Testing the indirect effects of somatic and parental effort on stress: the roles of worldviews and coping strategies

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Abstract

Life history theory (LHT) is a mid-level theory from evolutionary biology. LHT, adapted to humans, assumes that individuals can be placed along a single continuum of LH strategies referred to as the slow-to-fast LH continuum: faster life history strategists score higher on mating effort and lower on somatic and parental effort. In the present study we examine the hypothesis that worldview and coping strategies are mediators between somatic and parental effort (SPE) and current perceived stress. 226 participants completed a set of instruments: Mini-K, the World Assumptions Scale, Brief COPE, and the Perceived Stress Scale. In order to test the hypotheses about mediators, Structural Equation Modeling (SEM) was used. The results from the current study showed that individuals allocating their own resources to SPE experienced lower current stress, and felt positive about the benevolence and meaningfulness of the world as well as the worthiness of the self. A more complex linkage was also revealed: individuals displaying SPE endorsed stronger beliefs about self-worth, which in turn was associated with a lower tendency to use disengagement coping and which again translated into a lower level of perceived stress. Furthermore, females investing in SPE maintained a higher level of belief in the meaningfulness of the world, which translated into a higher tendency to use external support for coping.

Keywords Life history strategy · Somatic and parental effort · Stress · Coping strategies · Self-worth · Worldviews

Introduction

According to many researchers psychosocial stress experienced in early childhood determines the type of an individual's reproductive strategy (e.g. Belsky 2014; Cabeza de Baca

and Ellis 2017; Del Giudice and Belsky 2011; Ellis 2004; Ellis et al. 2016b; Mell et al. 2017). The original prediction about this was made in the theory of socialization by Belsky and others (Belsky et al. 1991), which emphasized that early exposure to family stressors (marital discord, single parenthood, unstable employment) leads to harsh parenthood and therefore to insecure attachment, accelerated puberty, earlier sexual activity, short-term pair bonding and limited parental investment. Recently, this theory in a much more generalized and complex form has been named the psychosocial acceleration theory (Ellis 2004) which “addresses the contextual regulation of rate of development (i.e., speeding up, slowing down) in the service of (reproductive) fitness goals” (Belsky 2014, p. 16). This issue is discussed and explored in the context of concepts referring to the evolutionary theory of life history (e.g. Del Giudice and Belsky 2011; Del Giudice et al. 2011; Ellis and Del Giudice 2014; see also Del Giudice et al. 2015) although, in principle, it omits such important psychological variables as worldview and coping strategies, which in the psychology of stress are considered to be important factors that influence the experience of stress that follows traumatic events (Bonanno et al. 2011; Goldenberg and Matheson 2005; Ireland et al.

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2005; Mancini et al. 2011; O'Connor and Elklit 2008). The intention of this article is to try and fill this gap.

Life History Strategies

Life history theory (LHT) assumes that individuals' reproductive strategies (LH strategies, LHS) depend on a specific allocation of material and bioenergetic resources of the body (Gadgil and Bossert 1970). Two basic directions of this allocation are the somatic effort associated with the organism's survival (e.g. the maintenance of vital functions or the development of an organism, but also in humans' acquisition of knowledge, education or skills) and the reproductive effort associated with having a child (Del Giudice and Belsky 2011; Figueredo et al. 2006; Griskevicius et al. 2011b). Reproductive effort, in turn, consists of mating effort of attracting and maintaining a partner (e.g., intrasexual rivalry and, in the case of humans, partner retention tactics, jealousy, etc.), parental effort, and nepotistic effort, aimed at helping a genetically related person (apart from one's own child). The so-called fast strategies prioritize reproductive over somatic effort and mating over parental effort, while slow strategies prioritize somatic over reproductive and parental over mating effort (Figueredo et al. 2012).

There are different correlates of LH strategies; for example the slow strategy involves a tendency towards later sexual maturation (Copping et al. 2014), long-term relationships, is linked with better mental and physical health, self-worth, moral intuitions and secure attachment while the fast strategy is linked with a drive towards short-term relationships (see: Figueredo et al. 2013; Gladden et al. 2010), early puberty and initiation of sexual activity (Del Giudice and Belsky 2011), a higher level of paranoia, depression, anxiety, lower level of general trust (Chua et al. 2017). The slow strategy develops in an early-life environment characterized by low levels of unpredictability and harshness, while the fast strategy develops under ecological stress and unpredictable environmental changes (Ellis et al. 2009; Griskevicius et al. 2013). Life history strategies are responsive to several types of environmental cue, for example mortality cues in the current environment and resource scarcity in childhood, indicated by family socioeconomic status (SES, Griskevicius et al. 2013; Mittal and Griskevicius 2014). The development of LH strategies also correlates with different family factors: fatherlessness in early childhood, marital conflicts, parental investment and attachment style (Belsky et al. 1991; Del Giudice and Belsky 2011). For instance, the absence of the father in childhood accelerates sexual maturation whereas the presence of the father leads to delayed maturation in girls (Belsky et al. 1991; Draper and Belsky 1990; Draper and Harpending 1982). However, not only family or environmental but also genetic factors can influence the formation of LHS (see Gibbons et al. 2012). For instance, behavioral genetic

studies suggest (Mendle et al. 2009) that genetic factors may confound the association of the father's absence with an early sexual activity. LHT emphasizes the first 5–7 years of life as crucial for the forming of LH strategy (Belsky et al. 1991).

Psychometrics and Life History Strategies

According to LHT adapted to humans, individuals can be placed along a single continuum of LH strategies, referred to as the slow to fast LH continuum (Gladden et al. 2009). The psychometric approach to LHT often combines multiple indicators for the purpose of constructing latent variables: K-factor or Super-K factor (higher K – slow LHS, lower K – higher LHS; Figueredo et al. 2007; Patch and Figueredo 2017). It should be noted that according to the latest suggestions, K-factor does not capture overall life history speed, but more of one dimension (somatic and parental effort) of a multidimensional human LHS (e.g. Richardson et al. 2017a).

Research on reproductive strategies often takes advantage of the Arizona Life History Battery (ALHB) or its shortened version, the Mini-K instrument (Figueredo 2007). The questionnaires are designed to measure the K-factor, and individuals' scores in these instruments show their position on the dimension from a slow (high-K) to fast strategy (low-K). Currently, however, the use of these instruments to measure reproductive strategy is being questioned (e.g. Copping et al. 2014; Gruijters and Fleuren 2018; Richardson et al. 2017c). Research indicates, that K-factor has not subsumed mating effort and there are at least two separate dimensions of LHS: K-factor and mating effort (Richardson et al. 2014, 2017a, b, c; also see Copping et al. 2014). There is a moderate negative residual correlation between them, which may be interpreted as a trade-off between the two LHS dimensions (Richardson et al. 2017b). There are two largely different sets of indicators of these dimensions. For instance, the Super-K has 12 indicators: physical/mental health, neuroticism (–), extroversion, agreeableness, conscientiousness, openness to experience, positive affect, social support, aggression (–), education, pair-bonding, and substance use/abuse (–) (Richardson et al. 2017c). These are the reasons why the K-factor, as measured via ALHB and Mini-K, is an empirical proxy not for life history speed but rather one LHS dimension - somatic and parental effort (SPE).

Early Stress

The Adaptive Calibration Model (ACM; Ellis and Del Giudice 2014; Ellis et al. 2016a; Ellis et al. 2016b; Del Giudice et al. 2011) assumes that the stress response system (SRS) is accountable for the allocation of body resources to a specific reproductive strategy. SRS consists of three anatomically distinct neuroendocrine circuits: the sympathetic and

parasympathetic parts of the autonomic system, and the hypothalamic-pituitary-adrenal (*HPA*) axis. Its role is to coordinate the reaction of the body in response to physical or social challenges or threats. SSR activation in early childhood shapes individual differences in reproductive strategies and stress responsivity. SRS is involved in the regulation of caregiving behavior, body growth, sexual maturation and intrasexual competition, thus allocating resources to parental, somatic and reproductive effort. Early experience of stress can develop susceptibility to stress in later life (Evans 2016; Heim and Nemeroff 2002; Lupien et al. 2009; Syed and Nemeroff 2017). Early familial and interpersonal stress (e.g. racial discrimination) lead to faster LHS, which in turn has a negative effect on resilience in early adulthood (Gibbons et al. 2012). A warm, supportive family environment and low level of childhood stress are related to a sensitive responsivity pattern, associated with a slower LHS. The highest levels of prenatal/perinatal risk factors and childhood stress are related to the vigilant responsivity pattern associated with faster LHS (Ellis et al. 2016b). The fast strategy is associated with higher levels of perceived stress (Chua et al. 2017). It can therefore be anticipated that there is a relationship between LHS and coping in stressful situations.

The Regulatory Role of Coping Strategies

There are many categories of coping strategy, and researchers have not reached a consensus on which ones are critical although some researchers distinguish between engagement and non-engagement strategies (Carver and Connor-Smith 2010; Compas et al. 2001; Skinner et al. 2003). Engagement strategies are directed towards actively coping with stressors and related emotions, and disengagement strategies allow for escaping threatening situations and the resulting disturbing emotions (Tobin et al. 1989). Engagement coping includes problem-focused coping and some forms of emotion-focused coping: support seeking, religious involvement, emotion regulation, distraction, acceptance, and cognitive restructuring. Disengagement coping includes responses such as avoidance, denial, wishful thinking, substance use and withdrawal (Carver and Connor-Smith 2010; Connor-Smith and Flachsbart 2007). Disengagement coping is often emotion-focused, because it involves an attempt to escape feelings of distress (Carver and Connor-Smith 2010, p. 685). Engagement strategies are positively correlated with mental and physical wellbeing, while disengagement strategies correlate negatively with wellbeing (Connor-Smith and Compas 2004; Connor-Smith and Flachsbart 2007).

Stress response and stress management models emphasize that stress responses depend on certain specific individual dispositions, such as sense of coherence (Antonovsky 1979), hardiness (Kobasa 1979), or self-efficacy (Bandura 1977).

They maintain individual's wellbeing in spite of external threats, and therefore are protective against the effects of stress (Besser and Zeigler-Hill 2012). Worldview performs the same role.

The Regulatory Role of Worldviews

Worldview is a set of beliefs and assumptions that describe reality, including human nature, the meaning and nature of life, and the construction of the universe; they also influence behavior (Koltko-Rivera 2004). Worldviews influence people's understanding and interaction with the world (Schlitz et al. (2010) and are associated with many aspects of human functioning. For instance, religious fundamentalism is a positive predictor of homosexual prejudice (Laythe et al. 2001). Environmental values are one of important preconditions of intentional ecological behavior (Kaiser et al. 1999). Moreover, types of worldviews are to be expected for social integration and different local environmental issues (Lima and Castro 2005). Existential attitudes have been found to be closely related to identity formation, moral development, value-related attitudes, personal goals, and lifestyle choices (Piko et al. 2016). Beliefs in the benevolence of the world are positively associated with wellbeing (Poulin and Cohen Silver 2008). Positive beliefs about the world are associated with more adaptive approaches to dealing with stress (Bonanno et al. 2011) and coping with the loss of a spouse (Mancini et al. 2011). Beliefs about the self and the world determine the type of coping strategy; individuals with more positive beliefs tended to use more active and less passive coping strategies (Goldenberg and Matheson 2005; for a review see Tweed and Conway 2006).

The World Assumption Scale (Janoff-Bulman 1989), which measured beliefs and attitudes expressed following traumatic events, showed that the scores for self-worth, luck, and the belief in the benevolence of people and the world were all significantly negatively correlated with PTSD symptom severity, while randomness correlated significantly positively (Elklit et al. 2007). Individuals develop assumptions about the world and themselves which are essential to healthy functioning (Janoff-Bulman 1992). The most important assumptions include beliefs in a fair, benevolent and predictable world, in which individuals are competent and worthy. Such assumptions are formed in early childhood in interaction with caregivers (Janoff-Bulman 1992). In a healthy relationship, it is the mother, father or other care-giver that provide for a child and protect it. It is through interaction with them and their love that assumptions about other individuals and the world are formed (Janoff-Bulman 1992).

In a similar manner, the role of family functioning in the origin of worldview is also stressed in Bowlby's theory of attachment (Bowlby 1969/1982, 1973, 1988). Secure

attachment between a care-giver and a child in infancy is associated with self-confidence, trust, the belief that the world is safe, and an increased confidence in one's own resources when dealing with stress (Mikulincer and Shaver 2003; Weber and Federico 2007). A secure individual tends to view other people with optimism, as well-intentioned providers of protection, comfort, and security (Mikulincer and Shaver 2007). Individuals with an anxious attachment style demonstrate a very different pattern, consisting of a lower sense of self-worth and negative beliefs about others (Collins and Read 1990). Early attachment styles are also an indicator of the reproductive strategies that are likely to be adopted in adulthood (Simpson and Belsky 2016). People raised by sensitive parents in a secure attachment style are likely to be engaged in the slow strategy, while people who experience the opposite characteristics of family environment tend to be driven towards the fast strategy (Belsky 2010; Del Giudice and Belsky 2011; Simpson and Belsky 2016; Webster et al. 2014).

Previous research has not linked life history with worldview as such but it has indicated a relationship between LH and the variables correlated with worldview, including moral intuitions, religiosity (Gladden et al. 2009), self-evaluations (Gladden et al. 2010) and social cognition (Figueredo et al. 2017). Moreover, research also shows that slow reproductive strategies lead to the formation of a cooperative attitude towards others (Patch and Figueredo 2017). Altruism towards one's kin, friends, and community are the traits correlated with slow LH (Gladden et al. 2010). Fast strategies, on the other hand, favor aggressive and deviant behaviors (MacDonald et al. 2016). These do not constitute worldviews as such but, through often being part of stereotypes related to social and gender-related roles (Eagly and Steffen 1986), may be a manifestation of a worldview.

In relation to social cognition it has been emphasized that while slow LH develops mutualistic social schemata (Figueredo and Jacobs 2010), the fast LH strategy promotes the development of antagonistic schemata (Figueredo and Jacobs 2010), revenge ideology (Figueredo et al. 2012), negative ethnocentrism (Figueredo et al. 2011) and negative androcentrism (Gladden et al. 2013). In structural equation models, developed by Figueredo et al. (2017), antagonistic social schemata, operationalized in accordance with the concept of Early Maladaptive Schemas by Young and Brown (1999), mediated the relationship between LH and psychopathic attitudes and interpersonal aggression (Patch and Figueredo 2017; Figueredo et al. 2017). According to Kavanagh and Kahl (2018) the set of social schemata may be treated as a manifestation of cognitive expectations, which are a link between early life experiences, which in turn shape LHS, and the current environment. In this light, worldview can be considered as an one's expectations about the current social environment and interactions with other people on the

basis of life history strategy. Therefore, analogously to the mediation model presented by Figueredo et al. (2017), we hypothesize that worldview, including beliefs about self and others, is a mediator of relationships between LH and current stress.

The Current Study

We assume that the allocation of material and bioenergetic resources to the somatic and parental effort (SPE), which is formulated in early childhood in a life lived in a low stress environment, is related to creating positive beliefs about the world and the self, and also to better coping with everyday stress in later life.

We put forward the following hypotheses:

- H1. Somatic and parental effort relates to a lower level of perceived stress.
- H2. Somatic and parental effort is associated with positive assumptions about self-worth, benevolence and the meaningfulness of the world.

We have formulated a directional hypothesis with mediators:

- H3. Positive beliefs about self-worth, benevolence and the meaningfulness of the world are the predictors of engagement coping strategies rather than disengagement (escape) strategies.
- H4. Somatic and parental effort has an indirect effect on reducing the level of current perceived stress through indicated in H3 relationship between beliefs and coping strategies (serial mediation hypothesis).

Methods

Participants

226 people participated in the research; they were between 18 and 53 years of age ($M = 27.17$, $SD = 7.62$). The sample included 76.5% women. The participants were all Polish, recruited from the provinces of Podkarpackie, Podlaskie, and Swietokrzyskie. In our sample 56.2% of respondents represented towns and villages with a population below 10,000, 15% of came from small towns (10,000 – 50,000), 11.1% from bigger towns (50,000-100,000) and 16.8% came from towns with a population over 100,000. 2 people did not indicate their place of residence. Only 5.7% were educated to a level below secondary, over 51% completed secondary education and 42.5% had a degree. 2 people (0.9%) did not indicate their level of education.

The research procedure and the goal of the study were approved by the Ethics Committee of the University of Rzeszów.

Procedure

The participants completed the set of self-reporting measures described below. The study was anonymous. All participants gave informed consent and were debriefed in person.

Measures

Somatic and Parental Effort

In the present study, we used a Polish version of the Mini-K (Figueredo et al. 2006) translated by Anna Czarna (Jonason et al. 2013). Mini-K is a 20-item short-form measure of the Arizona Life History Battery (ALHB; Figueredo 2007; Figueredo et al. 2006). Life history theory suggests that a proportion of individual variance in a variety of indicators of life history strategy can be explained by a single factor - the K-factor (Figueredo et al. 2007).

However, and as mentioned elsewhere, this assumption is currently criticized and it is accepted that Mini-K serves the purpose of measuring only one dimension of reproductive strategy, that is of somatic and parental effort (SPE).

The Mini-K is a self-reporting questionnaire. Participants answer questions on a scale from -3 (strongly disagree) to +3 (strongly agree). The higher the score, the higher the rate of their somatic and parental effort. The reliability of the scale is satisfactory (see Table 1).

World Assumptions

The World Assumptions Scale (WAS) is a self-reporting questionnaire consisting of 32 items (Janoff-Bulman 1989; Polish adaptation by Załuski and Gajdosz 2012). The scale was constructed to identify people's assumptions about the world, especially after a traumatic event. WAS includes three main categories, each of them building on several assumptions: (1) the perceived benevolence of the world (8 items) (2) the meaningfulness of the world (12 items) (3) the worthiness of the self (12 items). The benevolence of the world category consists of two main assumptions: the benevolence of the impersonal world, and the benevolence of people, which are related to the belief that the world is a good, safe place and that people are basically noble and caring (i.e. *For the most part, I believe people are good*). The meaningfulness of the world category involves people's beliefs about the distribution of basic outcomes, which are good or bad (i.e. *By and large, good people get what they deserve in this world*). It includes three dimensions: (a) justice, (b) controllability, (c) randomness. The third primary category is self-worth, which

contains three subscales: (a) self-worth (whether individuals perceive themselves as good or moral people, i.e. *I have a bad opinion of myself*), (b) self-controllability (i.e. *I almost always try not to let bad things happen to me*), and (c) luck (a self-perception that allows individuals to believe that they will be protected from misfortune, i.e. *I am a lucky person*).

By filling out the questionnaire, a participant determines the extent to which he or she agrees with the subsequent statements on a 6-point Likert scale. The final score is presented as the sum of the points obtained within the three groups of beliefs. The higher the score, the stronger the conviction on the topic. The reliability of the scale is shown in Table 1.

Current Perceived Stress

Levels of current perceived stress were measured by the Perceived Stress Scale (PSS) (Cohen et al. 1983; Polish adaptation by Juczyński and Ogińska-Bulik 2012). Stress intensity corresponds here to the subjective evaluation of the person's stress in the last month. The Polish version of the tool includes 10 questions (i.e. *In the last month, how often have you found that you could not cope with all the things that you had to do?*). Participants answer these questions by choosing a number from 0 (never) to 4 (very often). Before calculating the general stress index, it is necessary to reverse the answers of positively-formulated questions. The total score is the sum of all partial scores. The higher the score the higher the perceived stress intensity. The reliability of the scale is satisfactory (see Table 1).

Coping Strategies

Coping strategies were measured by Brief COPE (Carver 1997; Polish adaptation by Juczyński and Ogińska-Bulik 2012). The Brief COPE consists of 28 items which measure 14 different coping responses (Carver 1997). Participants respond to every statement by choosing an answer on a 0–3 scale (0 - hardly ever; 3 - nearly always). Each strategy is the sum of the points from two statements – the higher the score for the surveyed dimension, the more likely the participant is to use a given coping strategy.

However, some of the original Brief Cope subscales showed low reliability in the current study (i.e. Venting $\alpha = .15$, Self-distraction $\alpha = .38$, Acceptance $\alpha = .52$), suggesting that Carver's tool structure was not well reflected in the study group. For this reason, we decided to apply a two-stage exploration analysis of the factor (see the supplementary material section for details), which allowed for the selection of three subscales with significantly improved reliability indexes (Engagement - Active Coping, $\alpha = .79$, Engagement - External Support $\alpha = .75$, Disengagement $\alpha = .71$). In the research presented here the Engagement - Active Coping and Engagement - External Support factors were considered as

Table 1 Descriptive statistics, Cronbach's alphas and correlations between measured variables

	<i>M</i>	<i>SD</i>	α	1	2	3	4	5	6	7	8	9	10
1.Age				–									
2.Sex				.17**	–								
3. SPE	1.54	0.56	.65	.04	–.11	–							
4.Benevolence of the world	3.96	0.83	.79	–.06	–.23***	.20**	–						
5.Meaningfulness	3.49	0.59	.61	.09	–.02	.25***	.28***	–					
6.Self-worth	4.08	0.75	.81	–.08	–.29***	.33***	.56***	.46***	–				
7.Engagement - Active coping	1.83	0.48	.79	–.05	–.15*	.36***	.28***	.22**	.47***	–			
8.Engagement - External support	1.75	0.61	.75	.17*	–.30***	.40***	.29***	.22**	.34***	.44***	–		
9.Disengagement	1.17	0.48	.71	–.01	.13*	–.11	–.18**	–.19**	–.32***	.02	.09	–	
10. Perceived Stress	2.05	0.53	.73	–.10	–.11	–.31***	–.13	–.23**	–.32***	–.20**	–.07	.29***	–

SPE – somatic and parental effort * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$, Sex coded as 0 = women, 1 = men

adaptive coping strategies (cf.: Carver et al. 1989). Moreover, research shows that social support contributes to wellbeing and protects from stress (Dunkley et al. 2000). The reliability of the sub-scales is shown in Table 1.

Results

All statistical analyses were performed using IBM SPSS ver. 21. Descriptive statistics and correlations between study variables are shown in Table 1.

Structural Equations Model (SEM)

In order to verify the hypotheses on direct and indirect relationships between variables, Structural Equations Modeling (SEM) was performed with maximum likelihood estimation using the AMOS 21 program included in IBM SPSS ver. 21. In view of the small study group, the scale scores were included in the model as observable variables (the use of SEM with latent variables would result in a necessity to estimate too many parameters in relation to the sample size) (Marcoulides and Saunders 2006). In this way, the relationship between somatic and parental effort and current stress was tested through assumptions about the world and coping strategies. Inferences about indirect effects were based on bias-corrected (BC) confidence intervals derived from 10,000 bootstrap resamples. When the 95% confidence intervals (CI) for an indirect effect did not include zero, the indirect effect was significant (MacKinnon et al. 2004).

The specified model had satisfactory fit to the data, $\chi^2(2) = .50$, $p = .779$, CFI = 1.00; NFI = 1.00, SRMR = .007, RMSEA = .000. Figure 1 shows the path coefficients (β s) expressed as maximum likelihood regression weights.

The results indicated that SPE was significantly positively related to self-worth ($\beta = .35$, $p < .001$), meaningfulness of the world ($\beta = .27$, $p < .001$) and benevolence of the world

($\beta = .21$, $p < .01$). The SPE was also positively associated with active coping strategies ($\beta = .24$, $p < .001$) and external support ($\beta = .33$, $p < .001$), while the path of the SPE's direct effect on disengagement was non-significant ($\beta = -.01$, $p = .901$). However, the indirect effect of SPE on disengagement via self-worth was demonstrated ($B = -.11$, $SE = .03$, 95% CI = $-.185$, $-.052$), which in the absence of relevance of the direct effect of SPE on disengagement suggests that the negative relationship between SPE and disengagement was fully mediated by self-worth. This indirect effect indicates that individuals who allocate their own resources to somatic and parental effort maintained higher self-worth beliefs and that this higher self-worthiness translated into lower tendency to use disengagement coping. Self-worth was also the only significant mediator of SPE relationship with active coping ($B = .13$, $SE = .03$, 95% CI = $.076$, $.210$) and external support ($B = -.05$, $SE = .03$, 95% CI = $.003$, $.115$). In this case, individuals who allocate their own resources to SPE reported higher self-worthiness, which in turn was associated with a higher tendency to use active coping and external support. Both indirect effects were partial mediations - taking into account the mediator, SPE was still significantly positive, albeit more weakly linked to active coping ($\beta = .24$, $p < .001$) and external support ($\beta = .33$, $p < .001$). The indirect effects of SPE on coping strategies via meaningfulness and benevolence of the world were insignificant. In the model, three direct effects on stress were significant. A higher level of current stress was negatively predicted by SPE ($\beta = -.25$, $p < .001$) and self-worth ($\beta = -.19$, $p < .05$) and positively predicted by disengagement coping strategies ($\beta = .20$, $p < .01$). The model presented also reveals three significant indirect effects on stress. The first specific indirect effect is the effect of SPE on stress via self-worth ($B = -.07$, $SE = .03$, 95% CI = $-.138$, $-.005$). This effect informs us that individuals who allocate their own resources to SPE reported higher self-worthiness, which was in turn related to a lower level of perceived stress. The second specific indirect effect is the effect of self-worth

Fig. 1 Structural Equations Model depicting the associations among SPE, worldviews, coping strategies and stress. For the sake of clarity only significant pathways are marked. Notes: SPE – somatic and parental effort, * $p < .05$; ** $p < .01$ *** $p < .001$

on stress via disengagement ($B = -.06$, $SE = .03$, 95% CI = $-.131, -.019$) - individuals with lower self-worth were more likely to use disengagement coping, which was in turn associated with a higher level of perceived stress.

Finally, the third specific indirect effect showed a more complex chain of dependency between SPE and stress, involving two mediators operated in serial manner. Individuals allocating their own resources to somatic and parental effort endorsed higher self-worth beliefs, which was associated with a lower tendency to use disengagement coping, and this in turn translated into a lower level of perceived stress ($B = -.02$, $SE = .01$, 95% CI = $-.050, -.007$).

Alternative Model in Female Participants

Furthermore, due to the fact that the sex of participants was correlated with world assumptions and coping strategies (see Table 1), and that our sample was female biased, we performed alternative SEM using the same hypothesized model in female participants only ($N = 173$). Due to insufficient sample size, analogical SEM for males was not performed (the ratio of sample size to free model parameters in SEM should be at least five observations to one free parameter (Marcoulides and Saunders 2006). The model fit indicators for women were very similar to the model calculated for the whole group: $\chi^2(2) = .333$, $p = .847$, CFI = 1.00; NFI = 1.00, SRMR = .006, RMSEA = .000. In the group of women, all the above direct and indirect effects were also proven significant (see Table 2). In addition, two direct effects and one indirect

effect were revealed, which were insignificant in the total sample. These direct effects indicated that in females external support was positively predicted by self-worth ($\beta = .18$, $p < .05$) and meaningfulness of the world ($\beta = .17$, $p < .05$). The indirect effect, on the other hand, indicates that meaningfulness of the world mediated the relationship between SPE and external support coping. This indirect effect indicated that females who allocate their resources to somatic and parental effort maintained a higher level of belief in the meaningfulness of the world, which translated into a higher tendency to use external support coping ($B = .06$, $SE = .03$, 95% CI = $.011, .139$). In this case, the significance of the direct effect of SPE on external support ($\beta = .29$, $p < .001$) implied partial mediation.

Discussion

The results of the study suggest that individuals allocating their resources to parental and somatic effort (SPE), i.e. those who grew up in a stable and safe psychosocial environment in childhood, report lower levels of perceived stress (H1). According to the Adaptive Calibration Model, the perception of weaker current stress is probably related to calibration of the stress response system (SRS) in early childhood under the influence of favorable environmental factors (Del Giudice et al. 2011; Ellis et al. 2016a, b). SRS leads to the development of a slow reproductive strategy developing in childhood in a safe and predictable environment. It is postulated that such

Table 2 Parameters and 95% CIs for the significant direct and indirect effects in females ($N = 173$)

Pathways	Estimated effect	SE	95%CI		p
			LL	UL	
Direct effects					
SPE → Benevolence	.22	.07	.094	.349	.002
SPE → Meaningfulness	.34	.07	.139	.534	<.001
SPE→ Self-Worth	.39	.07	.255	.517	<.001
SPE → Active Coping	.24	.08	.107	.386	.001
SPE → External Support	.29	.07	.160	.424	<.001
SPE → Stress	−.20	.08	−.354	−.043	.008
Self- Worth → Disengagement	−.28	.10	−.493	−.063	.005
Self-Worth → Active Coping	.36	.09	.177	.538	<.001
Self-Worth → External Support	.18	.09	.024	.352	.046
Self-worth -> Stress	−.33	.10	−.526	−.110	<.001
Meaningfulness → External Support	.17	.07	.019	.324	.017
Disengagement → Stress	.26	.07	.073	.440	<.001
Indirect effects					
SPE → Self- Worth → Disengagement	−.11	.05	−.207	−.027	.010
SPE → Self-Worth → Active Coping	.14	.04	.068	.239	<.001
SPE → Self-Worth → External Support	.07	.04	.012	.150	.018
SPE → Meaningfulness → External Support	.06	.03	.011	.139	.014
SPE → Self-Worth → Stress	−.13	.05	−.230	−.045	.003
Self-Worth → Disengagement → Stress	−.07	.03	−.161	−.012	.007
SPE → Self-Worth → Disengagement → Stress	−.03	.01	−.068	−.009	.005

SPE somatic and parental effort

individuals have increased SRS activity, which facilitates the learning process and regulation of behavior, e.g. deferral of gratification, and sensitivity to social feedback (the so-called sensible type). It can be assumed that such mental traits may facilitate stress management, as the individual may experience lower emotional tension due to the lack of immediate gratification, feeling more capable of learning more adaptive behaviors, and using social support in difficult situations.

The hypothesis (H2) that somatic and parental effort is associated with beliefs about the worthiness of the self, the benevolence of the world and meaningfulness of the world was also confirmed. People allocating resources to SPE have a positive opinion about the benevolence of the world, the meaningfulness of the world and the worthiness of the self. However, the hypothesis (H3) assuming the association of positive beliefs about the self and the world with engagement coping strategies and the hypothesis (H4) that this mechanism mediates the relationship between SPE and stress was confirmed only partially. This is because for people allocating resources to SPE only self-worthiness appeared to have a role, increasing the frequency of use of active stress coping strategies and reducing the frequency of the use of disengagement coping.

It seems that for such people, self-worthiness is the main protective factor in coping with stress, while beliefs about the

world and people do not play such an important role. In a sense, this is confirmed by research on the locus of control. It has been shown that people with high self-esteem also have an inner sense of control, hence a sense of being able to influence events. As a result they experience less stress than people with external sense of control who feel that their actions are determined by external factors (Abouserie 1994). Self-worthiness is one of the most important competencies in resilience (Davey et al. 2003), that is “the process of, capacity for, or outcome of successful adaptation despite challenging or threatening circumstances” (Masten et al. 1990, p. 426). An analysis of the family environment of resilient people shows the presence of warmth and closeness in relationships between parents and children (Alvord and Grados 2005; Miller-Lewis et al. 2013; Walsh 1996). From the life-history theory perspective such a family environment develops a slow strategy (Belsky et al. 1991), and high self-esteem is positively correlated with slow LH strategy (Gladden et al. 2010). Self-worthiness can act as a buffer against distress and the effects of harmful circumstances: people with high self-esteem have a lot of cognitive ability to cope with such situations (Cast and Burke 2002; Thoits 1995).

The lack of the relationship between benevolence of the world and meaningfulness of the world with coping strategies may be due to another reason. According to the basic hope

theory (Erikson 1950; Trzebiński and Zięba 2004), basic hope is seen as a fundamental view that the world is orderly, relevant and positive. Such beliefs are only triggered when the scale of human dangers is very high (e.g., death of a friend, loss of work), allowing to accept the loss (Trzebiński and Zięba 2004) and performing a protective and facilitating role in the coping with stress and trauma. In our study, stress was measured by the Perceived Stress Scale, which refers to average stress situations at most, without focusing on particularly traumatic situations. So, the participants in the study did not need to refer to their fundamental assumptions about the world.

However, the results of the study show that self-worth relates to lower level of current stress only through reducing the frequency of avoidance strategies used to escape the threat or related emotions, while the use of active strategies directly targeting the stressor does not affect the perceived level of stress. There are two possible explanations for such dependencies.

Firstly, it may mean that for people allocating their resources to somatic and parental effort, the effectiveness of the defense against stress and therefore their resilience – lies in reducing the costs associated with, the use of psychoactive substances, self-blame or denial of difficult situations, for example study suggests that K-factor has a negative effect on substance use (Richardson et al. 2017a). Such costs of emotion-focused strategies are, for example, the internalization of symptoms in depression, anxiety, and somatic symptoms (Compas et al. 2001). This may provide evidence of a high ability to regulate one's own emotions - one of the most important protective factors in resilience (Alvord and Grados 2005; Zolkoski and Bullock 2012). Consequently, such persons may be emotionally more stable. It has been shown that the K-factor (somatic and parental effort) is negatively correlated with neuroticism, so people with the slow strategy are more emotionally stable (Gladden et al. 2015). Emotional stability is, in turn, important from a long-term perspective, contributing to increased marital satisfaction in both sexes (Botwin et al. 1997).

Secondly, the meta-analyses of research point not only to the positive impact of strategies aimed at solving the problem on lowering stress level but also, on the contrary, even on an intensification of psychological problems (Compas et al. 2001; Thoits 1995). The actual effectiveness of these strategies depends on a number of factors, such as the type of stress (e.g. chronic or sudden), the cause of stress (such as the death of a loved one, interpersonal problems) or a combination of these factors (Thoits 1995). The type of strategy also depends on personality traits (Carver and Connor-Smith 2010; Connor-Smith and Flachsbart 2007).

Because our sample was female biased, we performed alternative SEM using the same hypothesized model in female participants only. A number of differences were demonstrated in relation to the general model: External support was positively

predicted by self-worth and meaningfulness of the world (direct effects) and females allocating their resources to somatic and parental effort maintained a higher level of belief in meaningfulness of the world, which translated into a higher tendency to use external support coping (mediating effect). Direct effects suggest that women's use of other people's support (advice, guidance, understanding) and also looking for comfort in religion as a stress coping strategy is related to having a more generally optimistic and trustful approach towards the self, people and the world – the existence of such attitude is indicated by the correlation between self-worth, benevolence of the world and meaningfulness of the world (Table 1).

The meaningfulness of the world, on the other hand, seems to play a particular role in coping with stress for women who allocate resources to somatic and parental effort, which may suggest that a childhood environment with low psychosocial stress, i.e. growing up in the family with safe attachment style and rare parental conflicts produces a vision of the just, controllable world, which later on makes reaching for external support easier. Our research confirmed that social support (i.e. from friends and family) correlates positively with SPE (slow LHS, see: Olderbak et al. 2014). The research presented above (see Table 1) confirms the relationships shown by other researchers; for instance, people with higher self-esteem are more likely to develop adaptive stress strategies (in our terminology engagement-active coping and engagement - external support) and less frequently non-adaptive strategies (Bélanger et al. 2014; Doron et al. 2013; Miller Smedema et al. 2010).

The current research also has implications for developing childhood interventions to combat negative effects of low level somatic and parental effort. Due to the role of early childhood experiences in the shaping of reproductive strategy, therapeutic interactions should be directed at the family as early as possible in fact from the first years of the child's life. Above all, in families where there are factors conducive to the development of lower SPE the focus should be on increasing harmony in the relationship between the parents, educating them towards the ability to build a safe attachment style with the child, leading to a positive image of the world and self-worth in the future. As noted earlier, positive beliefs about the world are essential to healthy functioning (Janoff-Bulman 1992), as they are associated with more adaptive ways of dealing with stress (Bonanno et al. 2011). As we found, in individuals allocating their resources to SPE, self-worth correlates negatively with the level of perceived stress and may promote reduced distress through its association with reduced frequency of disengagement coping strategies. Such interventions, which are directed at building positive beliefs about the world and self-worthiness in a child, could not only help in reducing emotional distress in later years, but also reduce the behavioral problems correlated with low level of SPE (low K), for instance impulsivity, short-term thinking, and low-investment in parenting behavior (Figueredo et al. 2006). Another option is

to aim for a direct therapeutic impact on an individual's stress-coping strategies, both in childhood and in adulthood, with the goal of weakening the disengagement coping strategies that are linked with higher levels of experienced stress or changing them towards engagement coping, in this way producing a chance for stress reduction. Moreover, engagement coping is linked with higher levels of wellbeing Connor-Smith and Compas 2004; Connor-Smith and Flachsbart 2007; Dijkstra and Homan 2016), which has considerable consequences for health e.g. positive psychological wellbeing is associated with reduced mortality (Chida and Steptoe 2008).

Limitations

Firstly, the sample was dominated by women (76.6%) and the tendency towards somatic and parental effort is significantly determined by gender. According to the sexual selection theory (Trivers 1972) in humans and other mammals, female parental effort is stronger than male (Buss 1989; Trivers 1972), which is of serious consequences. Research shows that women more often show a tendency to slow strategy than men (Figueredo et al. 2006), which may mean that the results of the study presented here are of limited explanatory scope.¹

The second limitation is linked to the fact that most of our respondents were educated to higher or secondary level and only 6% were educated to a lower level. Aspirations linked to education are characteristic of people who invest in somatic effort at the cost of reproductive effort (Griskevicius et al. 2011a). Therefore, generally speaking, our respondents, in view of their education, belong to a group of people allocating their own resources to somatic and parental effort, which limits the generalizability of our results.

The third limitation of the study is that the data used were gathered only through self-reporting scales; also, the study has a cross-sectional structure, so it is difficult to draw causal relationships.

Fourthly, our research used SEM for model testing. The role of causality in SEM research is controversial and discussed (McCoach et al. 2007; Pearl 1998). Besides in SEM it is impossible to confirm a model: statistical tests and descriptive fit indices do not confirm that a model is really correct, but rather “they suggest that the discrepancy between the observed variance covariance and the model-implied variance covariance matrix is relatively small” (McCoach et al. 2007, p. 565). Therefore, there is a need for longitudinal designs to test the validity of the directional, causal claims embedded in this model.

Fifthly, the Mini-K has scales that measure family and peer support, so any estimated effect on external support should be

treated with caution (i.e., it could be biased by item content overlap).

Sixthly, in our research, we assumed that SPE affects the current perception of stress. It should be emphasized, however, that the reverse causation is possible - various stress factor in the current environment influence reproductive strategies. In particular, this applies to cues signaling environmental harshness, for example a shorter life expectancy (Dunkel et al. 2010), or current neighborhood (Chua et al. 2017).

Conclusions

Our research is an attempt to fill in the existing gap in research on LHT, which has until now omitted such important psychological variables as worldview and coping strategies, considered to be important factors that influence the experience of stress. The research presented confirms that people who allocate their resources to somatic and parental effort have positive beliefs about the benevolence of the world, the meaningfulness of the world, the worthiness of the self. However, only self-worthiness is related to lower stress by reducing the frequency of the use of avoidance strategies. We suppose that people allocating resources to SPE are more effective in reducing stress due to its lowering of the costs related to, e.g., using psychoactive substances, self-blame or denial in difficult situations. It is possible, however, that the obtained results were influenced by other factors, such as those related to personality or the type of stressful situation. In future research these factors should be taken into consideration. Besides, for females allocating their resources to SPE, meaningfulness of the world facilitates the use of external support coping. We suggest that low social stress environment in childhood facilitates women's use of external support in the future.

We also hope, as noted in the Discussion section that even given all the limitations mentioned the results of our research may have important practical implications for the development of psychological intervention procedures in both early childhood and in adulthood.

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Compliance with Ethical Standards

Conflict of Interest On behalf of all authors, the corresponding author states that there is no conflict of interest. This manuscript has not been published and is not under consideration for publication elsewhere. We have no conflicts of interest in disclosing it. The paper has been approved by all co-authors.

¹ However, in the current study the difference between Mini-K scores of men and women was small (g Hedges = .32).

Ethical Approval All procedures performed in the studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or other comparable ethical standards. This article does not contain any study with animals performed by any of the authors.

Informed Consent Informed consent was obtained from all individual participants included in the study. The datasets generated and/or analyzed during the current study are available from the corresponding author upon request.

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