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Too Much of a Good Thing: Curvilinear Effect of the Positivity Ratio on Emotional Dysfunction and Perceived Resources in Adolescent Females

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Abstract

Background: The benefits of a broadened mindset across moments of positivity accumulate over time and build enduring personal resources. Positivity can transform one's life for the better, enhancing health and building greater resilience to adversity. Evidence is strong that positivity is a key active ingredient in flourishing mental health, however, less is known about the upper limit of positivity for optimal functioning.

Aim: This study examined if exceedingly high positivity ratios – experienced positive to negative emotions – were associated with increased emotional dysfunction (stress, depressive symptoms) and downturned perceived personal (resilience, hope) and environmental (social support, school connectedness) resources.

Methods: Participants (N=510) attending an all-girls public school completed a survey assessing positive/negative emotions (the positivity ratio), emotional dysfunction, and perceived personal and environmental resources. Linear and quadratic regression equations for the relationship between the positivity ratio and emotional dysfunction and perceived resources were modeled and compared.

Results: The relationships between the positivity ratio and both emotional dysfunction and perceived resources were best fit by quadratic equations, indicative of enhanced functioning up to a point, beyond which functioning decreased at the highest levels of positivity.

Conclusion: More frequent experiences of positive emotions and/or less frequent experiences of negative emotions are adaptive, within bounds, in promoting emotional functioning and helping adolescents perceive greater availability of personal and environmental resources.

Keywords: Positive emotions; Hope; Resilience; Connectedness; Stress; Depressive symptoms

Introduction

Adolescence is a developmental period marked by rapid physical and psychological changes. Adolescent females are more likely than males to experience a decrease in emotional functioning (e.g., increased perceived stress and depressive symptoms), particularly those lacking the resources essential for personal growth [1]. According to the Broaden-and-Build Theory of Positive Emotions, experiences of positive emotions influence emotional functioning by fostering the awareness and growth of adaptive personal (e.g., hope, resilience) and environmental (e.g., social support, school connectedness) resources. There is reason to believe that adolescents who experience a greater ratio of positive to negative emotions benefit from a broadened range of perceptions, ideas, and actions [2] – the *broaden effect* – and that over time, repeated experiences of positivity build a variety of enduring personal and environmental resources such as improved adaptation to adversity and greater resilience, [3] more thoughtful decision making, and greater social connection [4] – the *build effect* [5,6]. Conversely, adolescents experiencing too few and/or dysregulated positive emotions would report poorer emotional functioning, including increased stress and depressive symptoms [7].

The frequency that a person experiences positive versus negative emotions is termed the positivity ratio, and is a widely-used indicator of well-being in positivity research [8,9]. Among adults, this ratio has distinguished individuals who lead a flourishing life - full of meaning, possibility, and growth - from those who desire more meaning and purpose [7]. Conversely, non-flourishing individuals describe their lives as being "stuck in a rut" and "yearning for more" [10], and report only moderate levels of mental health [11]. Although ample evidence using adult samples supports the role of higher positivity ratios in predicting flourishing mental health and greater resilience to adversity, the positivity ratio has rarely been employed with adolescent samples. Given that the positivity ratio has successfully predicted levels of adult well-being, one could speculate that it may function similarly in adolescents. By age nine, youth are able to experience and understand simultaneous positive and negative emotions [12]; however, well-being decreases during adolescence [13], potentially complicating the hypothesized relationship with positivity. The utility of the positivity ratio in relation to indicators of well-being (e.g. perceived resources and emotional function) among adolescents thus represents an intriguing question.

A key point in Fredrickson's [8] latest review of positivity ratios, was the assertion that the relationship between positivity and adaptive functioning is nonlinear—specifically, that positivity rising without an appropriate increase in negativity, is associated with diminished flourishing. Adult research supports this hypothesis, demonstrating

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that positivity above a certain point is accompanied by a downturn in proactive behavior [14], creativity [15], and adaptive functioning under stress [16]. Consequences of excessive positivity have not been examined in adolescents, although we expect a similar pattern to emerge given that adolescents are capable of experiencing mixed emotions [12]. To inform more targeted positivity-promoting educational interventions, the present study aimed to characterize the nature of the relationship between positivity and emotional dysfunction and between positivity and personal and environmental resources, with emphasis on the upper reaches of the positivity ratio. Specifically, we determined if a nonlinear pattern best represents the associations, hypothesizing that a quadratic equation would account for more variance than a linear equation for: 1) the relationship between positivity and emotional dysfunction (e.g., perceived stress, depressive symptoms), representing a U-shaped relationship; and 2) the relationship between positivity and personal (e.g., hope, resilience) and environmental (e.g., social support, school connectedness) resources, representing an inverted U-shaped relationship.

Method

Study participants

Participants were students between 11 to 18 years old attending an all-girls public school in the southwest United States. Participants returned a signed parent consent form, available in both English and Spanish, and signed a student assent form. Self-report surveys were completed and collected during the students' advisory period. Students did not receive extra credit for participating, although they did receive a small bottle of lavender-scented hand lotion for returning a signed parent consent form, and a small deck of 10 inspirational quote cards for completing the self-report survey. The University's Institutional Review Board and the participating school district approved all study procedures.

School enrollment included 684 students in grades 6 through 12 with an ethnic distribution of 58% Hispanic, 24% Caucasian, 11% African American, 4% Asian American, and 3% Other. Sixty-five percent of the student body was from low-income families who qualified to receive school meals at discounted or no cost. Students who elected to participate (N=510) represented a final response rate of 75% of the total enrollment, which was reflective of the school's ethnic distribution, and included: 6th grade (n=99, 76%); 7th grade (n=118, 84%); 8th grade (n=95, 84%); 9th grade (n=57, 59%); 10th grade (n=65, 71%); 11th grade (n=40, 70%); and 12th grade (n=36, 69%).

Measures

Demographics

Participants reported their age, grade level, and ethnicity. Perceived family income was assessed using the question, "In terms of income, what best describes your family's standard of living in the home where you live most of the time?" with response options including: 1 (*poor*), 2 (*nearly poor*), 3 (*just getting by*), 4 (*living comfortably*), and 5 (*very well off*).

Emotional dysfunction

Emotional dysfunction was assessed using two measures: perceived stress and depressive symptoms. Perceived stress was measured using the 10-item Perceived Stress Scale (PSS) [17], defined as how overloaded students felt and the degree to which stressful life situations were perceived as unpredictable and uncontrollable, on a 5-point scale ranging from 0 (*never*) to 4 (*very often*). Internal consistency was strong (α=0.85). Depressive symptoms was measured using the 20-item Center for Epidemiologic Studies Depression (CES-D) scale, defined as students' experiences of depressed mood, feelings of guilt, worthlessness, helplessness, and restless sleep, on a 4-point scale ranging from 0 (*rarely or none of the time; less than one day*) to 3 (*most or all of the time; 5 to 7 days*) [18]. To minimize conceptual overlap with the positive emotion items, 4 positively worded items on the CES-D were omitted [19]. Internal consistency was strong (α=0.91).

Positivity ratio

The positivity ratio is the quotient of one's experienced positive emotions to negative emotions, as measured by the 20-item Modified Differential Emotions Scale (mDES) [20,21]. Ten items assessed students' positive emotions and ten items assessed negative emotions over the past two weeks on a scale ranging from 0 (*never*) to 4 (*most of the time*). Positive emotions rated at least a 2 (*some of the time)* and negative emotions rated at least a 1 (*hardly experienced*) were tallied with the different thresholds in place to account for positivity offset and negativity bias. Positivity offset reflects that most individuals usually feel at least mild levels of positive emotions during the day [22], while negativity bias reflects that negative events have more weight and thus a stronger impact than positive events [23]. The mDES was reliable in the current study for both positive (α=0.91) and negative (α=0.89) emotions. A positivity ratio score was calculated by dividing the positive emotion sum by the negative emotion sum; if the sum of the negative emotion items was 0, it was recoded as 1 to prevent division by 0 [21]. Sums rather than means were used in computation to allow for more score variation.

Personal and environmental resources

Two personal resources (hope, resilience) and two environmental resources (social support, school connectedness) were assessed. Hope was measured using six items from the Children's Hope Scale (CHS) [24], which assessed two interrelated, goal-directed thinking components: agency and pathways. Agency thoughts reflect the perception that one can initiate and sustain action toward a desired goal, while pathway thoughts reflect one's capability to envision ways to achieve a desired goal. Students responded how they generally felt on a scale from 1 (*none*) to 6 (*all of the time*). A total score was calculated as the sum of all items; internal consistency was strong (α=0.90).

Resilience was defined as one's perceived ability to recover from stress and measured using the Brief Resilience Scale (BRS) [25]. The BRS consists of six items with response options ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). A resilience score was calculated as the mean of all items [25], and internal consistency was adequate (α=0.77).

Social support was defined as the perceived social support students received from family, friends, and significant others, and measured using The Multidimensional Scale of Perceived Social Support (MSPSS) [26]. The scale consists of 12 items with four statements addressing each of the three support sources with responses ranging from 1 (*very strongly disagree*) to 7 (*very strongly agree*). A total score was calculated as the 12-item sum; internal consistency was strong (α=0.94).

School connectedness was defined as the psychological bond that students felt toward the school, and measured using the School Connectedness Scale (SCS) [27]. The scale consists of five items drawn from the National Longitudinal Study of Adolescent Health adapted by Resnick et al. [27] with responses ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). A total score was calculated as the sum of all items; internal consistency was strong (α=0.85).

Variable	Mean	*SD*	PS	DS	PR	H	R	SS
Perceived Stress (PS)	18.24	6.26						
Depressive Symptoms (DS)	12.07	8.53	0.63*					
Positivity Ratio (PR)	1.95	2.07	-0.50*	-0.43*				
Hope (H)	24.71	6.31	-0.58*	-0.51*	0.46*			
Resilience (R)	3.29	0.70	-0.55*	-0.51*	0.41*	0.54*		
Social Support (SS)	68.85	13.06	-0.39*	-0.45*	0.36*	0.52*	0.33*	
School Connectedness	19.86	3.89	-0.41*	-0.43*	0.33*	0.55*	0.37*	0.54*

Note: *p<0.01

Table 1: Means, standard deviations (*SD*) and bivariate correlations for study variables (*N*=510).

Dependent variables	Equation	Model Summary (adjusted for age, ethnicity and income)						Bivariate Parameter Estimates			
		R^2	R^2 Change	F Change	df1	df2	Sig. F Change	Constant	b	a	Minimum
Perceived Stress	Linear	0.34	0.20	150.83	1	501	0.000	21.19	-1.51	0.36	6.78
	Quadratic	0.42	0.09	76.42	1	500	0.000	24.80	-4.84		
Depressive Symptoms	Linear	0.24	0.16	106.96	1	501	0.000	15.52	-1.77	0.54	6.30
	Quadratic	0.46	0.12	93.20	1	500	0.000	20.95	-6.78		

Note: Minimum value calculated using x = -b/2a from the quadratic equation $ax^2 + bx + c$. Perceived stress, for example: 6.78 = -(-4.84)/2(.36).

Table 2: Results of regressing perceived personal resources on the positivity ratio using linear and quadratic equations.

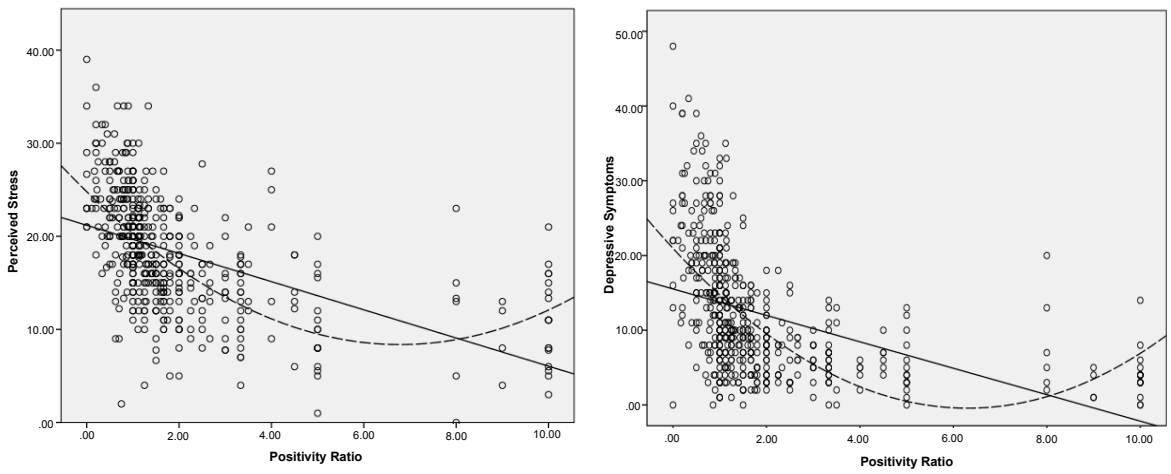

Figure 1: Comparison of the linear and quadratic relationship between the positivity ratio and mental health indices.

Statistical analyses

Mean values or percentages, standard deviations, and bivariate correlations of study variables were examined by descriptive statistics. Pearson correlations were computed for continuous variables, and point-biserial correlations for continuous and dichotomous variables. Prior to correlation analyses, ethnicity was coded to create three categories: Caucasian, Hispanic, and Other. All analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 23.

To test if the relationship between the positivity ratio and emotional dysfunction was better characterized by a quadratic rather than linear equation, perceived stress and depressive symptoms were regressed on the positivity ratio in two separate hierarchical regression models, using the following steps. In step 1, age, perceived family income, and ethnicity were entered as covariates. In step 2, the positivity ratio was mean-centered and entered. Finally, the square of the mean-centered positivity ratio was entered in step 3. R-square change statistics were calculated after steps 2 and 3 to determine if including the positivity ratio and positivity ratio squared improved model fit, respectively. A significant fit increase after step 3 would indicate that the quadratic equation characterized the relationship between positivity and emotional dysfunction components better than the linear model. To test if the relationship between the positivity ratio and reported resources was better fit by a quadratic rather than linear equation, the same steps outlined above were performed using four separate hierarchical regression models (one for each resource).

To illustrate the point at which the positivity ratio was associated with the lowest average score on each emotional dysfunction component, the x-value (positivity ratio) at which the quadratic curve reached its minimum y-value (emotional dysfunction component mean score) was calculated using the formula: x=-b/2a; where a=the quadratic coefficient and b=the linear coefficient from the quadratic equation: $ax^2 + bx + c$. This procedure was repeated to determine the positivity ratio associated with the highest average score on each resource, using instead the x-value at which the quadratic curve reached its maximum.

Results

Descriptive statistics and bivariate correlations

The majority of students reported their perceived level of family income as "living comfortably" (68%), followed by "just getting by" (23%), "very well off" (7%), "nearly poor" (1%), and "poor" (1%).

Dependent variables	Equation	Model Summary (adjusted for age, ethnicity and income)						Bivariate Parameter Estimates			
		R^2	R^2 Change	F Change	df1	df2	Sig. F Change	Constant	b	a	Maximum
Hope	Linear	0.27	0.18	125.66	1	500	0.000	21.97	1.41	-0.35	6.66
	Quadratic	0.37	0.09	71.50	1	499	0.000	18.40	4.70		
Resilience	Linear	0.20	0.17	103.99	1	501	0.000	3.02	0.14	-0.03	6.88
	Quadratic	0.27	0.07	45.44	1	500	0.000	2.69	0.44		
Social Support	Linear	0.20	0.11	67.11	1	500	0.000	64.38	2.29	-0.64	6.45
	Quadratic	0.27	0.07	45.48	1	499	0.000	57.91	8.27		
School Connectedness	Linear	0.15	0.08	49.14	1	500	0.000	18.66	0.62	-0.20	6.19
	Quadratic	0.24	0.09	56.25	1	499	0.000	16.62	2.50		

Note: Maximum value calculated using x = -b/2a from the quadratic equation $ax^2 + bx + c$. Hope, for example: 6.66 = -4.70/(2(-.35).

Table 3: Results of regressing perceived personal and environmental resources on the positivity ratio using linear and quadratic equations.

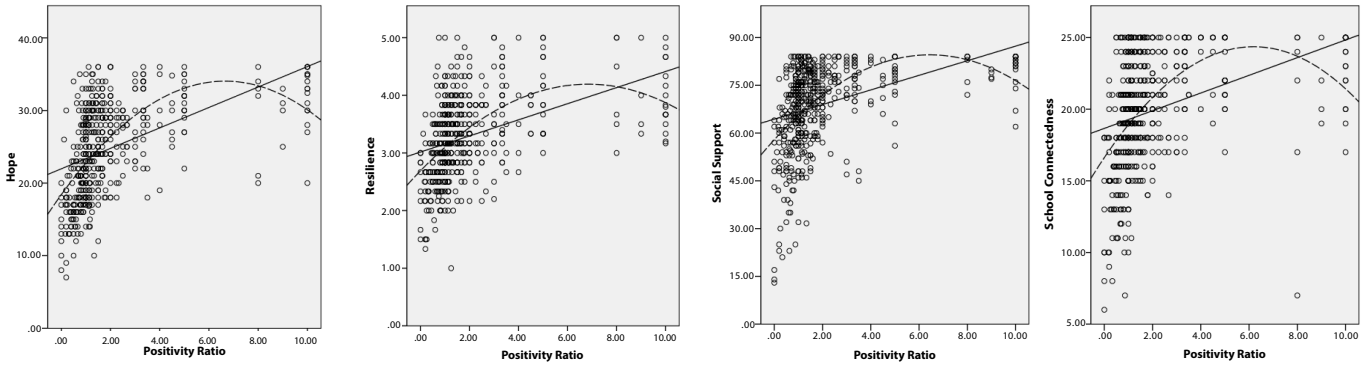

Figure 2: Comparison of the linear and quadratic relationship between the positivity ratio and perceived personal and environmental resources.

Students with higher perceived family income reported lower perceived stress and depressive symptoms, and higher levels of personal and environmental resources. Age was positively associated with perceived stress (r=0.26, p<0.01) and depressive symptoms (r=0.13, p<0.01), and negatively associated with the positivity ratio (r = -0.20, p<0.01). There was a negative association between age and each resource except for resilience, such that older students reported less hope (r=-0.18, p<0.01), social support (r=-0.14, p<0.01), and school connectedness (r=-0.22, p<0.01) than younger students. Table 1 displays descriptive statistics and bivariate correlations for perceived stress, depressive symptoms, the positivity ratio, and all resource variables.

Linear and curvilinear regression

Results of the regression models predicting emotional dysfunction components are presented in Table 2. Considering first the linear equations, the addition of the positivity ratio (step 2) improved model fit (F change: p<0.001 for all) beyond variance explained by the covariates (step 1). Addition of the positivity ratio squared as the quadratic term (step 3) improved model fit for both perceived stress and depressive symptoms (F change: p<0.001 for both), indicating that a quadratic equation characterized the relationship between the positivity ratio and emotional dysfunction better than the linear equation (Figure 1). The positivity ratios at the lowest average score on perceived stress and depressive symptoms – labeled "minimum" and representing where the relationship shifts from negative to positive - are shown in the far-right column of Table 2.

Table 3 shows the results of the regression models predicting personal and environmental resources, respectively. First examining the linear equations for the four resources, the addition of the positivity ratio (step 2) improved model fit (F change: p<0.001 for all) beyond variance explained by the covariates (step 1). Addition of the positivity ratio squared as the quadratic term (step 3) improved model fit for all reported resources (F change: p<0.001 for all), indicating that a quadratic equation better characterized the relationship between the positivity ratio and all resources compared to the linear equation (Figure 2). The positivity ratios associated with the highest average score on each reported resource – labeled "maximum" and representing where the relationship turns from positive to negative - are shown in the far-right column of Table 3.

Discussion

The present study examined if extremely high levels of positivity were associated with increased emotional dysfunction (stress, depressive symptoms) and downturned perceived personal (resilience, hope) and environmental (social support, school connectedness) resources. As hypothesized, the relationships between the positivity ratio and both emotional functioning and reported resources were best fit by a quadratic equation indicative of a decline in functioning at the highest positivity levels. These findings are broadly consistent with prior adult literature demonstrating that well-being reaches a tipping point at elevated levels of positivity.

The results of this study establish evidence for the nonlinear relationship between positivity and adolescent emotional functioning. Among adults, creativity [15] and adaptive stress response [16] both increase with positivity before down-turning as positive emotions excessively surpass negative emotions. However, these studies restricted their positivity ratios so that the true upper bounds were undetectable. Here, we calculated the positivity ratio using sums rather than means, which allowed a wider range of positivity ratios. Future work using the mDES with adolescent and adult samples in the same study would help elucidate age group differences at the highest levels of positivity.

These results pose an intriguing question: Why might mental functioning decrease at the highest levels of positivity? Oishi et al. [28] state that extreme happiness fails to produce the "slight dissatisfaction" that motivates people to set goals, work to promote change, and strive for self-improvement. A similar elevated comfort level may be why our study participants with excessive positivity reported less available resources. Content individuals may have less need to seek out resources that improve their functioning, which could lower perception of available resources.

Noticeably, 94.7% of our sample had positivity ratios five or below, while 5.3% had values eight or above, with none between five and eight. We repeated the curvilinear regression analyses using positivity ratio raw scores rather than frequencies, and the results did not change substantively. Based on the scoring method utilized, those students in the top 5.3% of positivity ratios reported a combination of excessively high positive emotion scores and exceptionally low negative emotion scores. That is, in order to have positivity ratio of eight to ten, students must have reported at least eight positive emotions and only zero or one negative emotions. The challenge for these students appears to be a lack of appropriate negativity to balance high levels of positivity.

The point at which the decrease in mental health and reported personal/environmental resources occurs should also be considered. Fredrickson and Losada [7] proposed 11.6 as the threshold at which flourishing begins to disintegrate, and the range in this study of 6.19 to 6.88 for all mental functioning outcomes is considerably lower. As this is the first study to examine the positivity ratio in a nonlinear way using the mDES, the present study offers an initial point of reference for investigating excessive positivity using this scale.

There is reason to believe this study's results are generalizable to the larger population of adolescent females. This sample was racially/ethnically diverse, and included large numbers of students from various socioeconomic backgrounds. Further, the mean positivity ratio of our sample (M=1.96) was similar to that reported in a comparable sample of 405 female adolescents ages 12-15 (M=2.06) [29]. The age range of our sample spanned wider by including all high school grade levels, and thus captured the full spectrum of adolescent ages. Although the age range in our study was a strength, future research into if and how the relationship between positivity and functioning shifts as girls progress through their teenage years may also provide interesting results to questions focused on changes that occur within adolescence.

Findings from the present study should be considered with the following limitations. First, the design was cross-sectional, which does not permit determination of causality or directionality. Second, the data were also vulnerable to error due to common-methods bias and survey self-reporting. Additionally, emotional dysfunction was assessed using only two components, which is less comprehensive than in other studies. Future research in this area should consider other psychosocial factors that are especially relevant to adolescent emotional functioning. Finally, the PSS and CES-D are biased towards general/global recall, whereas the mDES requires short-term recall. This temporal misalignment could result in a misrepresentation of excessive positivity experienced from just the prior two weeks, discounting previous weeks of low positivity that would otherwise "balance" positivity assessed over a longer time frame reflective of the general/global recall scales.

Conclusion

This study investigated if exceptionally high values of positivity were associated with a negative shift in mental health and perceived resources. The relationship between the positivity ratio and both mental health and reported resources was best fit by a quadratic equation indicating a downturn in functioning at the highest levels of positivity. Increased experiences of positive emotions and/or decreased experiences of negative emotions—up to a point—may help adolescents perceive greater resource availability and promote flourishing during this psychologically challenging time.

Human Subjects Approval Statement

All procedures were approved by The University of Texas at Austin Institutional Review Board. Parent informed consent and student assent were obtained prior to data collection.

Conflict of Interest Disclosure Statement

The authors declare no conflict of interest.

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