitations

Despite of novelty of the current results, generalization and interpretation of data should consider some limitations. We used different methods of sample collection for the two moments. In the first moment, data collection was done with paper and pencil, whereas, in the second moment, adolescents answered the questionnaires online, due to the pandemic constraints and the state of emergency imposed by the Portuguese Government. Although no differences or interaction have been highlighted for sample collection type (e.g., Vosylis et al., 2012), this could have interfered with the results. The sample was mainly constituted by adolescents attending public schools, with a residual number of students attending private and professional schools. Also, the Portuguese version of two of the instruments is still under validation. In addition, no information about life events during confinement (e.g., being infected with the SARS-CoV-2; having a family member infected; and having technological resources required for attending home school with quality) was collected. Therefore, future studies should investigate the role of psychosocial dimensions associated with the pandemic, BPN, and cognitive well-being in adolescents.

CONCLUSIONS

Overall, the pandemic event had a major impact on adolescent well-being and mental health (Ellis et al., 2020; Holzer et al., 2021; Ravens-Sieberer et al., 2021). The current findings highlight the role of cognitive well-being dimensions, such as life satisfaction and quality of life, on the satisfaction of BPN in school during COVID-19 pandemic in Portuguese adolescents. In general, adolescents seem to have coped positively with online classes and to have experienced greater cognitive well-being, during this period of progressive deconfinement, when some normality was reestablished. In summary, quality of life and life satisfaction are closely related to feelings of autonomy, competence, and connectedness at school, even during the stressful period experienced globally all over the world.

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CONFLICT OF INTEREST

The authors declared no conflict of interest.

ETHICS STATEMENT

This study was approved by the authors' affiliation institution ethics committee.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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