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Affective neuroscience correlates of personality and the formation of early maladaptive schemas – preliminary reports

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Abstract

Purpose: The concept of emotional needs occupies a key place in Young's theory of early maladaptive schemas (EMS). The primary caregiver's attitude that is ineffective from the point of view of such needs leads to frustration, which is expressed in the personality of the child and in the resulting disorders. The purpose of this paper is to examine the relationship between retrospective evaluation of parenting as a tool for meeting basic emotional needs and the neural correlates of personality – affective neuroscience emotional systems, according to the theory by Panksepp.

Methods: The study involved 65 individuals between the age of 18 and 62 years (mean age: $M = 34.09$). The following instruments were used: Young Parenting Inventory (YPI) and Affective Neuroscience Personality Scales (ANPS).

Results: Meaningful statistical differences in mothers' and fathers' behavior are related to one domain – Impaired Autonomy and/or Performance ($p < 0.001$). Within this domain, all schemas reached statistical significance, with fathers showing the strongest influence on the formation of the Failure schema ($p = 0.022$). Across all schema, the majority of statistically significant results were found in two domains: Disconnection/Rejection and the Impaired Autonomy and/or Performance. Significant statistical correlations between EMS and neural emotional systems were predominantly associated with the Anger and Sadness systems.

Conclusions: Retrospective assessments of maternal and paternal behaviors show the strongest associations with schemas in two EMS domains: Disconnection/Rejection and Impaired Autonomy/Performance. These two domains are further linked to the activation of two neural emotional systems: Anger and Sadness.

Key words: parental attitudes, early maladaptive schemas, neural emotional systems.

INTRODUCTION

Among the many roles that parents assume in the parenting process, the role of attachment figure stands out as particularly important for the later emotional and social functioning of offspring [1]. The initial bond that connects a child to their primary caregiver endures into adulthood as a kind of template – a reference point and prototype for later interpersonal relationships [2, 3]. The quality of the relationship between child and caregiver depends largely on the caregiver's competence, behavior, and strategies. It is the caregiver's responses that not only enable the child's needs to be met, but also gradually teach the child to recognize their own emotional states and self-regulate [1].

Building on the theory of early maladaptive schemas (EMS), Jeffrey Young highlighted the importance of addressing a person's developmental and life history in therapy, particularly early childhood experiences that may contribute to mental disorders [4]. According to Young's concept, EMS can be understood as pervasive motives or patterns, involving memories, emotions, beliefs, and bodily sensations about oneself and one's relationships with others, which developed during childhood and/or adolescence and were reinforced throughout life [5]. Some schemas, formed in childhood, can underlie many chronic clinical syndromes, milder personality issues, and personality disorders [5], depending on the strength and range of the schemas, with their influence stretching from personality traits of an abnormal personality disorder to a personality that meets diagnostic criteria for a personality disorder [6].

Building on the legacy of attachment theory, Young looks into childhood for the roots of EMS. This developmental perspective views schema formation as closely tied to the fulfilment or frustration of basic needs: having these needs satisfied fosters healthy schemas, while unmet needs contribute to the development of maladaptive

Table 1. The characteristics and biological basis of J. Panksepp's affective neuroscience emotional systems (10, 11, 15, 16)

System name	Characteristics	Cerebral localization
Positive affect		
SEEKING (*interest*)*	It is the main and oldest incentive system. It triggers activities related to exploring the world, interest in reality, seeking and anticipating positive experiences. The arousal of this system leads to intensive learning processes, emergence of adaptive behavior (basal nuclei) and knowledge (neocortex). The SEEKING neural system includes the reward center – in terms of enthusiasm and euphoria of engaging, but not hedonistic satisfaction.	It is associated with the activity of, among others, the nucleus accumbens, the ventral tegmental area and the hypothalamus – the periaqueductal gray (PAG) as well as mesolimbic and mesocortical pathways.
PLAY (*playfulness/joy*)	It controls responses related to social adaptation, the formation of social patterns and pro-social attitudes. The PLAY system is otherwise known as the physical social engagement system. PLAY, as animal and human studies show, shapes social patterns that have no previous representations in the brain. PLAY reduces negative affect (e.g., anger), strengthens pro-social attitudes, influences brain neuroplasticity, and modifies the functions of other emotional systems.	The brain areas of significance are the dorsomedial part of the diencephalon, the parafascicular area and PAG.
CARE (*caring/ nurturance*)	It controls responses related to maternal and caring behaviors and feelings, as well as the development of interpersonal ties. It plays an important role in early childhood development and is associated with activation of the opioid, oxytocin and prolactin systems in the brain.	The areas relevant to this system include the anterior cingulate cortex and the bed nucleus of the stria terminalis, the preoptic area, the ventral tegmental area and PAG.
Negative affect		
ANGER (*rage*)	Responses associated with experiencing feelings of anger and rage and a tendency to exhibit aggressive behavior. The ANGER system activates when the SEEKING system is blocked.	It is located in the medial amygdala to the bed nucleus of the stria terminalis and in the medial and perifornical parts of the hypothalamus to PAG. Areas of the brain undergoing stimulation in RAGE include the amygdala, stria terminalis, medial hypothalamus and periaqueductal gray, among others. The system also connects to the frontal cortex and the insular cortex.
FEAR (*anxiety*)	Its activation is associated with the experience of anxiety, a tendency to worry, difficulty in making decisions, frequent ruminations, and a sense of internal tension. Activation of this system elicits an escape or freeze response. The system has also been linked to reduced pain sensations.	It is linked to the activity of the medial and posterior part of the amygdala to the medial part of the hypothalamus and the dorsal part of PAG.
SADNESS (*panic/ separation distress/grief*)	It forms the basis of the attachment response and is activated in situations of separation from objects that are important to us. It involves experiencing a sense of loneliness.	Functional resting-state connectivity between the left basolateral amygdala and a cluster in the postcentral gyrus, and between the right basolateral amygdala and clusters in the superior parietal lobe and subgyral in the parietal lobe was associated with SADNESS.

Other names for particular neural emotional systems that we can find in the literature.

schemas [7]. Consequently, not only core beliefs but also so-called core emotional needs (CEN) are central to EMS theory [8]. Each of the EMS identified by Young finds its primary source in a basic emotional need that has not been adequately met [5, 8].

As an indicator of the level of satisfaction or frustration of basic emotional needs, Roediger *et al.* [7] propose the concept of core emotions as outlined by Paul Ekman [9]. In our model, we have used Jaak Panksepp's neural emotional systems, which reflect the emotional states experienced by the subjects. According to Panksepp, unbalanced or excessive activity of these emotional systems can become a source of mental suffering [10], which

in turn poses a risk for developing mental disorders [11]. The characteristics of each neural emotional system are listed in Table 1. Research in personality psychology (e.g. [12, 13] and clinical psychology confirms the model's assumptions (e.g. [14]).

Research objective

Maintaining a developmental perspective, it is essential to revisit the role of parents and parental attitudes – specific strategies or styles that support fulfilling parental responsibilities [2], including meeting the child's basic emotional needs. When a primary caregiver adopts attitudes

that are ineffective in addressing these needs, frustration arises, which impacts the child's forming personality and may contribute to personality disorders. Thus, the present study aims to examine the relationship between the retrospective evaluation of parenting as a means of satisfying basic emotional needs and the neural correlates of personality – affective neuroscientific emotional systems according to Panksepp's theory, which may reflect the frustration of basic emotional needs.

METHODS

The presented project was approved by the Research Bioethics Committee of Medical University of Łódź (no.: 1/KBBN-UŁ/II/2021-2022, dated 13 December 2021). The study procedure was conducted in compliance with the Declaration of Helsinki of the World Medical Association [17] (WMA, 2013) and the ethical codes of the Belmont Report [18].

Study group

The study included 65 individuals between the ages of 18 and 62 years (mean age: $M = 34.09$, $SD = 10.77$); 78.46% of the subjects were women. Most individuals in the sample came from cities with a population over 100,000 (72.14%). Respondents were primarily with higher education (46.53%) and secondary education (33.04%).

Measurements

In the first part of the study, the participants completed a short questionnaire to collect sociodemographic data. The respondents then filled out:

1. Young Parenting Inventory (YPI). Young's questionnaire is designed to retrospectively assess parental behaviors (mother and father separately) that may influence the formation of core beliefs underlying EMS [19, 20]. In the present study, the first version of the questionnaire was used, which assess of the mother's and father's involvement in the development of 17 EMS (excluding the social isolation schema). Research by Sheffield *et al.* [20], has shown satisfactory reliability and validity indicators for the scale. The study used a 72-item Polish translation by J. Oettingen (unpublished version).

2. Affective Neuroscience Personality Scales (ANPS). The Polish version of the Affective Neuroscience Personality Scales by Davis and Panksepp [21], translated by the authors of this article, was used to assess personality traits. This tool evaluates endophenotypes associated with the activity in core emotional systems identified in affective neuroscience [22]. The ANPS consists of 112 statements rated on a 4-point Likert scale (strongly disagree (1) to strongly agree (4)), measuring the intensity of six emotional systems: SEEKING (interest), ANGER (rage), FEAR (anxiety), CARE (caring/nurturance), SADNESS/

PANIC (separation distress/grief), and PLAY (playfulness/joy). Of those, LUST, was excluded from this version due to its limited relevance to current human personality frameworks [21]. In the study by Cwojdzińska and Rybakowski [23], all ANPS subscales demonstrated reliability with Cronbach's α exceeding 0.7.

As a result of years of research, Panksepp distinguished seven emotional systems in the mammalian brain, some with evolutionarily distant 'reptilian' origins [Seeking, Anger (rage), Fear (anxiety), Lust (sexuality)], but three [Care (nurturance), Panic (separation), Play (joy)] are forms of adaptation unique to mammals. Each system can be independently activated by stimulating distinct, though overlapping, areas of the brain. Usually, however, they work together to enhance the adaptability of an individual's feelings, thoughts, and behaviors [11]. Emotional systems generate instinctive behavioral responses closely linked to primary affects accompanying these responses. Emotions are an important foundation of personality; thus personality assessments offer insights into these subcortical affects [24].

The study used the 2004 version of the ANPS 2.4 scale, which includes 6 subscales: Play, Seeking, Care, Fear, Anger, and Sadness.

Study procedure

The survey was conducted between January and March 2023, using a Google form. Respondents were recruited using the snowball sampling method. The survey was shared on Facebook platform via a private profile and in public groups. Participants were recruited from among adult, unrelated Poles with a negative somatic and psychiatric history.

Inclusion criteria were formulated as follows: age 18-65, signed informed consent to participate in the study, no Axis I or II mental disorders in the interview. Personal data, collected in connection with the research, included basic demographic data (age, gender, education), which was collected directly from participants, using a created questionnaire. Only data specific to study participants were obtained. Anonymized data are stored for the duration of the study and preparation of the publication, after which they will be securely destroyed.

The processing of personal data complied with the General Data Protection Regulation (GDPR). Each participant was required to read the provisions on personal data protection (GDPR) and provide consent to data processing. All data were anonymized before sharing. The collected data is stored as secure, encrypted files on appropriately protected equipment.

All data were exported to files in publicly accessible formats (csv, jpg, txt, pdf) with the total volume of data obtained estimated at about 100 MB. The data were taken from the devices that were calibrated according to

Table 2. The results recorded in YPI and PCR questionnaire in the sample (*N* = 65)

	YPI								Wilcoxon test for paired samples *Z*	*p*	*r_g*
	Mother				Father						
	M	*SD*	*Min*	*Max*	*M*	*SD*	*Min*	*Max*			
I. Disconnection/Rejection	**45.62**	**9.64**	**31**	**76**	**45.53**	**10.09**	**27**	**72**	**711.1**	**0.968**	–
Emotional Deprivation	22.94	6.91	5	30	19.27	7.22	5	30	4.04	< 0.001*	0.512
Abandonment/Instability	7.26	4.44	4	19	9.01	4.61	4	19	3.21	0.001*	0.398
Mistrust/Abuse	6.69	4.24	4	24	7.94	4.73	4	24	2.81	0.001*	0.348
Defectiveness/Shame	8.73	5.93	4	24	9.32	5.77	4	24	1.71	0.091	0.212
II. Impaired Autonomy and/or Performance	**39.56**	**12.67**	**19**	**73**	**34.52**	**10.72**	**15**	**58**	**4.29**	**< 0.001***	**0.532**
Failure	7.05	4.61	4	24	7.66	4.75	4	24	2.29	0.022*	0.284
Dependence/Incompetence	7.56	4.27	3	18	6.89	3.56	3	18	2.58	0.011*	0.321
Vulnerability to Harm or Illness	13.59	5.36	4	24	10.34	3.95	4	20	4.37	< 0.001*	0.542
Enmeshment/Undeveloped Self	11.16	3.77	4	20	9.63	3.96	4	20	3.28	< 0.001*	0.407
III. Impaired Limits	**19.24**	**6.24**	**8**	**39**	**20.35**	**6.63**	**8**	**43**	**1.91**	**0.057**	–
Entitlement/Grandiosity	10.18	3.22	4	20	10.76	3.42	4	24	1.93	0.053	–
Insufficient Self-Control and/or Self-Discipline	9.07	4.15	4	21	9.61	4.41	4	20	1.03	0.301	–
IV. Other-Directedness	**33.09**	**11.41**	**16**	**72**	**31.98**	**10.62**	**13**	**59**	**0.47**	**0.639**	–
Subjugation	8.91	5.24	4	24	9.94	5.26	4	24	1.91	0.056	–
Self-Sacrifice	11.73	4.35	5	24	9.95	4.11	4	20	4.52	< 0.001*	0.561
Approval-Seeking/Recognition-Seeking	12.47	5.03	4	24	12.11	4.82	4	24	0.73	0.465	–
V. Overvigilance/Inhibition	**62.26**	**19.37**	**27**	**103**	**60.85**	**17.43**	**25**	**105**	**0.389**	**0.696**	–
Unrelenting Standards/Hypercriticalness	21.66	7.79	7	37	21.01	8.07	7	37	0.771	0.441	–
Emotional Inhibition	17.07	4.99	7	28	17.05	4.95	7	27	0.03	0.976	–
Negativity/Pessimism	12.73	5.67	4	24	11.13	4.85	4	24	2.81	0.004*	0.349
Punitiveness	10.81	5.31	4	24	11.68	5.41	4	24	0.845	0.397	–

ANPS	*M*		*SD*		*Min*		*Max*				
Play	20.32		5.37		8		34				
Seeking	20.25		7.21		7		36				
Care	21.86		6.42		8		34				
Fear	21.43		6.47		9		33				
Sadness	20.63		5.65		7		32				
Anger	21.29		5.67		8		35				

YPI – Young Parenting Inventory, ANPS – Affective Neuroscience Personality Scales, N – group size, M – Mean, SD – standard deviation

*p statistically significant, ≤ 0.05.

the manufacturer's instructions; each dataset was checked for correctness by qualified personnel, according to the manufacturer's instructions.

Statistical analysis

Statistical analysis was performed using Statistica version 13.1. The study began with basic descriptive statistics, followed by the Shapiro-Wilk test to assess the normality of the variable distribution. The test results were statistically significant. The distributions of the variables deviated from a normal distribution; therefore non-parametric test variations were used for the remainder of the analysis. The Wilcoxon paired rank test was applied to assess differences in the intensity of various parenting attitudes/behaviors exhibited by participants' mothers and fathers. Spearman's *rho* coefficient was used to assess relationships between EMS and the parenting attitudes of participants' mothers and fathers. A significance level of α = 0.05 was adopted.

RESULTS

The results of the YPI and ANPS questionnaires are shown in Table 2. The YPI questionnaire also presents tests of significance of differences for subscales assessing maternal and paternal behavior.

Analysis of schema domains indicated by the YPI questionnaire revealed significant statistical differences only in the domain of Impaired Autonomy and/or Performance ($p < 0.001$). All schemas in the group were statistically significant, with fathers exerting the strongest influence on the development of the Failure schema ($p = 0.022$) while other three schemas – Dependence/Incompetence, Vulnerability to Harm or Illness, Enmeshment/Undeveloped Self – were significantly more often dependent on the mothers' behavior.

When schemas from each domain were analyzed, statistically significant differences were also found in the following domains:

- maternal influence was significantly higher in the formation of schemas related to Emotional Deprivation, Dependence/Incompetence, Vulnerability to Harm or Illness, Enmeshment/Undeveloped Self, Self-Sacrifice, and Negativity/Pessimism;
- paternal influence was significantly higher in schemas associated with Abandonment/Instability, Mistrust/Abuse, and Failure.

In our analyses, the effect size ranged from moderate to high (Table 2).

A correlational analysis was conducted to examine the interrelations between the individual parenting attitudes of participants' mothers and fathers and the intensity of the affective neuroscience personality traits as measured by the ANPS questionnaire (Table 3). Given the extensive nature of the analyses, only the results of significant correlations for the YPI questionnaire are presented in Table 3, separated for mothers and fathers.

As shown in Table 3, statistically significant correlations between the ANPS questionnaire scales and retrospectively assessed parental behaviors predominantly involve fathers of participants. The affective neuroscience correlates of personality that proved to be significant for the analyses conducted were Anger and Sadness.

For retrospectively assessed maternal behavior, Anger is associated with the domains of Impaired Autonomy and/or Performance and Other-Directedness, and with schemas from the second group. In contrast, for fathers, Anger correlates with the domains of Other-Directedness and Overvigilance/Inhibition, and with schemas from these domains, while Sadness is related to two schemas from the Disconnection/Rejection domain (Emotional Deprivation and Abandonment/Instability).

Overall, the results indicate a weak strength of the relationship.

DISCUSSION

Developed by John Bowlby in the 1960s [25], attachment theory has become one of the most popular and empirically supported psychological frameworks [1], gathering significant interest from both the scientific community and practitioners. Although originally focused

Table 3. Relationships between YPI and ANPS questionnaire scores in the sample

Variable	ANPS Play	ANPS Seeking	ANPS Care	ANPS Fear	ANPS Sadness	ANPS Anger
YPI Mother						
I. Impaired Autonomy and/or Performance	–	–	–	–	–	–0.251*
II. Other-Directedness	–	–	–	–	–	–0.277*
Subjugation	–	–	–	–	–	–0.268*
Self-Sacrifice	–	–	–	–	–	–0.284*
Entitlement/Grandiosity	0.362*	0.294*				
YPI Father						
I. Other-Directedness	–	–	–	–	–	–0.314*
II. Overvigilance/Inhibition	–	–	–	–	–	–0.303*
Emotional Deprivation	–	–	–	–	0.301*	–
Abandonment/Instability	–	–	–	–	0.266*	–
Subjugation	–	–	–	–	–	–0.255*
Self-Sacrifice	–	–	–	–	–	–0.252*
Negativity/Pessimism	–	–	–	–	–	0.257*
Punitiveness	–	–	–	–	–	–0.252*

YPI – Young Parenting Inventory, ANPS – Affective Neuroscience Personality Scales, L – loving attitude, D – demanding attitude, A – protective attitude, R – rejecting attitude, C – liberal attitude

*p statistically significant, ≤ 0.05.

on the parent-child relationship, attachment theory now serves as a theoretical framework for studying various psychological processes, such as emotion regulation, stress management, resilience, or mental health in general, along with its associated pathologies [26].

In a meta-analysis examining the relationship between attachment and psychopathology, Mikulincer and Shaver [26] conclude that a broadly insecure attachment style is a pathogenic condition that underlies the development of both mild subclinical affective symptoms and highly disorganized and disabling adaptive personality disorders. The authors also reference a widely accepted assumption in the therapeutic perspective that the healing factor in the therapeutic process, whose effect seems to go beyond the effectiveness of specific approaches or interventions, is the therapeutic relationship/covenant [27, 28]. These findings align with the theoretical framework of attachment theory, which posits that insecure attachment styles underlie the development of psychopathology. Conversely, the formation of a secure attachment style acts as a factor that mitigates the symptoms of such disorder, fostering a sense of security and enhancing the psychological resources needed to face challenges, evoking and reinforcing positive emotions [26].

Maternal and paternal behavior and the formation of EMS

In our study, the statistically significant differences in parental behavior were observed solely within the domain of Impaired Autonomy and/or Performance ($p < 0.001$). All schemas in this domain reached statistical significance, with fathers exerting the strongest influence on the formation of the Failure schema ($p = 0.022$). Conversely, the formation of the other three schemas – Dependence/Incompetence, Vulnerability to Harm or Illness, Enmeshment/Undeveloped Self – was significantly more often dependent on maternal behavior. Additionally, the analysis of individual schemas revealed statistical significance for schemas in two domains: Disconnection/Rejection and Impaired Autonomy and/or Performance. Mothers were significantly influenced by six EMS, while fathers were significantly impacted by three.

Our findings are consistent with data from the literature, which suggests that in the area of the relevance of parental attitudes to the formation of EMS, the severity of EMS depends more on the attitudes of mothers than on those of fathers [29]. Mącik emphasizes the influence of parental attitudes of both parents on schemas mainly in two areas: Disconnection/Rejection and Impaired Autonomy and/or Performance [29].

The Impaired Autonomy and/or Performance domain is associated with beliefs that make it difficult for an individual to separate from the family and develop mature independence [30]. Behaviors that promote

the development of EMS from this domain include emotional entanglement, undermining the child's self-confidence, overprotection, or failure to support independent needs, goals, decisions, and actions [31].

In the retrospective assessment of the participants, fathers exerted the strongest influence on the formation of the Failure schema, the core of which is the belief in one's incompetence in terms of achievement [32]. The dominant role of mothers, in turn, concerned the schemas characterized by beliefs about one's weakness, helplessness, emotional and instrumental dependence in everyday life (Dependence/Incompetence schema, Vulnerability to Harm or Illness, Enmeshment/Undeveloped Self) [33]. The findings are consistent with the notion that it is the mother's role is to keep the child safe, while the father's role is to teach the child how to adapt to living in the community [34].

Schemas from the Disconnection/Rejection domain are associated with difficulties in the area of attachment formation, with beliefs revolving around the lack of stability and security in relationships with others [35]. The individual nurtures a belief that they have no chance of their needs for empathy, security, care, respect, stability, acceptance, and sharing of feelings to be met. This is due to their childhood experiences of distance, emotional coldness, loneliness, withdrawal, rejection, unpredictable situations, explosive reactions from family members, or violence [36]. In the present study, the formation of schemas in this group was mainly influenced by the subjects' mothers, and these findings are consistent with reports by other authors [37-39]. Additionally, according to Nordahl *et al.* [40], the strongly active maternal schemas in the Disconnection/Rejection domain are also an accurate indicator of the quality, intensity and closeness of the bond between a woman and her unborn child.

These findings are also significant from another perspective. According to numerous authors, two domains of schemas in which parents play a key role (Disconnection/Rejection and Impaired Autonomy and/or Performance) are most relevant to the development of psychopathology [41-45]. According to Emami *et al.* [46], it is the intensity of schemas from the two domains analyzed that separates individuals diagnosed with a personality disorder from healthy individuals.

Affective neuroscience correlates of personality versus retrospective assessment of parental behavior

The next step was to analyze the relationships between affective neuroscience correlates of personality and EMS.

In the case of mothers, a significant relationship was found between the lowered activity of the Anger system and the Impaired Autonomy and/or Performance domain and the Other-Directedness domain, as well as two

schemas from this domain (Subjugation and Self-Sacrifice). The Entitlement/Grandiosity schema, on the other hand, correlated positively with the intensity of Play and the tendency to seek sensations (Seeking).

For fathers, the affective system of Sadness is positively associated with two schemas in the domain of Disconnection/Rejection (Emotional Deprivation and Abandonment/Instability). The Anger system, on the other hand, correlates negatively with the domains of Other-Directedness and Overvigilance/Inhibition, as well as with the schemas of Subjugation, Self-Sacrifice, Punitiveness. A positive relationship was also found between the affective system of Anger and the Negativity/Pessimism schema.

As we stressed in the introduction to this paper, an unbalanced activity of neural emotional systems is associated with the experience of suffering and can be an indicator of the level of having one's needs satisfied [10]. As our results show, the most numerous correlations between the YSQ-S3-Pl questionnaire and the ANPS involve two neural systems: Anger and Sadness.

The Anger system [14], is activated by a sense of frustration and situations in which one's freedom is restricted. Its role is to activate the body's defensive behavior. Sadness, on the other hand, is the attachment response activated in situations of separation from objects that are important to us, and is associated with the experience of loneliness [47, 48].

Thus, it can be concluded that maternal and paternal behaviors that limit a child's autonomy and independence and force them to suppress their needs and emotions are associated with a strong containment of the child's anger. At the same time, paternal behavior that violates the need for feeling secure is a source of sadness and intensifies the child's feelings of abandonment.

Interestingly, the Negativity/Pessimism schema, characterized by persistent focus on negative aspects of life, excessive worry and inability to make decisions, is also associated with anger, which on this occasion takes the form of passive aggression.

These results are consistent with the findings from our previous studies on the neural connections between emotional systems and EMS in patients treated for depression [49]. The mediating role of EMS between feelings of anger and symptoms of mental disorders is indicated by Shute *et al.* [50] and Özmen [51]. Moreover, according to Panić *et al.* [52], EMS domains are linked to the ability to adequately recognize facial expressions (including sadness and anger).

In conclusion, this study confirms the direct influence of childhood experiences on the formation of EMS mas. However, it should be emphasized that further in-depth research, focusing on the biological foundations of EMS, seem to be necessary. On the one hand, it will help us understand the formation of the personality structure and, on the other, it can provide the basis for programming specific therapeutic interventions.

LIMITATIONS

The sample size and the fact that only people who were not under treatment for mental disorders were recruited may be considered as limitations of the present study. It is recommended to consider replicating the assumptions of the study in larger and more varied clinical groups.

The sample size may have also affected the strength of the relationships obtained.

Another limitation in the interpretation of the obtained results may be the fact that the used tools have not been adapted to the Polish language. Despite the confirmation of our results by other researchers (presented in the discussion), these should be interpreted with caution. Further research on this topic is certainly required.

CONCLUSIONS

Retrospectively assessed maternal and paternal behaviors are most strongly associated with schemas from two EMS domains: Disconnection/Rejection and Impaired Autonomy and/or Performance.

These two domains are associated with the activation of two neural emotional systems: Anger and Sadness.

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