SOMATOSENSORY AMPLIFICATION ABSORPTION CONTRIBUTE TO ELECTROSENSITIVITY

Ferenc KÖTELES[1], Péter SIMOR[2], Renáta SZEMERSZKY[1]

[1]Institute of Health Promotion and Sport Sciences, ELTE Eötvös Loránd University, Budapest
[2]Institute of Psychology, ELTE Eötvös Loránd University, Budapest

PRINT | English | https://doi.org/10.18071/isz.72.0000 | www.elitmed.hu

Background – Two trait-like characteristics, somatosensory amplification and absorption, have been associated with symptom reports and idiopathic environmental intolerances in past research.
Purpose – As the two constructs are not connected with each other, their independent contribution to symptom reports and electromagnetic hypersensitivity, as well as their interaction can be expected.
Methods – On-line questionnaire.
Patients – 506 506 college students completed an on-line questionnaire assessing absorption, somatosensory amplification, negative affect, somatic symptoms, and electromagnetic hypersensitivity.
Results – Somatosensory amplification ($\beta = 0.170$, $p < 0.001$) and absorption ($\beta = 0.128$, $p < 0.001$) independently contributed to somatic symptoms after controlling for gender and negative affect ($R2 = 0.347$, $p < 0.001$). Similarly, somatosensory amplification (OR = 1.082, $p < 0.05$) and absorption (OR = 1.079, $p < 0.01$) independently contributed to electromagnetic hypersensitivity after controlling for somatic symptoms, gender, and negative affect (Nagelkerke $R2 = 0.134$, $p < 0.001$). However, no interaction effects were found.
Discussion – Somatosensory amplification and absorption independently contribute to symptom reports and electromagnetic hypersensitivity.
Conclusion – The findings suggest that psychological mechanisms underlying symptom reports and electromagnetic hypersensitivity might be heterogeneous.

Keywords: *absorption, somatosensory amplification, electromagnetic hypersensitivity, nocebo, medically unexplained symptoms*

SZOMATOSZENZOROS AMPLIFIKÁCIÓ, ABSZORPCIÓ ÉS ELEKTROMÁGNESES HIPERSZENZITIVITÁS
Köteles F; Simor P; Szemerszky R
Ideggyogy Sz 2019;72(5–6):000–000.

Célkitűzés – Korábbi kutatások alapján a tünetészleléshez és a különféle idiopathiás környezeti intoleranciákhoz két vonásjellegű jellemző, a szomatoszenzoros amplifikáció és az abszorpció is kapcsolódik.
Kérdésfelvetés – Mivel a két vonás kevés átfedést mutat egymással, feltételezhető egyrészt az, hogy függetlenül járulnak hozzá mind a tünetek észleléséhez, mind az elektromágneses hiperszenzitivitáshoz, másrészt az is, hogy kölcsönhatásba léphetnek egymással.
A vizsgálat módszere – Online kérdőíves vizsgálat.
A vizsgálat alanyai – 506 egyetemi hallgató töltött ki egy kérdőívcsomagot, ami a szomatoszenzoros amplifikációs tendenciát, az abszorpciót, a negatív affektivitást, a mindennapi testi tüneteket, valamint az elektromágneses hiperszenzitivitást mérte.
Eredmények – A lineáris regressziós elemzésben mind a szomatoszenzoros amplifikáció ($\beta = 0{,}170$, $p < 0{,}001$), mind az abszorpció ($\beta = 0{,}128$, $p < 0{,}001$) kapcsolódott a mindennapi tünetekhez, a nem és a negatív affektivitás kontrollálását követően is ($R2 = 0{,}347$, $p < 0{,}001$). Mind a szomatoszenzoros amlifikáció (OR = 1,082, $p < 0{,}05$), mind az abszorpció (OR = 1,079, $p < 0{,}01$) szignifikánsan hozzájárult az elektromágneses hiperszenzitivitáshoz a testi tünetek, a nem és a negatív affektivitás kontrollálását követően is (bináris logisztikus regressziós elemzés, Nagelkerke $R2 = 0{,}134$, $p < 0{,}001$). Interakciós hatást egyik elemzésben sem találtunk.
Következtetések – A szomatoszenzoros amplifikáció és az abszorpció egymástól függetlenül járulnak hozzá a tünetészleléshez. A tünetriportok és az elektromágneses hiperszenzitivitás mögött többféle pszichológiai mechanizmus húzódhat meg.

Kulcsszavak: *abszorpció, szomatoszenzoros amplifikáció, elektromágneses hiperszenzitivitás, nocebo, orvosilag megmagyarázatlan tünetek*

Correspondent: Ferenc KÖTELES, Institute of Health Promotion and Sport Sciences, Eötvös Loránd University; 1117 Budapest, Bogdánfy Ödön u. 10. E-mail: koteles.ferenc@ppk.elte.hu
https://orcid.org/0000-0001-5460-5759

Érkezett: 2018. május 8. Elfogadva: 2018. június 6.

A considerable proportion of symptoms that patients report to their physicians cannot be explained by pathophysiological processes, and thus are considered medically unexplained symptoms (MUS)[1, 2]. For the cases when MUS show characteristic patterns and become chronic, such as chronic fatigue syndrome and fibromyalgia, the term functional somatic syndromes was proposed[1]. The overlaps among these syndromes with respect to symptoms and comorbidities are so large that their integration into a single diagnostic category was also suggested[3].

Idiopathic environmental intolerances (IEI) can be regarded as a facet of MUS[4]. Their most distinct feature is that symptoms are attributed to various environmental factors (e.g. chemicals or electromagnetic fields) which do not impact the majority of the population. This is why these conditions have originally been called hypersensitivities, e.g. multiple chemical hypersensitivity or electromagnetic hypersensitivity. Later, as provocation studies did not support the causal role of the suspected factors in the maintenance of the respective conditions[5, 6], the use of the etiologically more neutral idiopathic environmental intolerance was suggested[7]. Research in the area today focuses primarily on possible psychological (top-down) etiological factors, for example classical conditioning or expectations (nocebo phenomenon)[8, 9].

As the impact of psychological factors on MUS appears substantial, exploration of stable (trait-like) personality characteristics that are reliably associated with these conditions might be helpful to better understand the phenomenon. Two characteristics related to symptom reports are female gender and negative affectivity[10]. The former was explained on a psychobiological basis (basically as an interaction between biological features and cultural factors), while the latter was understood as a special cognitive bias[11, 12].

Somatosensory amplification (SSA), the proneness to experience somatic sensation as intense, noxious, and disturbing, is associated with both symptom reporting and negative affect[13]. As it is also linked to body focus, SSA was formerly conceptualized as a blend of body focused attention and negative affect (or anxiety) which leads to the enhancement and misinterpretation of body signals[13, 14]. Recently, it has been suggested that sensitivity to threats to the integrity of the body would be a better explanation[15], and SSA is not characterized by higher levels of sustained attention[16]. The role of SSA in nocebo related symptom reports was demonstrated[17]. Moreover, SSA was associated with IEI attributed to electromagnetic fields (IEI-EMF) and predicted symptom reports in both actual and sham electromagnetic fields[9, 18].

Another trait-like characteristic reliably associated with symptom reports is absorption. Absorption is the tendency to become immersed in external (sensory) and internal (memories, imagination) experiences which often leads to altered states of consciousness[19]. Its most important feature is "total attention", i.e. when the available representational capacity is entirely dedicated to experiencing and modelling the object in focus[19]. In consequence, the experience or sensation in focus will be amplified at the expense of other representations. One can also be absorbed in neutral body sensations, such as breathing, as well as symptoms[19, 20]. Thus, absorption tendency might play a role in experiencing and reporting of symptoms [8]. In empirical research, absorption was associated with various forms of IEI[21, 22].

According to the empirical findings from studies where SSA and absorption were assessed simultaneously, the two traits are not ($r = 0.15$)[23] or only weakly ($r = 0.25$-0.26, $p < 0.05$)[21, 24] connected with each other. This raises the possibility that they might independently contribute to symptom reports. Moreover, their interaction is also possible, i.e. those with high levels on both constructs would show disproportionately more symptoms.

In the current study, six hypotheses were tested as follows. It was expected that both SSA and absorption would be independently associated with somatic symptoms (H1 and H2, respectively). Moreover, their interaction was also assumed (H3). Similarly, the independent contribution of SSA (H4) and absorption (H5) to IEI-EMF and their interaction (H6) were also hypothesized.

Method

PARTICIPANTS

The questionnaires were completed on-line in Hungarian. Participants were undergraduate university students (N = 506; age: 20.1±1.67 yrs; 22.8% female) following studies in economics or engineering at Budapest University of Technology and Economics. They received no reward for their participation. The study was approved by the Research Ethical Committee of the university (Approval Nr.: 2016/077), participants signed an informed consent form before completing the questionnaires.

QUESTIONNAIRES

Negative affect (NA), the general dimension of subjective distress and unpleasurable engagement, was assessed using the NA scale of Positive and Negative

Table 1. *Descriptive statistics (mean±standard deviation values) of and Pearson correlation coefficients between the assessed variables (n = 506)*

	M±SD	Somatosensory amplification	Negative affect	Somatic symptoms
Absorption	17.14±6.770	0.26***	0.11*	0.25***
Somatosensory amplification	27.28±5.569		0.35***	0.37***
Negative affect	20.98±6.264	–		0.46***
Somatic symptoms	6.19±4.23	–	–	–

Note: * : $p < 0.05$; ***: $p < 0.001$

Affect Schedule (PANAS)[25]. The NA scale consists of ten items, which are evaluated on a 5-point Likert scale (1: *not at all* ... 5: *extremely*) with respect to the last 4 weeks. Higher total scores refer to higher levels of NA. Internal consistency (Cronbach's α) of the NA scale in the present study was 0.84.

The prevalence and intensity of subjective somatic symptoms were assessed using the Patient Health Questionnaire Somatic Symptom Severity Scale (PHQ-15)[2]. The PHQ-15 is a 15-item scale designed to measure the prevalence of the most common body symptoms on a 3-point Likert scale (0: *not bothered at all* ... 2: *bothered a lot*) with respect to the last 2 weeks; it was also proposed as a diagnostic tool for a new and broader category of somatoform disorders. The Hungarian version showed good psychometric properties in previous studies[24], its Cronbach's α coefficient was 0.76 in the present study.

Somatosensory amplification, i.e., the tendency to experience somatic sensation as intense, noxious, and disturbing, was measured using the Somatosensory Amplification Scale (SSAS)[13, 26]. The SSAS is a 10-item scale, items are rated on a 5-point Likert scale (1: *not at all* ... 5: *extremely*). Higher scores refer to higher levels of amplification tendency. Internal consistency of scale was 0.67 in the present study.

Absorption, i.e. the openness to absorbing and self-altering experiences, was assessed using the Tellegen Absorption Scale (TAS)[19, 24]. The scale consists of 34 items rated in a binary (yes or no) scale; higher scores indicate higher absorption tendency. Cronbach's α coefficient was 0.86 in the present study.

STATISTICAL ANALYSIS

Statistical analysis was carried out using the SPSS v21 software. Variables' associations were estimated by Pearson-correlation. To analyze their hypothesized interactions, the SSAS and TAS scores were centered (i.e. the respective mean was subtracted from the individual scores for all participants), and an interaction term was calculated as the product of the two centered values. Hypothesis 1 and 2 were checked using multiple linear regression analysis with PHQ-15 score as criterion variable. Predictor variables were entered using the ENTER method in three steps: (Step 1) gender and negative affect as control variables, (Step 2) SSAS and TAS scores, and (Step 3) the interaction term. Hypothesis 3 and 4 were investigated with a binary logistic regression analysis with IEI-EMF score as criterion variable. Predictor variables were entered using the ENTER method in three steps: (Step 1) gender, negative affect, and PHQ-15 score as control variables, (Step 2) SSAS and TAS scores, and (Step 3) the interaction term.

Results

Descriptive statistics and correlation coefficients are presented in **Table 1**. Absorption showed weak connections with SSAS, NA, and PHQ-15 scores. Similarly, SSA was weakly associated with NA and PHQ-scores. 10.5% of participants (53 individuals) categorized themselves as being hypersensitive to electromagnetic fields.

In the multiple linear regression analysis, both SSAS and TAS scores significantly contributed to somatic symptom score even after controlling for gender and negative affect. However, their interaction term was not significant. The final equation explained 34.7% of the total variance ($p < 0.001$) (for details, see **Table 2**).

Concerning IEI-EMF, the significant contributions of both SSA and absorption were found in the binary logistic regression equation after controlling for gender, negative affect, and somatic symptoms. Similar to the previous analysis, the interaction term proved to be non-significant (for details, see **Table 3**).

Discussion

In a cross-sectional study with the participation of 506 young healthy adults, somatosensory amplification and absorption independently contributed to somatic

Table 2. *Regression coefficients in the three steps of the multiple linear regression analysis with somatic symptom score as criterion variable*

	Step 1 R2 = 0.296 p < 0.001			Step 2 ΔR2 = 0.050 p < 0.001			Step 3 ΔR2 = 0.002 p = 0.223		
	B ± SE	95% CI	Standardized β	B ± SE	95% CI	Standardized β	B ± SE	95% CI	Standardized β
Gender	2.993±0.381	2.244–3.742	0.297***	2.548±0.376	1.810–3.286	0.253***	2.545±0.375	1.807–3.282	0.252***
Negative affect	0.279±0.026	0.229–0.329	0.413***	0.234±0.026	0.182–0.285	0.346***	0.234±0.026	0.182–0.285	0.346***
Somatosensory amplification	–		–	0.129±0.030	0.070–0.189	0.170***	0.132±0.030	0.072–0.192	0.174***
Absorption	–		–	0.080±0.024	0.034–0.127	0.128**	0.079±0.024	0.033–0.125	0.126**
Somatosensory amplification x absorption	–		–	–		–	0.005±0.004	0.003–0.013	0.044

Note: ** : p < 0.01; ***: p < 0.001

symptoms and IEI-EMF. However, their interaction was not supported by the analysis in either case.

Concerning subjective somatic symptoms, both female gender and higher levels of negative affect showed a significant contribution. These findings are in accordance with previous empirical results and models of symptom perception[10, 27]. In line with our research hypothesis, both somatosensory amplification and absorption contributed to symptom reports even after controlling for the aforementioned variables. For SSA, this finding supports the notion that, contrary to past proposals[28], the construct is not equal to negative affect and has additional explanatory power in the understanding of symptom reports[15]. Although absorption showed a weak association with negative affect, SSA, and symptom reports in the correlation analysis, its contribution to symptoms remained significant after controlling for the former two constructs. This supports the idea that the underlying psychological mechanisms are different: SSA represents a primary (automatic) evaluation process, while absorption refers to a non-evaluative submersion in the somatic experience. The lack of interaction between the two constructs is also in accordance with this concept, as the above described psychological mechanisms are rather incompatible with each other. In our view, high levels of absorption reflect a special information-processing style favouring emotionally- and perceptually-driven, associative processes over conventional, verbally structured evaluative processes. This way, absorption can similarly amplify positive and negative experiences depending on the content of the representation. On the other hand, SSA reflects "categorical" interpretations of mainly adverse, bodily sensations. In this sense, the content of the representation (i.e. bodily sensations) is fundamental and determines the adverse experiences that are measured by SSA.

As hypothesized, SSA and absorption also contributed to IEI-EMF even after controlling for symptoms, the most salient feature of the condition. IEI-EMF refers to a functional somatic syndrome (i.e. a characteristic pattern of symptoms that is attributed to a well-defined environmental factor), which appears to be more serious and threatening than individual symptoms. Therefore, its association with SSA after partialling out symptoms can be explained by the threat perception approach[15]. Concerning absorption, it was proposed that electromagnetic hypersensitivity can be considered as an overvalued idea, i.e. a strong preoccupation (still not a delusion) that is not supported by available evidence[29]. As attention can be occupied with internal images and fantasies, the overvalued idea approach can explain the finding that absorption remains connected with IEI-EMF even after controlling for symptoms.

Understanding the psychological factors underlying symptom reports and electromagnetic hypersensitivity might also contribute to the development of treatment protocols. For instance, the identification of the role of somatosensory amplification in relation to adverse experiences and false beliefs could be crucial to the development of personalized cogni-

Table 3. *Regression coefficients in the three steps of the binary logistic regression analysis with IEI-EMF as criterion variable*

	Step 1 Nagelkerke R2 = 0.056 p = 0.003		Step 2 Nagelkerke R2 = 0.134 p < 0.001		Step 3 Nagelkerke R2 = 0.134 p < 0.001	
	B ± SE	OR (95% CI)	B ± SE	OR (95% CI)	B ± SE	OR (95% CI)
Gender	0.265±0.345	1.304 (.663–2.563)	0.127±0.353	1.135 (0.568–2.266)	0.128±0.353	1.136 (0.569–2.271)
Negative affect	0.032±0.025	1.033 (.983–)1.086	0.022±0.027	1.022 (0.970–1.077)	0.022±0.027	1.022 (0.970–1.077)
Somatic symptoms	0.076±0.037	1.078* (1.003–1.160)	0.031±0.039	1.031 (0.955–1.113)	0.030±0.039	1.031 (0.954–1.113)
Somatosensory amplification	–	–	0.079±0.031	1.082* (1.019–1.149)	0.076±0.032	1.079* (1.013–1.150)
Absorption	–	–	0.076±0.024	1.079** (1.030–1.131)	0.074±0.026	1.077** (1.024–1.133)
Somatosensory amplification x absorption	–	–		–	0.001±0.004	1.001 (0.993–1.009)

Note: IEI-EMF: idiopathic environmental intolerance attributed to electromagnetic fields; * : p < 0.05; **: p < 0.01

tive behavior therapies that focus on the correction of maladaptive schemas and automatic negative evaluations. Similarly, a patient prone to absorption might benefit from treatments using guided imagery and positive suggestions.

The current study has shortcomings that limit its generalizability. Most importantly, a non-representative and special sample (university students) was used. Second, no conclusions can be drown about causality due to its cross-sectional design. Finally, the assessment of IEI-EMF with only a single yes-or-no question is also criticized[30].

Keeping these limitations in mind, this is the first study that assesses SSA and absorption simultaneously in the context of symptom reports and IEI-EMF. The findings indicate that very different psychological mechanisms can lie behind both phenomena. Thus, their etiology and phenomenology can be heterogeneous as well.

Conclusion

Somatosensory amplification and absorption independently contribute to symptom reports and electromagnetic hypersensitivity. This suggest that the underlying psychological mechanisms might also be heterogeneous.

Declaration of interest: none.

ACKNOWLEDGEMENTS
This research was supported by the Hungarian National Scientific Research Fund (K 109549, K 124132) and the János Bolyai Research Scholarship of the Hungarian Academy of Sciences (for R. Szemerszky). Péter Simor was supported by the Hungarian Scientific Research Fund (NKFI PD 115432) of the National Research, Development and Innovation Office.

REFERENCES

1. *Barsky AJ, Borus JF*. Functional somatic syndromes. Ann Intern Med 1999;130:910-21. https://doi.org/10.7326/0003-4819-130-11-199906010-00016
2. *Kroenke K, Spitzer RL, Williams JBW*. The PHQ-15: validity of a new measure for evaluating the severity of somatic symptoms. Psychosom Med 2002;64:258-66. https://doi.org/10.1097/00006842-200203000-00008
3. *Kanaan RAA, Lepine JP, Wessely SC*. The association or otherwise of the functional somatic syndromes. Psychosom Med 2007; 69:855-9. https://doi.org/10.1097/psy.0b013e31815b001a
4. *Bailer J, Witthöft M, Paul C, Bayerl C, Rist F*. Evidence for overlap between idiopathic environmental intolerance and somatoform disorders. Psychosom Med 2005;67:921-9. https://doi.org/10.1097/01.psy.0000174170.66109.b7
5. *Rubin GJ, Das Munshi J, Wessely S*. Electromagnetic hypersensitivity: a systematic review of provocation studies. Psychosom Med 2005;67:224-32. https://doi.org/10.1097/01.psy.0000155664.13300.64
6. *Staudenmayer H, Binkley KE, Leznoff A, Phillips S*. Idiopathic environmental intolerance: Part 2: A causation ana-

lysis applying Bradford Hill's criteria to the psychogenic theory. Toxicol Rev 2003;22:247-61. https://doi.org/10.2165/00139709-200322040-00006
7. *WHO*. Electromagnetic Hypersensitivity. editors, Kjell Hanson Mild, Mike Repacholi, Emilie van Deventer and Paolo Ravazzani. Prague, Czech Republic: proceedings, International Workshop on Electromagnetic Field Hypersensitivity; 2006.
8. *van den Bergh O, Brown RJ, Petersen S, Witthöft M.* Idiopathic Environmental Intolerance: A Comprehensive Model. Clinical Psychological Science 2017;5:551-67. https://doi.org/10.1177/2167702617693327
9. *Dömötör Z, Doering BK, Köteles F*. Dispositional aspects of body focus and idiopathic environmental intolerance attributed to electromagnetic fields (IEI-EMF). Scand J Psychol 2016;57:136-43. https://doi.org/10.1111/sjop.12271
10. *Pennebaker JW.* Psychological bases of symptom reporting: perceptual and emotional aspects of chemical sensitivity. Toxicol Ind Health 1994;10:497-511.
11. *Aronson KR, Barrett LF, Quigley KS.* Emotional reactivity and the overreport of somatic symptoms: Somatic sensitivity or negative reporting style? J Psychosom Res 2006; 60:521-30. https://doi.org/10.1016/j.jpsychores.2005.09.001
12. *Watson D, Pennebaker JW*. Health complaints, stress, and distress: exploring the central role of negative affectivity. Psychol Rev 1989;96:234-54. https://doi.org/10.1037//0033-295x.96.2.234
13. *Barsky AJ, Wyshak G, Klerman GL.* The Somatosensory Amplification Scale and its relationship to hypochondriasis. J Psy Res 1990;24:323-34. https://doi.org/10.1016/0022-3956(90)90004-a
14. *Köteles F, Doering BK*. The many faces of somatosensory amplification: The relative contribution of body awareness, symptom labeling, and anxiety. J Health Psychol 2016; 21:2903-11. https://doi.org/10.1177/1359105315588216
15. *Köteles F, Witthöft M*. Somatosensory amplification - An old construct from a new perspective. Journal of Psychosomatic Research [online serial]. 2017;0. Accessed at: http://www.jpsychores.com/article/S0022-3999(17)30713-4/abstract. https://doi.org/10.1016/j.jpsychores.2017.07.011
16. *Tihanyi BT, Ferentzi E, Köteles F*. Characteristics of attention-related body sensations. Temporal stability and associations with measures of body focus, affect, sustained attention, and heart rate variability. Somatosensory & Motor Research 2017;34:179-84. https://doi.org/10.1080/08990220.2017.1384720
17. *Doering BK, Szécsi J, Bárdos G, Köteles F*. Somatosensory amplification is a predictor of self-reported side effects in the treatment of primary hypertension: a pilot study. Int J Behav Med Epub 2016 Jan 15:1-6. https://doi.org/10.1007/s12529-016-9536-0
18. *Szemerszky R, Gubányi M, Árvai D, Dömötör Z, Köteles F*. Is There a Connection Between Electrosensitivity and Electrosensibility? A Replication Study. IntJ Behav Med 2015;22:755-63. https://doi.org/10.1007/s12529-015-9477-z
19. *Tellegen A, Atkinson G*. Openness to absorbing and self-altering experiences ("absorption"), a trait related to hypnotic susceptibility. J Abnorm Psychol. 1974;83:268-77. https://doi.org/10.1037/h0036681
20. *Rosen C, Jones N, Chase KA, Melbourne JK, Grossman LS, Sharma RP*. Immersion in altered experience: An investigation of the relationship between absorption and psychopathology. Conscious Cogn 2017;49:215-26. https://doi.org/10.1016/j.concog.2017.01.015
21. *Skovbjerg S, Zachariae R, Rasmussen A, Johansen JD, Elberling J.* Attention to bodily sensations and symptom perception in individuals with idiopathic environmental intolerance. Environ Health Prev Med 2010;15:141-50. https://doi.org/10.1007/s12199-009-0120-y
22. *Witthöft M, Rist F, Bailer J.* Evidence for a specific link between the personality trait of absorption and idiopathic environmental intolerance. J Toxicol Environ Health Part A 2008;71:795-802. https://doi.org/10.1080/15287390801985687
23. *Zachariae R, Paulsen K, Mehlsen M, Jensen AB, Johansson A, von der Maase H*. Anticipatory nausea: the role of individual differences related to sensory perception and autonomic reactivity. Ann Behav Med 2007;33:69-79. https://doi.org/10.1207/s15324796abm3301_8
24. *Simor P, Köteles F, Bódizs R*. Submersion in the experience: The examination of the Tellegen Absorption Scale in an undergraduate university sample. Mentálhigiéné és Pszichoszomatika 2011;12:101-23. https://doi.org/10.1556/mental.12.2011.2.1
25. *Gyollai Á, Simor P, Köteles F, Demetrovics Z.* The Psychometric properties of the Hungarian version of the original and short form of Positive and Negative Affect Schedule (PANAS). Neuropsychopharmacologia Hungarica 2011;13:73-9.
26. *Köteles F, Bárdos G*. Nil nocere? A nocebo-jelenség. Magyar Pszichológiai Szemle 2009;64:697-727. https://doi.org/10.1556/mpszle.64.2009.4.5
27. *Barsky AJ, Peekna HM, Borus JF*. Somatic symptom reporting in women and men. J Gen Intern Med 2001; 16:266-75. https://doi.org/10.1046/j.1525-1497.2001.016004266.x
28. *Aronson KR, Barrett LF, Quigley KS.* Feeling your body or feeling badly: evidence for the limited validity of the Somatosensory Amplification Scale as an index of somatic sensitivity. J Psychosom Res 2001;51:387-94. https://doi.org/10.1016/s0022-3999(01)00216-1
29. *Hausteiner C, Bornschein S, Zilker T, Henningsen P, Förstl H*. Dysfunctional cognitions in idiopathic environmental intolerances (IEI)—an integrative psychiatric perspective. Toxicol Lett 2007;171:1-9. https://doi.org/10.1016/j.toxlet.2007.04.010
30. *Baliatsas C, Kamp IV, Lebret E, Rubin GJ*. Idiopathic environmental intolerance attributed to electromagnetic fields (IEI-EMF): A systematic review of identifying criteria. BMC Public Health 2012;12:643. https://doi.org/10.1186/1471-2458-12-643