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The role of temperament in the changes of coping in Type 2 diabetes: direct and indirect relationships

Abstract: *The paper investigates whether the changes in cognitive appraisal and coping strategies related to initiation of insulin treatment onset mediate the effect of temperament on changes in positivity ratio among diabetic patients. Temperament, cognitive appraisal, coping strategies and positivity ratio (ratio of positive to negative affect) were assessed among 278 patients: just before conversion to insulin therapy and then one month later. Mediation analysis indicated that endurance and briskness were directly connected to changes in positivity ratio, whilst the effect of perseveration on positivity ratio was indirect via changes in negative appraisal, emotion- and problem-focused coping. The results confirm the stressful nature of the initiation of insulin treatment, and the assumptions of Lazarus' model of stress and regulative role of temperament.*

Key words: *temperament, coping, cognitive appraisal, emotions, diabetes mellitus, mediation*

Type 2 diabetes is a chronic controllable metabolic illness, requiring treatment maintaining the optimal blood glucose level in order to prevent long-term complications (Cox & Gonder-Frederick, 1992). The number of people with diabetes in Poland in 2011 was estimated at 3.1 million (International Diabetes Federation, 2012). Initially, the therapy is non-invasive (oral medication as well as diet and exercise) and may be a source of mild stress. However, 5-10% of diabetic patients per year require insulin therapy to improve metabolic control (Gumprecht & Grzeszczak, 2003). This is usually administered approximately eight years after the initial diagnosis (Sieradzki & Nazar, 2004). Insulin injections are viewed as the most burdensome treatment (Vijan, Hayward, Ronis & Hofer, 2005) and may constitute a potentially highly stressful situation for patients. The reluctance to initiate insulin therapy has been termed '*psychological insulin resistance*' (Korytkowski, 2002). This phenomenon is, among others, caused by fear of injections and hypoglycaemia (Polonsky, Richard & Jackson, 2004).

According to the transactional model of stress and coping by Lazarus and Folkman (1984), cognitive appraisal and coping are critical contributors in stress response, both are connected with emotions and mediate the effect of causal antecedents (e.g., dispositional traits) on the immediate and long-term stress outcomes (e.g., affect and psychological well-being). Cognitive appraisal refers to a distinctive evaluation of the significance of an event for the well-being of a person and adequacy of their resources for coping (ibidem). According to Lazarus and Folkman stressful events are appraised as threatening, challenging or harmful (ibidem). There is evidence for threat and loss appraisals to be associated with negative stress-outcomes, e.g., poor emotional adjustment (Matthews et al, 2002) and high levels of anxiety and depression (Chandler, Kennedy & Sandhu, 2007). On the other hand, challenge appraisal tends to be associated with positive outcomes, e.g., life satisfaction (Lequerica, Forchheimer, Albright, Tate, Duggan & Rahman, 2010) and eustress (McGowan, Gardner & Fletcher, 2006).

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Coping refers to dynamically fluctuating thoughts and behavior undertaken in order to manage a stressful transaction (Lazarus & Folkman, 1984). Coping behaviours represent a variety of modes whose function is to modify and manage the problem (*problem-focused coping*) and/or to down-regulate emotional reactions of individuals (*emotion-focused coping*). In general, problem-focused coping turns out to be related most often to positive emotionality and challenge appraisal, while regulating strategies tend to refer to negative affect and appraisal (threat and harm/loss) (cf. McGowan et al., 2006; Lequerica et al., 2010; Watson & Sinha, 2008). The mediating role of coping in stress model was proven in many studies (Bargiel-Matusiewicz, Kroemeke & Polańska, 2013; Bolger & Zuckerman, 1995; Knoll, Rieckmann & Schwarzer, 2005). Nevertheless, all the variables included in Lazarus and Folkman's model have been simultaneously applied in only few works (cf. Gruszczyńska & Kroemeke, 2009). In particular the cognitive appraisal has usually been omitted; instead, the focus was mostly on personal determinants of coping. Consequently, it has been stated that personality can affect: appraisal of a stressor (Bouchard, Guillemette & Landry-Léger, 2004), coping strategy use (Lee-Baggley, Preece & DeLongis , 2005) and its effectiveness (Bargiel-Matusiewicz et al., 2013; Bolger & Zuckerman, 1995; Roesch, Aldridge, Vickers & Helvig, 2009). Nonetheless few works have actually dealt with temperament in stress–coping process, especially with the role of temperament in cognitive and affective process as well as different situational conditions (Fajkowska, Wytykowska & Riemann, 2012), even though presumably it plays a significant role in stress phenomena (Roesch et al., 2009).

The Regulative Theory of Temperament (RTT) emphasizes the functional significance of temperament, based on modifying the 'stimulating (energetic) and temporal values of behavior and reactions' (Strelau, 2008, p. 74). The significance of this disposition manifests itself mostly in stressful situations, since it refers to the concept of arousal and negative emotions which constitute the state of stress (Eysenck, 1967). The RTT structure is composed of six dimensions:

- Emotional reactivity (ER), which manifests itself in the tendency to experience intense emotional reactions. ER relates to enhanced sensitivity to threat-related stimulus (Fajkowska & Marszał-Wiśniewska, 2006) and is associated with emotion-focused coping (Szczepaniak, Strelau & Wrześniewski,1996; Rzeszutek, Oniszczenko & Firląg-Burkacka, 2012)
- Perseveration (PR)–the tendency to continue and repeat behavior or emotional states. Perseveration strengthens the subjective evaluation of nuisance of life events (Zawadzki & Strelau, 1997) and is associated with emotion-focused coping style (Szczepaniak et al., 1996)
- Briskness (BR)–the tendency to react quickly to external stimulations and to maintain the tempo of activity. BR is associated with problem-focused coping (ibidem)
- Endurance (EN)–the tendency to react adequately under highly stimulating conditions and tolerance to strong physical stimulation. There is evidence that EN decreases the subjective evaluation of nuisance of life events (Zawadzki & Strelau, 1997) and is associated with emotion-focused coping (Szczepaniak et al., 1996)
- Activity (A)–the tendency to get involved in highly stimulating behaviors. This dimension is connected to challenge appraisal (Strelau, 2008) as well as avoidance-focused coping style (Szczepaniak et al., 1996)
- Sensory sensitivity (SS)–the tendency to react to sensory stimuli of low value (Strelau, 2008).

Energetic temperamental features (ER, EN, A, SS) are responsible for a need and to high stimulation processing capacities, whereas temporal characteristics (BR, PR) impact on level of arousal and its release (Zawadzki & Strelau, 1997).

Current study

The aim of the study was to examine whether the cognitive appraisal and coping strategies mediate the relationship between temperamental factors and emotional adaptation in the situation of switching over to insulin treatment in Type 2 diabetes. It was assumed that subjective experienced stress would increase after the initiation of insulin therapy due to treatment and psychological burdens.

The operationalization of the emotional consequences of coping requires a commentary. Most of the results indicate the co-occurrence of positive (PA) and negative (NA) emotions in stress process (Folkman, 2008). Simultaneously, emotion-oriented researchers agree that it is rather the mutual proportion of one affect to another that plays the most important role here (Fredrickson & Losada, 2005). The rationale for testing the affect balance provides the evidence for differences in the experience of PA and NA, defined as a negative bias (negativity is more intense; cf. Baumeister, Bratslavsky, Finkenauer & Vohs, 2001) and positive offset (positivity appears more frequently; cf. Diener & Diener, 1996). Therefore, one of the affect balance indicators – the positivity ratio, defined as the ratio of PA to NA (Fredrickson & Losada, 2005)–was applied in this study.

Following the assumptions of the transactional model (Lazarus & Folkman, 1984), the cognitive appraisal was given priority in relation to coping activity. Thus, the research question was as follows:

1. Is temperament associated directly with positivity ratio before, as well as after implementation of insulin treatment or indirectly through, corresponding to a given stage cognitive appraisal, and in turn coping strategies?

Examination of the cross-sectional relationships does not give a full picture of coping following a change in treatment. This is because it does not allow for studying of

relationships between dynamic changes of variables over a period of time, i.e., it does not explain how a shift in a given variable influences another variable. In the context of a change in pharmacological treatment of diabetes, it was expected that there would be a shift in the way that patients cope with their illness. The question posed here was whether temperament plays a significant role in this process. Thus, it has been decided to verify the changes of coping, defined as change in the intensity of stress variables (cognitive appraisal and coping strategies) prior to and after implementation of insulin therapy. Consequently, another research question was:

> 2. Does the temperament directly influence the changes in positivity ratio of the patients? Or does it impact them indirectly, through changes in cognitive appraisals and further changes in coping strategies resulting from insulin therapy?

Following the transactional model of stress, it was expected to note indirect associations between temperament and positivity ratio (and its change) through cognitive appraisal (i.e., shift of thereof), and, consequently, through coping strategies (namely their change over period of time). Drawing on the concept of regulative function of temperament it was assumed that traits characterised by high stimulation-processing capacities (activity, endurance, briskness) would lead to a better positivity ratio thanks to its positive cognitive appraisal, and what follows, instrumental strategies. On the contrary, the hypothesis was that traits associated with low stimulation-processing capacities (emotional reactivity, perseveration, sensory sensitivity) would be negatively correlated with positivity ratio, and that this would be mediated by a negative cognitive appraisal and emotion-focused coping strategies.

Method

Design and sample

Patients with Type 2 diabetes and with medical indication to initiate insulin therapy in short term were recruited in public diabetic outpatient units. Other eligibility criteria comprised of age (up to 60 years old), no severe co-morbidity and primary education level as minimum.

After giving informed consent, participants completed questionnaires assessing temperament (only before insulin treatment), cognitive appraisal, coping strategies and emotions twice: just before being informed by the physician about conversion to insulin treatment (Time 1 [T1]), and subsequently 1 month after (mean time=35 days after) (Time 2 [T2]). The full sample at T1 comprised of 305 persons (162 women, 143 men; mean age=50.12, *SD*=9.59). The final longitudinal sample consisted of 278 participants (91.15 % of the original sample; 148 women, 130 men; non-completers were better educated and presented more long-term diabetic complications than the completers). They were aged between 20–60 years old (*M*=50.05, *SD*=9.80). Of the participants, 64% were married, 87.1% lived with their partner or family and 60.8% were employed. The most frequent co-morbid illness was hypertension (52.9%), while the most common long-term diabetic complication was ischemic heart disease (15.8%).

Measures[1]

Temperament. The temperament was assessed by Formal Characteristics of Behavior-Temperament Inventory (FCB-TI; Strelau & Zawadzki, 1995). The FCB-TI is a 120-item scale, designed to measure: briskness (e.g., *I usually manage to jump aside so as not to be splashed by a passing car*), perseveration (e.g., *I often become preoccupied with one thought*), sensory sensitivity (e.g., *I can smell even the subtlest fragrances of flowers*), endurance (e.g., *I can work intensively after a sleepless night*), emotional reactivity (e.g., *I often break down in difficult moments*) and activity (e.g., *My social life is very active*). Cronbach's α coefficients ranged from .74 (perseveration) to .87 (activity).

Cognitive appraisal. Appraisal was assessed by the Stress Appraisal Questionnaire to measure cognitive appraisals in terms of Lazarus' theory (Włodarczyk & Wrześniewski, 2010). The scale consists of 35 items describing how people might perceive a specific stress situation. Two subscales were taken into account: negative (consisting of threat and harm/loss appraisal, e.g., *This situation was terrifying*; 10 items) and positive cognitive appraisal (comprising active challenge appraisal, e.g., *This situation was mobilizing*; 7 items). Cronbach's α coefficients ranged from .76 (positive appraisal, T1) to .93 (negative appraisal, T2).

Coping strategies. Coping was assessed with Coping Inventory for Stressful Situation by Endler and Parker (1994). Only two sub-scales: problem-focused (e.g., *I focus on the problem and on how to solve it; 7 items*) and emotion-focused strategies (e.g., *I focus on my helplessness; 7 items*) were used in the study. Cronbach's α coefficients ranged from .81 (emotion-focused coping, T1,T2) to .83 (problem-focused coping, T1, T2).

Positivity ratio. Positivity ratio is a ratio of the positive to negative affect. Affect was assessed by Positive and Negative Affect Schedule by Watson, Clark and Tellegen (1988; the Polish adaptation by Brzozowski, 2010). Cronbach's α coefficients ranged from .91 (NA, T1) to .96 (PA, T2). The higher the value of the ratio, the higher was the level of positive emotions; in particular, values exceeding 1 indicated the prevalence of positive emotions to negative ones, whilst values below one (proper fractions) indicated prevailing negativity.

[1] Because of a specific character of the sample, for all the tools except FCZ-KT, a factor analysis was performed in this study. Since the results varied to a certain extent from those yielded by the questionnaires' authors, our own variables were used in the analysis.

Statistical analysis

According to the goal of the study, the analyses were aimed at examining the parallel-serial multiple mediation models using a bootstrapping procedure (Hayes, 2013). A bootstrap sample N=5000 allows to calculate indirect effects between temperament and positivity ratio through the mediators (cognitive appraisal and coping strategies). The total indirect effect (the sum of indirect effects across all mediators in a certain model), as well as the specific indirect effect (the indirect effect of a particular mediator) were examined. If the 95% bias-corrected and accelerated confidence interval (BCA) for the parameter estimate did not contain zero, then the indirect effect was statistically significant at the .05 level and mediation was demonstrated (ibidem). The possibility of parallel-serial testing of several potential mediators is the advantage of this method. It is also the most frequently used and recommended method for mediation analyses (ibidem). Due to six independent variables, models included all temperament factors were estimated (with one tested variables and the other as covariate, and so forth for each temperament variable). In addition, significant socio-demographic variables were also included as covariates.

Corresponding to the first research question, separate multiple mediation for time 1 and 2 was conducted. Models included temperament factors and variables measured before and after conversion to insulin injection, respectively. In order to construct the coefficients of change for the analyzed variables in time (the second research question), standardized residuals of regression were calculated following the regression analysis, where the variable measured at T2 was the dependent variable, while the one measured at T1 was the independent one (cf. Tabachnik & Fidell, 2013). Coefficients obtained in this way were included in the mediation analyses.

Results

Prior to mediation analysis descriptive statistics and simple correlations between variables (in T1 and T2) were identified (see Table 1.). Significance of socio-demographic variables for dependent variables was also tested: employment (0-no, 1-yes) was associated with positivity ratio in T1 (ρ=.16; p<.01), age in T2 (r=.15; p<0.5), while socioeconomic status (1-high, 2-avarage, 3-low; ρ=-.14; p<.05) and having children (0-no, 1-yes; ρ=.15; p<.01) were related to changes in positivity ratio over time. All these variables were included in respective models. (See Tabel 1. - page 241)

Effect of temperament on positivity ratio: cross-sectional analyses

To test the total and specific indirect effects of temperament (BR, A, EN, RE, PR, SS) on positivity ratio as mediated by cognitive appraisal and coping strategies respectively before and after conversion to insulin treatment, multiple mediation analyses were conducted (see Figure 1a and b). (See Figure 1. - page 243)

Before insulin therapy. Only two temperament dimensions were identified as indirectly connected to positivity ratio: endurance (β=.01, *SE*=.01, LL BCA=.003, UL BCA[2]=.02) and emotional reactivity (β=-.02, *SE*=.01, LL BCA=-.04, UL BCA=-.01). As both direct effects were non-significant (EN: β=-.006, *SE*=.01, p=.457; ER: β=-.006, SE=.01, p=.476), full mediations were observed. Interestingly, both total indirect effects had opposite sign–positive for EN and negative for ER – and consisted of two specific effects: the first via the negative cognitive appraisal (for EN: β=.01, *SE*=.004, LL BCA=.005, UL BCA=.02; for ER: β=-.02, *SE*=.004, LL BCA=-.03, UL BCA=-.01), and the second via negative cognitive appraisal and, then, emotion-focused coping (for EN: β=.003, *SE*=.001, LL BCA=.001, UL BCA=.01; for ER: β=-.005, *SE*=.002, LL BCA=-.01, UL BCA=-.002). Temperament explained 17% of the variance of positivity ratio at T1. For perseveration (β=-.006, *SE*=.009, p=.483; β=.004, *SE*=.006, LL BCA=-.008, UL BCA=.017), activity (β=.01, *SE*=.006, p=.124; β=-.001, *SE*=.004, LL BCA=-.01, UL BCA=.01), briskness (β=.005, *SE*=.01, p=.532; β=.01, *SE*=.006, LL BCA=.000, UL BCA=.02) and sensory sensitivity (β=.01, *SE*=.01, p=.362; β=.01, *SE*=.005, LL BCA=-.004, UL BCA=.02), both respectively direct and indirect effects on positivity ratio were non-significant.

Examination during insulin therapy. This time endurance was directly (β=.02, *SE*=.01, p<.05) as well as indirectly (β=.013, *SE*=.006, LL BCA=.001, UL BCA=.03) positively related to emotional outcome (partial mediation). The four specific indirect competing effects turned out to be significant–two positive: one through negative cognitive appraisal (β=.02, *SE*=.005, LL BCA=.01, UL BCA=.03) and the second one through negative cognitive appraisal and, in turn, emotion-focused coping (β=.003, *SE*=.001, LL BCA=.001, UL BCA=.01); and two negative: via negative cognitive appraisal and, in turn, problem-focused coping (β=-.001, *SE*=.001, LL BCA=-.003, UL BCA=-.0001) as well as via only problem-focused coping (β=-.004, *SE*=.002, LL BCA=-.01, UL BCA=-.0005). In addition, significant direct negative relation was observed between briskness and positivity ratio (β=-.02, SE=.01, p<.01; total indirect effect: β=.01, *SE*=.01, LL BCA=-.0005, UL BCA=.03). Temperament explained 10% of the variance of positivity ratio at T2. The remaining direct and indirect (respectively) effects were not significant (perseveration: β=-.01, *SE*=.01, p=.194; β=-.01, *SE*=.01, LL BCA=-.03, UL BCA=.004; emotional reactivity: β=.01, *SE*=.01, p=.286; β=-.004, *SE*=.01, LL BCA=-.02, UL BCA=.01; activity: β=.006, *SE*=.005, p=.283; β=-.003, *SE*=.005, LL BCA=-.01, UL BCA=.01; sensory sensitivity: β=-.003, *SE*=.01, p=.664; β=.004, *SE*=.01, LL BCA=-.01, UL BCA=.02).

Effects of temperament on positivity ratio:

[2] LL BCA and UL BCA = lower and upper bias-corrected confidence intervals, respectively.

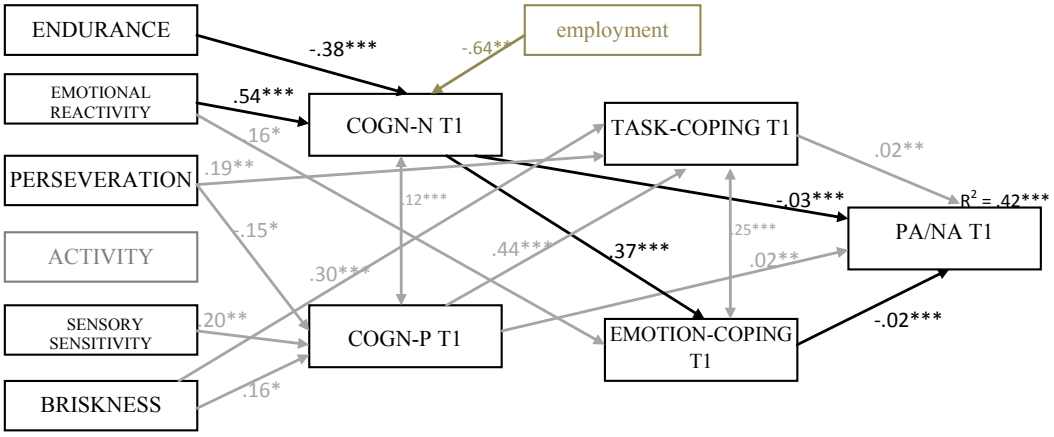
Table 1. Descriptive statistics and correlations (*N* = 278).

	Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
1.	BR		.34**	.53**	-.39**	-.12*	.32**	-.21**	.27**	.35**	-.16**	.30**	-16**	.12*	.21**	-.10	.08
2.	A			.25**	-.33	-.07	.06	-.07	.15*	.22**	-.10	.21**	.01	.04	.18**	-.02	.06
3.	EN				-.53	-.36**	.08	-.34**	.18**	.09	-.25**	.28**	-.29**	.05	-.03	-.25**	.24**
4.	ER					.56**	-.03	.35**	-.19**	-.03	.37**	-.35**	.20**	-.04	.00	.27**	-.16**
5.	PR						.16**	.13*	-.16**	.10	.24**	-.17**	.18**	-.08	.05	.24**	-.20**
6.	SS							-.04	.21**	.16**	-.05	.15*	-.04	-.02	.11	-.07	-.02
7.	COGN-N 1								.10	.13*	.61**	-.52**	.57**	.05	.13*	.45**	-.30**
8.	COGN-P 1									.48**	.03	.24**	-.01	.48**	.32**	-.08	.28**
9.	PROB 1										.23**	.17**	.01	.31**	.70**	.11	.22**
10.	EMOT 1											-.45**	.33**	.03	.21**	.57**	-.22**
11.	PA/NA 1												-.35**	.17**	.12*	-.34**	,49**
12.	COGN-N 2													-.02	.14*	.64**	-.61**
13.	COGN-P 2														.45**	-.08	.34**
14.	PROB 2															.24**	.18**
15.	EMOT 2																-.46**
16.	PA/NA 2																
	M	13.75	8.62	8.25	10.26	11.77	13.78	24.53	20.45	22.38	18.32	1.13	27.61	20.89	22.39	16.74	1.05
	SD	4.73	5.21	4.91	4.59	4.08	3.97	8.00	4.57	4.81	5.34	.63	7.94	4.13	4.65	5.53	.63

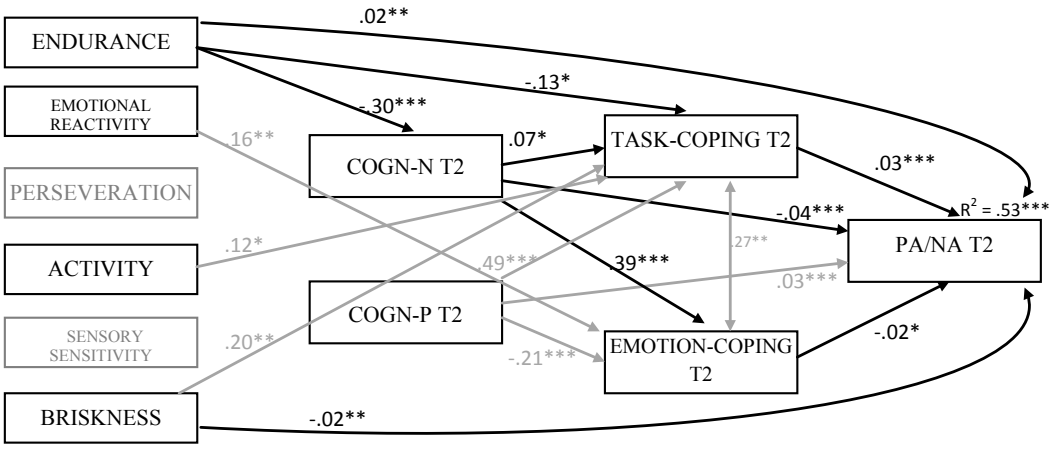
Note: BR= briskness; A = activity; EN = endurance; ER = emotional reactivity; PR = perseveration; SS = sensory sensitivity; COGN-N = negative appraisal; COGN-P = positive appraisal; PROB = problem-focused strategies; EMOT = emotion-focused strategies; PA/NA = positivity ratio. Index 1and 2 – the time of the study.
*$p<.05$; **$p<.01$; ***$p<.001$

Figure 1. The effect of temperament on positivity ratio. Results of multiple mediation analysis.

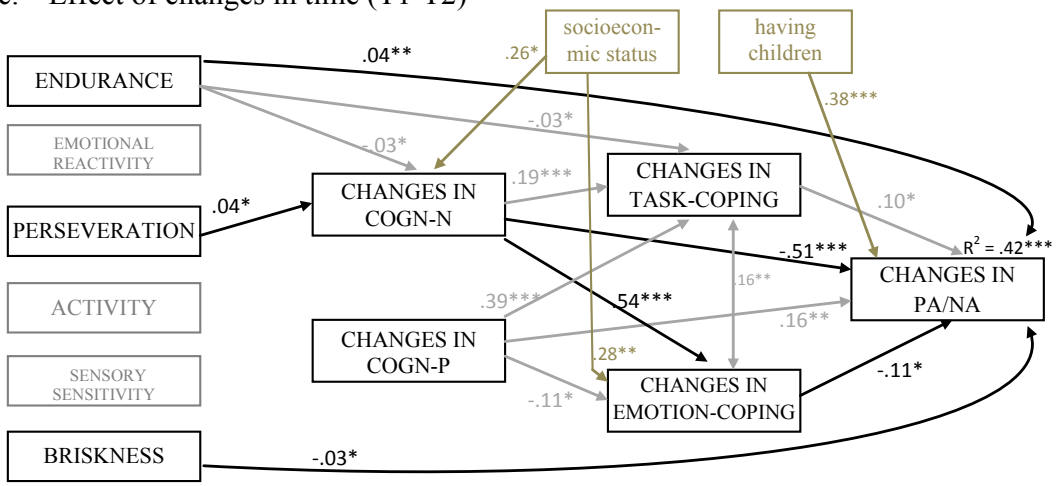
a. Before insulin treatment (time 1.)



b. After conversion to insulin treatment (time 2.; age as a covariante)



c. Effect of changes in time (T1-T2)



Note: Values presented are unstandardized coefficients (*p<.05; **p<.01; ***p<.001).

changes in time

It was hypothesized that initiation of insulin treatment would pose a stressful situation for Type 2 diabetics. Therefore, changes in cognitive appraisal, coping and affect were expected. A significant increase in negative appraisal (F[1,277]=46.64, p<.001, η^2=.14), as well as emotion-oriented coping (F[1,277]=26.51, p<.001, η^2=.09) with a simultaneous decrease in positivity ratio (F[1,277]=4.99, p<.05, η^2 =.02) was observed. In concordance with second research question, further multiple mediation analyses were conducted to test the total and specific indirect effects of temperament on changes in positivity ratio as mediated by the changes of cognitive appraisal and coping strategies (see Figure 1c).

Temperamental factors explained only 4% of the variance of the changes in positivity ratio. Only perseveration was indirectly negatively related to changes in positivity ratio (β=-.03, *SE*=.01, LL BCA=-.05, UL BCA=-.005; direct effect: β=-.01, *SE*=.01, p=.419). The two specific indirect effects turned out to be significant: one through changes in negative cognitive appraisal (β=-.02, *SE*=.01, LL BCA=-.04, UL BCA=-.004) and the second one through changes in negative cognitive appraisal and, in turn, changes in emotion-focused coping (β=-.002, *SE*=.001, LL BCA=-.01, UL BCA=-.0003).

In addition, two direct effects were observed: Endurance was positively associated with changes in positivity ratio (β=.04, *SE*=.01, p<.001; total indirect effect: β=.01, *SE*=.01, LL BCA=-.01, UL BCA=.03). The opposite relationship was observed for briskness, which was negatively related to positivity ratio (β=-.03, *SE*=.01, p<.05; total indirect effect: β=.00, *SE*=.01, LL BCA=-.02, UL BCA=.02).

Finally, for activity (β=.003, *SE*=.009, p=.692; β=-.006, *SE*=.007, LL BCA=-.02, UL BCA=.008), emotional reactivity (β=.02, *SE*=.01, p=.207; β=.02, *SE*=.01, LL BCA=.00, UL BCA=.04) and sensory sensitivity (β=-.02, *SE*=.01, p=.318; β=.001, *SE*=.01, LL BCA=-.02, UL BCA=.02), both respectively direct and indirect effects on changes in positivity ratio were non-significant.

Discussion

The main aim of the study was to explore the nature of temperament impact on positivity ratio (directly and/or indirectly–through cognitive appraisal and, then, through coping strategies) when introducing insulin treatment characterized by an increase in stress intensity over time (Goddijn, Bilo, Feskens, Groenirt, van der Zee & Mayboom-de Jong, 1999; Heszen, 2012). The intensification of negative cognitive appraisal and emotion-focused coping after initiation of insulin treatment seemed an adequate reflection of the health situation, and showed that the conversion was experienced as a strong stressor by patients. The intensification of problem-focused coping, usually used in health situations (Ouwehand, De Ridder & Bensing, 2006), was non-significant but the level of these strategies, compared with other kinds of coping, was the highest during the whole study, which can be explained by a "ceiling effect". The fact that this situation was difficult for the patients can also be proven by the value of positivity ratio (PA/NA) of Type 2 diabetes patients: low during both measurements and only slightly exceeding 1:1 proportion (PA only minimally prevailing NA, especially in T2). It is estimated that positivity ratio in the overall population is reflected by 2:1 proportion (Fredrickson & Losada, 2005), while values around or below one are characteristic for patients with depression, or those who did not experience remission of symptoms after therapy (Schwartz, Reynolds, Thase, Frank, Fasiczka & Haaga, 2002).

The results of bootstrapping analyses, which take into account changes in coping, pointed at direct effect of temperamental traits (endurance, briskness) associated with high stimulation processing capacities (expressed by positive emotions) on changes in positivity ratio. The ability to maintain effectiveness while performing a stimulating activity (endurance) was connected with the increase in positivity ratio, while the tendency to react quickly to external stimulations (briskness) with its decreased over time. The meaning of endurance in the coping process emphasizes the importance of emotional resistance in difficult situations. Direct negative effect of briskness on positivity ratio may be explained by a genetic covariance with fearfulness and associations with anxiety disorders (Strelau & Zawadzki, 2011). Simultaneously, perseveration indirectly influenced the more negative positivity ratio over time. Important mediators of this relation were changes in negative cognitive appraisal itself (perseveration linked to increase of negative appraisal of insulin therapy), as well as changes in negative appraisal and emotion-focused coping (perseveration led to increase in negative cognitive appraisal which was connected with increase of emotion-focused strategies, which in turn resulted in decline of the positivity ratio). The above regularities go in line with psychological characteristics of this temperament trait, associated with ineffectiveness of stimulation regulation. Analysis revealed predictive contribution of endurance and traits related to the temporal level of behavior (briskness, perseveration) to changes in coping process and its outcomes.

The effect of temperament traits on positivity ratio was also examined before (mild level of stress) and after initiation of insulin treatment (higher stress intensity). This analysis pointed at indirect effects of endurance and emotional reactivity on positivity ratio in the situation characterized by moderate stress level. These indirect effects were mediated by negative cognitive appraisal and, in turn, by emotion-focused coping. Previous studies support this finding, reporting the meditation effect of coping in personality traits–affect connections (Bargiel-Matusiewicz et al., 2013; Bolger & Zuckerman, 1995; Knoll et al., 1995; Roesch et al., 2009): Personality triggered differential choices of coping strategies and, in turn, differential stress outcomes (*differential coping-choice model*; Bolger & Zuckerman, 1995). Different relationships appeared in a more stressful situation (T2), which revealed direct effect of endurance (also in an indirect way) and briskness on positivity ratio. Results suggest that effect of temperament traits on positivity ratio depends on stress intensity.

Regardless of conditions, endurance turned out to be a significant factor predicting positivity ratio. Alongside endurance, briskness was of particular importance in the context of a change in treatment which required taking up new health-related behaviours. It is surprising here, that emotional reactivity was important to cognitive, behavioral and emotional reaction only in a mildly (T1) not highly stressful situation (T2), especially in the light of previous studies where this dimension was consistently related to the stress phenomena (see Strelau, 2008). These results may partially confirmed that the role of emotional reactivity is especially evident in unambiguously difficult situations and extreme behaviors.

Furthermore, no links have been found between activity and positivity ratio. This trait may stem from separate functions in the stimulation regulation system (cf. Strelau, 2008). Activity determines the intensity of actions, while briskness and perseveration respond to their processing over time, playing important role in dealing with stress. Sensory sensitivity also turned out to be an non-significant variable in the coping process, which can be explained by its specific character, as well as weakness of the theoretical approach to it, and its operationalization in the RTT (Kantor-Martynuska, 2012).

Moreover, the indirect effect of negative cognitive appraisal itself was stronger than cognitive process and coping activities. This result may derive from documented dependencies between cognitive and emotional processes (Gray, 2004). Distinguishing between cognitive and emotional states on a self-description level seems very difficult. Therefore, the cognitive appraisal indicator can be treated as cognitive appraisal of an emotional state. This is also a possible background for stronger dependencies between cognitive and emotional evaluation of difficult situations.

It must be noted that indirect effects between temperament and positivity ratio should be treated with caution. The bias-corrected and accelerated confidence interval (BCA) obtained for the parameter estimate was in most of the cases oscillating around zero. Also the direct effects of temperament on positivity ratio and its change was near zero in each tested model, also being lower than the share in situational variables. It may not be excluded that this phenomena stems from specifics of the tested stressful situations. Temperament appears mainly in highly stimulation situations (Strelau, 2008). Embarking on insulin regime may not have been a sufficiently extreme experience for the patients, although, the pattern of results obtained for cognitive appraisal, coping strategies and positivity ratio would suggest that this situation posses a stressful experience for patients. The results can also support the relevance of a situation-specific approach to adaptive behaviors (De Ridder & Kerssens, 2003). Analyses based on a bigger sample would perhaps bring about more clearly defined data on the topic of direct and indirect associations between temperament and emotional adjustment to changes in diabetes treatment.

Furthermore, when analysing variables changes over period of time, variables constructed during regression analysis were used, which is, unfortunately, not an ideal solution. Consequently it implied drawing on an assumption about linear changes of the variables (Tabachnik & Fidell, 2013). In future studies it would be recommended to explore curvilinear trends in those changes, and an impact that temperament may have on those.

Despite the constraints listed above, the obtained results may contribute to broadening our understanding of the role performed by temperament in the cognitive, affective and behavioural processes as well as situational mechanism of these influences. Findings have only partly confirmed the assumptions of transactional stress and coping model by Lazarus and Folkman (1984), that is, the impact of temperament on positivity ration was more direct, especially in a more stressful context, and in analyses exploring the changes in coping when changing diabetes treatment. The regulative function of temperament during stressful episode was also partially confirmed; however, we did not find evidence which would corroborate functionality of all model characteristics. Thus, the hypotheses were partly confirmed. Moreover, we would argue that temperament effect (direct vs. indirect) on affective adaptation depends on stress intensity. The obtained results could also have important implications for healthcare professionals. Identification and changes in negative perception of insulin regimen might be the mechanism which can overcome barriers in the conversion to insulin.

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