# The dark triad and depressive symptoms among chinese adolescents: moderated mediation models of age and emotion regulation strategies

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## Abstract

Dark Triad has been found to relate with depressive symptoms, but the underlying mechanism was rarely investigated. In the present study, we examined the mediating effect of two emotion regulation strategies (cognitive reappraisal and expressive suppression) and the moderating effect of gender and age. 709 Chinese adolescents aged 12–18 years (M = 14.54, SD = 1.70;55.3% girls) filled out the Dirty Dozen, Emotion Regulation Questionnaire and the 10-item of Center for Epidemiological Studies Depression Scale. As expected, Dark Triad was related with increased levels of depression and emotion regulation strategies acted as mediators in these associations. Suppression mediated the relationship between Machiavellianism and depression. Reappraisal and suppression mediated the link between psychopathy and depression. Reappraisal mediated the association between narcissism and depression. Besides, age moderated the effect of Machiavellianism on reappraisal, suggesting Machiavellianism had a negative impact on reappraisal for younger adolescents, but not for older adolescents. Age also moderated the effect of reappraisal on depression, indicating the negative effect of reappraisal on depression was stronger for younger adolescents than for older adolescents. These results address how Dark Triad traits affect depression via emotion regulation strategies and indicate the effectiveness of Dark Triad and emotion regulation strategies may change across age groups.

**Keywords** Dark triad · Depression · Emotion regulation strategies · Cognitive reappraisal · Expressive suppression · Age

## Introduction

Depression is characterized by sustained negative affect, which not only has adverse effects on individual's mental health and social functioning, but also results in huge economic costs for society (McTernan et al., 2013). Due to its wide and severe influences, depression has become a global public health issue. From the view of personality psychology, individuals with depressive symptoms seem to exhibit certain personality characteristics. The relation of personality and mental disorders has been discussed for a long time (Krueger & Eaton, 2010), and Big Five traits (neuroticism, extraversion, conscientiousness, agreeableness, and

openness to experience) is the most concentrated subject. In a meta-analysis from 175 empirical studies, patients with depression report higher levels of neuroticism, and lower levels of extraversion and conscientiousness than health people (Kotov et al., 2010). Besides Big Five traits, more and more researchers started to explore the relationship between depression and the "dark side" of personality, Dark Triad traits.

The Dark Triad is a group of socially malevolent personality traits, which includes three separate but related subclinical traits—Machiavellianism, psychopathy, and narcissism (Paulhus & Williams, 2002). Although these traits share the tendencies toward dishonesty, coldness, and selfishness, they still are different concept. Machiavellianism is characterized by apathy, utilitarianism, cheat and manipulation. Psychopathy refers to high impulsivity, thrill-seeking and low empathy. Narcissism is identified as grandiosity, dominance, and superiority (Paulhus &Williams, 2002). Based

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on life history theory, individuals high in Dark Triad traits apply a fast life strategy exhibited by short-term mating, risk-taking tendency and indifference to social morality (Jonason et al., 2010), in order to gain more reproductive and living resources. Thus, Dark Triad often correlated with aggressive, unethical and antisocial behavior (Sijtsema et al., 2019), and negative mental health outcomes such as depressive symptoms (Gómez-Leal et al., 2019).

Quiet a few of studies have examined the association between Dark Triad and depression among adults (e.g., Bonfá-Araujo et al., 2021; Gómez-Leal et al., 2019; Shih et al., 2019). Except for several evidences (Hansen et al., 2013; Willemsen et al., 2011), the majority of researchers observed that Machiavellian and psychopathic individuals appeared to exhibit higher levels of depression (Gómez-Leal et al., 2019; Gogola et al., 2021; Lyons et al., 2019; Mojsa-Kaja et al., 2021; Shih et al., 2019). As for narcissism, many studies found narcissism seem a "bright" trait of the Dark Triad, and correlated with less signs of depression (Bonfá-Araujo et al., 2021; Lyons et al., 2019; Shih et al., 2019). Whereas, recent findings during the COVID-19 pandemic showed individuals high in narcissism reported increased depressive symptoms (Gogola et al., 2021; Mojsa-Kaja et al., 2021).

Although the association between Dark Triad and depression has been investigated by many studies, participants in these studies mainly recruited from adults, less from other age groups, such as adolescents. Some research have found adolescents with Dark Triad traits could obtain high peer status (De Bruyn, & Cillessen, 2006). But high peer status could not protect them from experiencing emotional pain due to less secure relationships (Jonason et al ., 2010). Conversely, Dark Triad traits were likely to predict their bad mental health and adverse well-being outcomes, like depressive symptoms (Jonason et al., 2015). In the development of depression, adolescence is regarded as a crucial period (Nelemans et al., 2016). Intervention during this period can reduce the severity or persistence of depression disorders (De Girolamo et al., 2012). Thus, the association between Dark Triad and depression is need to be examined in adolescents, in order to figure out risking factors in the process of prevention and treatment of depression. Additionally, the underlying mechanism of the Dark Triad-depression association is still unclear. In particular, there is a lack of research to investigate factors moderating or mediating this association. And most researchers have examined the correlation of Dark Triad and depression in Western societies, few in Asian countries, especially in China. According to Lewis-Fernández and Kleinman (1994), culture had significant influences on the personality and psychopathology. The management of emotions was a major currency of relationships and a hallmark of health in Chinese communities. So,

it is necessary to explore the Dark Triad-depression relationship and the underlying factors, such as emotion regulation, between them among Chinese adolescents.

Emotion regulation, referring to the processes through which individuals influence their own emotional experiences and expressions using a variety of cognitive and behavior strategies (Gross, 1998). Emotion regulation deficits, particularly inappropriate habitual use of emotion regulation strategies, are considered as key components of depressive disorders (Liu & Thompson, 2017) and Dark Triad (Zeigler-Hill & Vonk, 2015). Based on the biopsychosocial model of health psychology (Sarafino & Smith, 2012), coping strategies can mediate the relationship between dispositional characteristics, such as Dark Triad traits, and health-related outcomes. In line with this model, a latest study demonstrated maladaptive cognitive emotion regulation strategies mediate the relationship between Dark Triad and stress, anxiety and depression experienced during the COVID-19 pandemic (Mojsa-Kaja et al., 2021). Hence, it is plausible to regard emotion regulation strategies as mediators between Dark Triad and depression.

As the most widely studied emotion regulation strategies, cognitive reappraisal and expressive suppression have distinct effects on depression. Expressive suppression, referring to the inhibition of outward emotional expression to control emotional responses, was regarded as a maladaptive behavioral strategy resulting in adverse emotional, social and cognitive consequences (Gross, 2002; Gross & John, 2003; John & Gross, 2004) including increased depressive symptoms (Sai et al., 2016). In contract, cognitive reappraisal, defined as an attempt to change one's subjective evaluation of the emotion-eliciting situation to alter its emotional impact, was considered as an adaptive cognitive strategy which is correlated with positive emotional experiences, good interpersonal functioning, and high well-being (Gross & John, 2003; John & Gross, 2004) and effectively relieved depressive symptoms (Sai et al., 2016). In addiction, Dark Triad traits have been shown to be correlated with cognitive reappraisal and expressive suppression. In a latest meta-analysis, psychopathy was significantly correlated with less use of reappraisal and more use of suppression (Walker et al., 2022). A recent work revealed that Machiavellians were habituated to more use of suppression, and narcissists were accustomed to less use of suppression (Akram & Stevenson, 2021). Thus, cognitive reappraisal and expressive suppression may serve as mediating roles in the relationship between Dark Triad and depression.

Moreover, there are gender differences in Dark Triad traits, emotion regulation strategies and depressive symptoms. Men tend to report higher scores in Dark Triad traits (Muris et al., 2017), and prefer to use more expressive suppression than women (Gross & John, 2003). Girls reported

to use more reappraisal and less suppression than boys in Chinese adolescents (Zhao et al., 2014). Yet, female adolescents often reported more symptoms of depression than males (Granrud et al., 2019; Shorey et al., 2021). This may be due to gender differences in the mediating effect of emotion regulation strategies. For example, in the relationship between trait forgiveness and depression, the mediating effect of cognitive reappraisal was significantly greater for girls than for boys (Zhang et al., 2020). So, the mediating effect of emotion regulation strategies between Dark Triad traits and depression are possible to be moderate by gender.

Age differences also existed in Dark Triad, emotion regulation strategies and depression. With age increased, the level of Dark Triad traits have decreased markedly in Japanese samples, and especially in women (Kawamoto, Shimotsukasa, & Oshio, 2020). From childhood to adolescence, boys' depression scores changed little, but girls reported a significantly increased level of depression (Twenge & Nolen-Hoeksema, 2002). Men turn to reappraisal from suppression with age, further enhancing positive mood, reducing negative mood and improving their mental health (Masumoto, Taishi, & Shiozaki, 2016), but women turn to suppression as they grow older (Nolen-Hoeksema & Aldao, 2011).

Given that empirical research of the relations between Dark Triad and depression yielded mixed results, the current study aims to examine the relationship between Dark Triad traits and depression in a Chinese adolescent sample. In addition, considering about the close connections among Dark Triad, emotion regulation and depression, we investigate whether emotion regulation strategies act as mediators between Dark Triad traits and depression and whether gender and age play moderating roles in the mediation model. According to prior studies, We hypothesized that (1) Dark Triad traits will related with increased levels of depression; (2) Dark Triad traits could correlated with more depressive symptoms via less use of cognitive reappraisal and more use of expressive suppression; (3) gender and age will moderate the mediating effect of emotion regulation strategies between Dark Triad traits and depression.

## Method

### Participants

730 students were recruited from two middle and high schools in Henan province, China. After eliminating invalid and extreme data, the sample included 709 adolescents (55.3% girls) aged 12–18 years (M = 14.54, SD = 1.70). Students completed this survey during the normal class period, and they were informed that their responses were anonymous and confidential. Informed consents were obtained from students and their parents.

### Measures

#### Dark triad

The Dark Triad was measured using the Dirty Dozen (DD; Jonason & Webster, 2010). It is a 12- item scale with three subscales: Machiavellianism (4 items, e.g., "I tend to manipulate others to get my way"), psychopathy (4 items, e.g.,"I tend to lack remorse") and narcissism (4 items, e.g.,"I tend to want others to admire me"). Participants were asked to rate statements on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree), and higher scores represented higher levels of Dark Triad traits. DD has been confirmed to have acceptable structural validity across eight world regions (Rogoza et al., 2020). In the present study, the Cronbach's α of Machiavellianism, psychopathy and narcissism subscales were 0.83, 0.62 and 0.84 respectively.

#### Emotion regulation strategies

Emotion regulation strategies were assessed using Emotion Regulation Questionnaire (ERQ; Gross & John, 2003). It is a 10-item questionnaire with two subscales: cognitive reappraisal (6 items, e.g., "I control my emotions by changing the way I think about the situation I'm in") and expressive suppression (4 items, e.g., "I control my emotions by not expressing them"). Participants were asked to rate items on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree), and higher scores represented more use of reappraisal or suppression. ERQ has great validity and reliability in Chinese adolescents and young adults (Wang et al., 2020). In the current sample, the Cronbach's α of reappraisal and suppression subscales were 0.84 and 0.72 respectively.

#### Depressive symptoms

Depressive symptoms were measured using the 10-item of Center for Epidemiological Studies Depression Scale (CESD-10) (Andresen et al., 1994). Participants were asked to rate each statement during the past week on a 4-point Likert scale: 0 (rarely or none of the time, < 1 day); 1 (some or few of the time, 1–2 days); 2 (occasionally or a moderate amount of the time, 3–4 days); 3 (most or all of the time, 5–7 days). All items is calculated to yield a global score, and higher scores indicate more symptoms of depression. CESD-10 has been validated and widely used in the China Health and Retirement Longitudinal Study (Cheng et al.,

**Table 1** Gender and age differences tests of all variables (M ± SD).

| Variables | Total | Boys(306) | Girls(403) | t | Younger(361) | Older(348) | t |
|---|---|---|---|---|---|---|---|
| 1.Machiavellianism | 1.72 ± 0.91 | 1.98 ± 1.04 | 1.53 ± 0.76 | 6.31* * * | 1.73 ± 0.95 | 1.72 ± 0.88 | 0.22 |
| 2.Psychopathy | 2.22 ± 1.04 | 2.42 ± 1.06 | 2.07 ± 1.00 | 4.51* * * | 2.18 ± 1.05 | 2.26 ± 1.02 | -0.98 |
| 3.Narcissism | 3.31 ± 1.54 | 3.49 ± 1.52 | 3.18 ± 1.54 | 2.62* * | 3.13 ± 1.50 | 3.51 ± 1.55 | -3.34* * |
| 4.Cognitive reappraisal | 4.60 ± 1.16 | 4.62 ± 1.13 | 4.60 ± 1.19 | 0.24 | 4.69 ± 1.17 | 4.52 ± 1.15 | 1.93 |
| 5.Expressive suppression | 3.99 ± 1.37 | 4.13 ± 1.31 | 3.89 ± 1.40 | 2.26* | 4.08 ± 1.34 | 3.91 ± 1.39 | 1.63 |
| 6.Depression | 1.01 ± 0.52 | 1.03 ± 0.53 | 0.99 ± 0.52 | 0.83 | 0.97 ± 0.56 | 1.04 ± 0.49 | -1.72 |

Note: * $p < .05$, * * $p < .01$, * * * $p < .001$

**Table 2** Correlations between all variables

| Variables | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1.Machiavellianism | - | 0.40** | 0.38** | -0.07 | 0.14** | 0.26** |
| 2.Psychopathy | | - | 0.36** | -0.20** | 0.18** | 0.30** |
| 3.Narcissism | | | - | -0.09* | 0.04 | 0.17** |
| 4.Cognitive reappraisal | | | | - | 0.07 | -0.28** |
| 5.Expressive suppression | | | | | - | 0.26** |
| 6.Depression | | | | | | - |

Note: * $p < .05$, * * $p < .01$.

2016). The Cronbach's α of CESD-10 was 0.80 in the present sample.

### Data analyses

Descriptive analysis and Pearson correlation analysis of all variables were conducted using SPSS 26.0. Parallel multiple mediation analyses were performed to examine the mediating effects of emotion regulation strategies between Dark Triad and depression by using the PROCESS macro for SPSS (Hayes, 2013). PROCESS model 4 was used to test three mediation models with an independent variable (Machiavellianism, psychopathy or narcissism), two mediators (cognitive reappraisal and expressive suppression) and a dependent variable (depression). Moderated mediation analyses were performed to examine the moderating effects of gender and age by using the PROCESS model 59. We set bootstrapping to 50,000 samples and a 95% confidence interval to determine statistical significance. If the confidence interval of indirect effect exclusive of zero, the mediating effect was considered as significant. According to age, the participants were divided into two groups: the younger group (age 12 to 14) and the older group (age 15 to 18).

## Results

### Common method deviation test

The Harman single factor test was used to examine common method biases. We found 7 factors of which eigenvalues were greater than 1 without rotation, and the first factor could explain 18.84% of the variation, which indicated that

the current study was not influenced by common method biases.

### Gender and age differences

As showed in Table 1, boys reported significantly higher scores on all of Dark Triad traits and more use of expressive suppression than girls. In terms of age, older students showed a significantly higher level of Narcissism than younger students.

### Correlation analyses

Person correlations (Table 2) suggested that Machiavellianism was positively related with expressive suppression and depression. Psychopathy were negatively related with cognitive reappraisal and positively related with expressive suppression and depression. Narcissism was negatively related with cognitive reappraisal and positively related with depression. As expected, cognitive reappraisal was negatively related with depression, and expressive suppression was positively related with depression.

### Mediation analyses

The direct and indirect effects of Dark Triad traits on depression through reappraisal and suppression were presented in Table 3. In model 1, the direct effect of Machiavellianism on depression ($\beta = 0.22$, $p < .001$) and the indirect effect via suppression ($\beta = 0.04$, 95% CI [0.02, 0.06]) was significant, indicating that suppression partially mediated the relationship between Machiavellianism and depression. Machiavellianism predicted higher depressive symptoms partially

**Table 3** Effects of Dark Triad traits on depression via emotion regulation strategies

| Model | Variables | Effect of IV on M | Effect of M on DV | Total effect | Direct effect | Indirect effect | 95% CI |
|---|---|---|---|---|---|---|---|
| Model1 | IV:Mac DV:Dep | | | 0.27*** | 0.22*** | | |
| | M1:CR | -0.08 | -0.27*** | | | 0.02 | [-0.00, 0.04] |
| | M2:ES | 0.15*** | 0.23*** | | | 0.04 | [0.02, 0.06] |
| Model2 | IV:Psy DV:Dep | | | 0.31*** | 0.22*** | | |
| | M1:CR | -0.20*** | -0.24*** | | | 0.05 | [0.03, 0.08] |
| | M2:ES | 0.19*** | 0.22*** | | | 0.04 | [0.02, 0.07] |
| Model3 | IV:Nar DV:Dep | | | 0.15*** | 0.12** | | |
| | M1:CR | -0.09* | -0.27*** | | | 0.02 | [0.00, 0.05] |
| | M2:ES | 0.04 | 0.25*** | | | 0.01 | [-0.01, 0.03] |

Note: IV = independent variable; Dep = Depression; Mac = Machiavellianism; Psy = Psychopathy; Nar = Narcissism; CR = Cognitive reappraisal, ES = Expressive suppression.
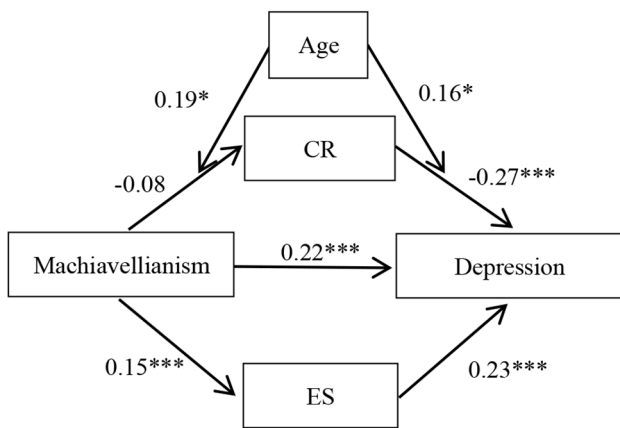
$*\ p < .05,\ **\ p < .01,\ ***\ p < .001.$



**Fig. 1** A moderated mediation model with Machiavellianism as a predictor. (CR=Cognitive reappraisal, ES=Expressive suppression. $***\ p < .001.$)
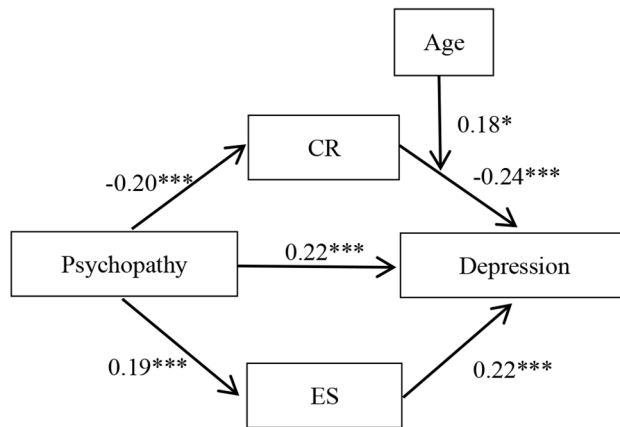


**Fig. 2** A moderated mediation model with psychopathy as a predictor. (CR=Cognitive reappraisal, ES=Expressive suppression.)
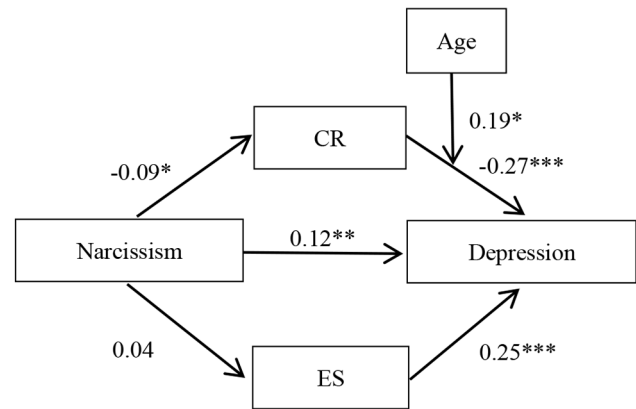


**Fig. 3** A moderated mediation model with Narcissism as a predictor (CR=Cognitive reappraisal, ES=Expressive suppression.)

through more use of suppression. In model 2, the direct effect of psychopathy on depression ($\beta = 0.22$, $p < .001$) and the indirect effects via reappraisal ($\beta = 0.05$, 95% CI [0.03, 0.08]) and suppression ($\beta = 0.04$, 95% CI [0.02, 0.07]) was significant, suggesting that reappraisal and suppression partially mediated the relationship between psychopathy and depression. Psychopathy predicted more depressive symptoms partially through less use of reappraisal and more use of suppression. In model 3, the direct effect of narcissism on depression ($\beta = 0.12$, $p < .01$) and the indirect effects via reappraisal ($\beta = 0.02$, 95% CI [0.00, 0.05]) was significant, showing that reappraisal partially mediated the relationship between narcissism and depression. Narcissism predicted more depressive symptoms partially through less use of reappraisal.

## Moderated mediation analyses

Three moderated mediation models were illustrated in Figs. 1, 2 and 3. Gender was not observed to moderate any associations in these models. Whereas, age was found

to moderate the effect of Machiavellianism on reappraisal (Fig. 1). The negative effect of Machiavellianism on reappraisal was significant for younger students ($\beta$ =-0.17, $p < .01$) but non-significant for older students ($\beta = 0.03$, $p > .05$). Age was found to moderate the effect of reappraisal on depression (Figs. 1, 2 and 3). The negative effect of reappraisal on depression was stronger for younger students ($\beta$ =-0.35, $p < .001$) than for older students ($\beta = -017$, $p < .01$) .

## Discussion

Although Dark Triad traits have been related with depressive symptoms among adults (Bonfá-Araujo et al., 2021; Gómez-Leal et al., 2019; Mojsa-Kaja et al., 2021; Shih et al., 2019), the relationships have not been examined in adolescents and the underlying mechanism was rarely investigated. In this study, moderated mediation models were carried out to investigate the underlying mechanism between Dark Triad and depression with a Chinese adolescents sample. The results determined the positive associations between Dark Triad traits and depression, the mediating effect of emotion regulation strategies and the moderating role of age in these associations .

As expected, Machiavellian adolescents reported more symptoms of depression. This findings correspond with most prior studies (Bonfá-Araujo et al., 2021; Gómez-Leal et al., 2019; Shih et al., 2019), but a cluster-analysic study indicated that high Machiavellianism coexisted with less symptoms of depression (Bianchi & Mirkovic, 2020). This discordance may be interpreted by potential moderators. For example, ability emotional intelligence has been proved to moderate the Machiavellianism-depression association in male. Machiavellian men with high emotional intelligence displayed less depression, but Machiavellian men with low emotional intelligence displayed more depression (Bianchi et al., 2020).

Also, in line with previous results (Bonfá-Araujo et al., 2021; Gómez-Leal et al., 2019; Shih et al., 2019), psychopathic adolescents exhibited increased levels of depression. However, particular works suggested the opposite evidences, indicating that depressed male prisoners scored lower in the Psychopathy Checklist-Revised (PCL-R) (Hansen et al., 2013; Willemsen et al., 2011). This incongruent result may be accounted for two facets of psychopathy, clinical and subclinical psychopathy. The PCL-R is developed and validated on criminal samples, and includes lots of items involving criminality. It is adapted for measuring clinical psychopathic personality in prisoners, not subclinical psychopathy. When the Levenson Self-Report Psychopathy Scale (LSRP) was employed to measure subclinical psychopathy among male offenders, psychopathy

exhibited a positive correlation with depression (Pennington et al., 2015), which was consistent with results in normal populations.

Consistent with our hypothesis, adolescents high in narcissism experienced more depressive symptoms. With regard to the relation of narcissism and depression, many researchers discovered narcissism was correlated with reduced depressive symptoms and may serve on a protective factor for depression disorder (Bonfá-Araujo et al., 2021; Lyons et al., 2019; Shih et al., 2019), while others found narcissism was correlated with increased depressive symptoms (Gogola et al., 2021; Mojsa-Kaja et al., 2021). This contradiction could be explained by two subdimensions of narcissism, vulnerability and grandiosity, which have different associations with depressive symptoms. Vulnerable narcissism is commonly regarded as a risk factor for depression (Papageorgiou, Denovan & Dagnall, 2019), but grandiose narcissism seems to be associated with a lower level of depression (Papageorgiou et al., 2019). Considering the narcissism scale of Dirty Dozen used in this study displayed more relation with the vulnerability dimension (Maples et al., 2014), the positive association between narcissism and depression we found is reasonable.

In regard to the mediating effects, our work proved that adolescents high in Dark Triad traits displayed improper use of emotion regulation strategies, bringing out an increased risk of depression. To be specific, Machiavellian individuals tended to apply expressive suppression leading to their higher level of depressive symptoms. For Machiavellians, manipulation of others requires hiding their own emotions to get what they want, leading to more use of expressive suppression (Walker et al., 2022). Although they can obtain short-term benefits by suppressing emotional expressions, their mental health will be impaired in the long run. Psychopaths are inclined to use expressive suppression and less likely to use cognitive reappraisal, which result in more symptoms of depression in them. This finding corresponds to the meta-analysis results (Walker et al., 2022), it may indicate that people high in psychopathy are unable to reappraise the adverse situations, and switch to apply suppression to regulate their own emotion processes. This habit of emotion regulation will further cause negative outcomes, such as depressive disorders. Narcissists are prone to less use of cognitive reappraisal which can give rise to their depressive symptoms. As for narcissists, they tend to seek admire, attention, and special favors from others. In China, adolescents high on narcissism need to achieve outstanding academic performance in order to obtain applause or reward from teachers and parents, and to gain the superiority status among peers. It is difficult to get prestige or status in the class by other ways. Thus, when facing stressful situations such as failure in the exam, narcissistic students can

not have a different way of looking at them, suggesting less use of cognitive reappraisal accompanying with a increased risk of depression.

Unexpectedly, gender was not observed to moderate any associations in mediation models. Although we observed that boys displayed higher levels of Dark Triad traits and more use of expressive suppression, they didn't reported more symptoms of depression than girls. Considering the previous finding (Bianchi et al., 2020), there might exist some variables, such as ability emotional intelligence, moderating the relationship between Dark Triad and depression among boys. These moderators can make Dark Triad traits become protective factors of depression in boys. Researchers should further explore potential moderators in order to explain inconsistent results of gender differences in Dark Triad, emotion regulation strategies and depression.

Age was found to moderate the effect of Machiavellianism on reappraisal and the effect of reappraisal on depression. Increased with age, the adverse impact of Machiavellianism on cognitive reappraisal was greatly lessened to non-significant. That is probably because younger adolescents are going through the transition from childhood to adolescence with dramatic biological and psychological changes (Götz et al., 2020). During this period, negative attitudes such as suspiciousness, mistrust, negativity, and cynicism may have significantly negative impact (Zhu et al., 2021). Then, the adverse impact disappeared with maturity.

Similarly, the weakening effect of cognitive reappraisal on depression was significantly attenuated with age. According to past studies (Nolen-Hoeksema & Aldao, 2011; Vannucci et al., 2018), the effectiveness of adaptive emotion regulation strategies may be susceptible to developmental changes in social contexts and stressor types. For instance, cognitive reappraisal was negatively related with depression under uncontrollable stress, while cognitive reappraisal was positively related with depression under controllable stress (Troy et al., 2013). Rather than gender differences, researchers have paid less attention to age changes in the use and effectiveness of emotion regulation strategies, which was not helpful to choose the most appropriate strategies to relive negative emotions at different ages, especially for children and adolescents. So, it is essential to investigated the developmental changes in the effect of emotion regulation strategies on mental health.

## Implications

This work confirmed the relationship of Dark Triad traits and depression in adolescents. Consistent with most results from adults, adolescents with higher levels of Dark Triad traits experienced increased symptoms of depression. This result enriched the profile of Dark Triad traits, and provided more evidence for the passive impact of Dark Triad on mental health.

For the first time, this study examined the mediating effect of suppression and reappraisal between Dark Triad and depression. More specifically, suppression mediated the Machiavellianism-depression association; reappraisal and suppression mediated the psychopathy-depression link; and reappraisal mediated the narcissism-depression association. These results provided a better understanding of the potential mechanism of Dark Triad on mental health. For different Dark Triad traits, we should take pertinent intervention focusing on effective emotion regulation strategies to reduce negative emotional states.

Significantly, we observed the moderating role of age between reappraisal and depression in adolescents. This finding is in keeping with the previous work (Vannucci et al., 2018), suggesting the effectiveness of emotion regulation strategies, such as cognitive reappraisal, may change across developmental age. Given the effect of reappraisal on depression is relatively weak for older adolescents, psychological teachers or counselors should consider more adaptive strategies and suitable therapies for them, such as interpersonal therapy to improve social functioning and mindfulness training aimed at paying attention to the present moment.

## Limitations and future directions

Whereas, several limitations should be noticed in this study. First, the Dirty Dozen (DD) we used can not cover the different facets of Dark Triad traits which may have distinct effect on depression, such as two subdimensions of narcissism (vulnerability and grandiosity). The more comprehensive measurements should be applied to explored the relation of Dark Triad traits and mental disorders. Second, our analysis only included two emotion regulation strategies (cognitive reappraisal and expressive suppression), but they were insufficient to fully explain the relationships between Dark Triad and depression. In future, researchers should concerned about more cognitive and behavior strategies in the processes of emotion regulation. Third, the 12–18 age range of adolescents in the current study was not wide, so the moderating effects of age we observed may be not significant in other age groups, such as children and adults. A sample covering more ages was needed to explore the developmental changes in the use and effectiveness of Dark Triad and emotion regulation strategies. Fourth, although some of the correlations in this study were significant, their sizes were relatively small. For instance, the correlation coefficient between narcissism and reappraisal is -0.09 ($p < .05$). This probably was due to the large sample size. So

the relationship between narcissism and reappraisal need to be further explored.

Finally, this study did not address the influence of specific negative events such as COVID-19 pandemic (Ren et al., 2021) and bullying experience (Ngo et al., 2021) on adolescents' mental health. Considering about previous findings during COVID-19 pandemic (Gogola et al., 2021; Mojsa-Kaja et al., 2021) and related evidences of bullying (Geel et al., 2017), it is necessary to investigate the underlying mechanisms of Dark Triad and depression related to specific negative events.

**Data availability** The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request

## Declarations

**Ethical approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards

**Informed consent** Informed consent was obtained from all participants and their parents included in the current study

**Conflict of interest** None

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