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Specific eating disorders – selected aspects of pathogenesis and risk factors

Specyficzne zaburzenia odżywiania – wybrane aspekty patogenezy i czynników ryzyka

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Abstract

Although research into the aetiology and pathogenesis of eating disorders has been ongoing for many years, it has not yet been possible to identify all the factors responsible for their development. Current research does not focus on a single risk factor, but looks for correlations between them. This article presents selected aspects of the pathogenesis and risk factors of specific eating disorders. Family and individual factors, social and cultural factors, and biological factors are described. Particular attention has been paid to the aspect of parenting styles and behaviours exhibited, e.g. excessive punishment and emotional coldness. The coexistence of personality disorders with specific and non-specific eating disorders is also described. The social aspect highlights the development of social media and their impact on self-esteem, body dissatisfaction, and promotion of pathological thinness. Cultural factors include progressive "westernisation" and the rapid increase in the prevalence of eating disorders in the areas of the world where they did not previously exist. Among biological factors, publications on appetite neuromodulators, genetic factors, gut microbiota disorders, and the so-called brain-gut axis were analysed. Modern science is not as yet able to answer the question of which of the mentioned factors has the greatest impact on the development of eating disorders, however, ongoing research offers hope for effective treatment of these diseases in the future. Knowing the factors predisposing to their occurrence will allow early identification of risk groups and undertaking preventive and therapeutic actions, including psychotherapy and pharmacotherapy.

Keywords: eating disorders, risk factors, microbiota, neurotransmitters

Streszczenie

Mimo że badania nad etiologią i patogenezą zaburzeń odżywiania trwają od wielu lat, nie udało się jeszcze zidentyfikować wszystkich czynników odpowiedzialnych za ich rozwój. Obecne badania nie koncentrują się na pojedynczym czynniku ryzyka, ale poszukują powiązań między nimi. W niniejszej pracy przedstawiono wybrane aspekty patogenezy i czynników ryzyka zaburzeń odżywiania. Opisano czynniki rodzinne i indywidualne, społeczne i kulturowe, jak również czynniki biologiczne. Szczególną uwagę zwrócono na aspekt stylów rodzicielstwa i prezentowanych zachowań, np. nadmiernego karania i chłodu emocjonalnego. Opisano także współistnienie zaburzeń osobowości ze specyficznymi i niespecyficznymi zaburzeniami odżywiania. W aspekcie społecznym zwrócono uwagę na rozwój mediów społecznościowych i ich wpływ na samoocenę, niezadowolenie z ciała oraz promowanie patologicznej szczupłości. Wśród czynników kulturowych uwzględniono postępującą „westernizację" i dynamiczny wzrost występowania zaburzeń odżywiania w tych rejonach świata, w których wcześniej nie występowały. W zakresie czynników biologicznych przeanalizowano publikacje na temat neuromodulatorów apetytu, czynników genetycznych, zaburzeń mikrobioty jelitowej oraz tzw. osi mózgowo-jelitowej. Współczesna nauka nie jest w stanie odpowiedzieć na pytanie, który z wymienionych czynników ma największy wpływ na rozwój zaburzeń odżywiania, jednak prowadzone badania dają nadzieję na skuteczne leczenie tych chorób w przyszłości. Poznanie czynników predysponujących do ich wystąpienia pozwoli na wczesne wyodrębnienie grup ryzyka oraz podjęcie działań profilaktycznych i terapeutycznych, w tym psychoterapii i farmakoterapii.

Słowa kluczowe: zaburzenia odżywiania, czynniki ryzyka, mikrobiota, neurotransmitery

INTRODUCTION

Eating disorders are a major public health problem. They are characterised by the presence of pathological eating behaviours that vary, depending on the type of disorder. Nevertheless, they always pose a significant threat to health, sometimes also becoming a direct threat to life. They are particularly common in adolescents and young adults. The treatment of eating disorders requires the cooperation of many professionals, including nurses, doctors, psychotherapists, psychologists, and dieticians. The person's immediate environment, including parents, siblings, grandparents, teachers, and friends, also plays an important role in the recovery process. Understanding the causes of eating disorders is necessary to ensure proper care and treatment (Chen and Couturier, 2019). Although the research on the origin and pathogenesis of eating disorders has been going on for many years, not all the factors responsible for their development have been identified. Interestingly, it has been proven that the same variables affect different individuals in various ways (Funez-Sokoła et al., 2018). This means that modern science is not as yet able to prove beyond any doubt that the long-term occurrence of certain factors will lead to the development of eating disorders. Numerous unsuccessful attempts to find the underlying causes of these diseases contributed to the change in the search for them. Current research does not focus on a single risk factor but looks for links between them (Funez-Sokoła et al., 2018).

The current literature divides eating disorders into two main groups. These can include specific eating disorders (anorexia nervosa, bulimia nervosa) and non-specific eating disorders (bigorexia, night eating syndrome, binge eating disorders, etc.) (Funez-Sokoła et al., 2018).

The first descriptions of symptoms that today would warrant a diagnosis of eating disorders go back to the Antiquity. At that time, however, they were treated as non-obvious symptoms of other diseases, such as pneumonia. Well-preserved are descriptions of monthly purging that involved provoking vomiting or inducing diarrhoea. These practices were commonly used in ancient Egypt. Similarly, in ancient Rome there were special places called "vomitoria," where, especially during parties, vomiting was provoked. This was done to get rid of excess food and to allow one to return to further feasting and the enjoyment of eating more food. Further information comes from the Middle Ages, but in that era these disorders were considered witchcraft, and the persons in whom they were observed were subject to punishment, including the death penalty (burning at the stake) (Kwaśny, 2018).

The first strongly described case of anorexia nervosa comes from the first half of the 19th century, when Richard Morton described a starving woman in his notes. Nevertheless, it was not until 1873 that the psychological basis of the disease was recognised. This fact marked the beginning of the recognition of anorexia nervosa among patients. The situation changed a century later, when in 1979 Gerald Russell proposed a set of diagnostic criteria for bulimia nervosa. Further breakthroughs occurred in the 21st century. The dynamic development of psychiatry and clinical psychology led to the identification of further disease entities which today are generally referred to as eating disorders (Kwaśny, 2018).

The prevalence of eating disorders has changed over the years. They are now considered as some of the most common mental health problems, especially among girls and young women. Moreover, a significant change in the prevalence of these disorders by gender and age has been noted over the past two decades. There has been a dynamic increase in the prevalence of eating disorders in boys and young men, as well as in the elderly of both sexes (Fisher et al., 2018).

The following is an overview of various factors that predispose individuals to the development of eating disorders. Family, personality, social and cultural factors as well as biological factors are described.

The purpose of this study was to address the risk factors of eating disorders and their aetiology based on recent research and available literature.

FAMILY AND PERSONALITY FACTORS

The well-known Slade's model of anorexia (Keski-Rahkonen and Mustelin, 2016) has distinguished three groups of factors that coexist with anorexia nervosa: predisposing (e.g. a pattern of a constantly slimming mother), liberating (e.g. traumatic experience, judgemental remarks on appearance), and supporting (e.g. family gathering around the sick person, family relationship repair) (Keski-Rahkonen and Mustelin, 2016).

In 1970, Salvador Minuchin (Kierus et al., 2012) distinguished the characteristics of families of people with eating disorders, such as stiffness of relationships, overprotection, failure to resolve conflicts within the family, involvement of children in parents' conflicts, and entrapment. Minuchin's views were particularly focused on parents. On the one hand, they emphasised the role of the overprotective mother, and on the other hand the absent father (Fisher et al., 2018). The researcher also highlighted family relations and argued that in families with diagnosed eating disorders, children were involved in the conflicts between parents (Fisher et al., 2018; Pilecki et al., 2014). Such a phenomenon was called a coalition, with one parent allying with the child against the other (the spouse), thus reducing conflicts between the spouses and increasing the psychological discomfort of the child (Fisher et al., 2018).

Cerniglia et al. (2017) examined the profiles of families with eating disorders. They found that all family profiles under study differed from the profile identified by Olson (2010) for balanced families, which showed higher levels of cohesion and flexibility, and lower scores on the sub-dimensions of disengagement, entanglement, rigidity, and chaos. In addition, differences were noted between family profiles depending on the disease present: anorexia nervosa, bulimia nervosa or binge eating disorders. In particular, families

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with adolescents diagnosed with anorexia nervosa tended to report problems with interpersonal boundaries, poor conflict tolerance, and low levels of overall family satisfaction. They also showed significantly higher scores for entanglement and rigidity, and lower scores for cohesion, chaos, and quality of communication. These results are in line with previous studies that indicated the presence of overdependence on other family members, low flexibility, poor communication and overprotectiveness in such families. Families of bulimic adolescents portrayed their families as less cohesive, poorly cohesive and poorly organised, and reported the presence of high levels of family conflict and anxiety. Families of adolescents diagnosed with binge eating disorders reported higher cohesion and flexibility scores and, like anorexic families, described their family as entangled and characterised by poor communication. Parents of children with a bulimia nervosa diagnosis described their families as more chaotic than parents in families with adolescents diagnosed with anorexia nervosa, with lower levels of flexibility and cohesion than all other groups.

Furthermore, Cummings et al. (2021) investigated the relationship between parental use or abuse of selected substances (alcohol and nicotine) on children's eating behaviour. Their results indicated that, in addition to the contributory role of child age, biological sex and family income, stronger parental nicotine dependence and frequent and/or heavy parental alcohol use were associated with significantly higher reward-motivated child eating behaviours. Family history of substance use may be an important transdiagnostic risk factor that identifies children at risk for obesity, bulimia nervosa or binge eating disorder (Cummings et al., 2021).

It has already been shown many years ago that the style of relationship established by parents with their children is important in a person's later mental and emotional development (Lobera et al., 2011). Healthy family relationships help children become well-adjusted adults, minimising the risk of problem behaviours and maximising self-efficacy, and supporting emotional, cognitive, and personal development (Enten and Golan, 2009). Parenting style should be understood as a complex activity including specific behaviours that work individually and in groups to influence outcomes in children, and is intended to describe normal differences in parenting, with an emphasis on issues of control (Enten and Golan, 2009). There are four parenting styles: permissive style, authoritarian style, authoritative style, and uninvolved style (Enten and Golan, 2009). Each of them reflects different values, practices, and behaviours of parents, with a distinct balance of sensitivity and demands (Cerniglia et al., 2017). Authoritarian parents are more demanding and less responsive, permissive parents are more sensitive and less demanding, and authoritative parents are both demanding and responsive (Enten and Golan, 2009). The authoritative parenting style has been identified as the most desirable parenting model because it is characterised by high levels of warmth and low levels of coercive control. In addition, it cares about the child's autonomy and is responsive to the child's needs. This style has been linked to positive child development outcomes regardless of gender, ethnicity, and socioeconomic background (Davis et al., 2001). Enten and Golan (2009) showed that certain aspects of eating disorder pathology (patients' desire to be slim and body dissatisfaction) were inversely correlated with the father's authoritative parenting style. Furthermore, the highest risk of developing an eating disorder was positively correlated with patients' perceptions of their father as authoritarian and inversely correlated with perceptions of their fathers as authoritative. Furthermore, extreme rigidity on the part of fathers has been highlighted and shown to be a possible contributing factor in the development of eating disorders in children. Similar results were obtained in a study by Lobera et al. (2011). Additionally, this study found that between 8.6% and 12.9% of patients with eating disorders perceived their parents' style as neglectful, and the most common parenting style was characterised by low concern and high control (Lobera et al., 2011). Grenon et al. (2016), studying a large population of adult subjects with eating disorders, found that low maternal care had a direct effect on body dissatisfaction, while low paternal care had an indirect effect via anxiety and internalising media. Family relationships have also been shown to influence the development of binge eating disorders and obesity. Perceptions of parental style as emotionless control have been associated with adult obesity, and individuals with binge eating disorders were more likely to report lower quality parental care and lower satisfaction of care from their mother (Amianto et al., 2021).

Parenting style may be an important target for early interventions to prevent the development of eating disorders. Inappropriate parent–child relationships and certain parenting styles (excessive control, lack of affection) have been shown to be a risk factor for eating disorders, and a mechanism potentially underlying the development of pathological eating behaviours characteristic of anorexia nervosa, bulimia nervosa, binge eating disorders, and others (Monteleone et al., 2020). These behaviours may involve a search for autonomy, desire for care and love, self-punishment, and coping with emotional strain beyond the body's adaptive capacity.

The observation of patients suffering from eating disorders allowed the identification of individual (personality) risk factors, which included histrionic, obsessive-compulsive, avoiding, and borderline personality disorders (Chen and Couturier, 2019). Some significant character traits were also observed among patients with restrictive eating disorders (e.g. anorexia nervosa, pregorexia, permarexia), overeating (e.g. binge eating), and purging disorders (e.g. bulimia nervosa). The characteristics of the restrictive type include perfectionism, diligence, unrealistic body image, meticulousness at work and school, constant striving for perfection, low self-esteem, placing excessive demands on the environment, avoiding contact with peers, meeting the expectations of the environment, achieving set goals, and narcissism (Wronka and Jezierska-Kazberuk, 2011). Typical

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findings also include inability to express emotions (such as anger, joy or sadness), failure to fulfil social expectations, depressive moods, loneliness, self-pity, and lack of motivation, lack of strong will, and assertiveness (Wronka and Jezierska-Kazberuk, 2011). Purging behaviours are linked to self-confidence, low self-esteem, loneliness, life in constant tension, need for praise and approval from the environment, submissiveness, and impulsiveness (Davis and Carter, 2009). It has also been proven that the prevalence of eating disorders, regardless of their type, increases in the presence of another mental illness (Wasik et al., 2012). Additionally, it was noted in the 1980s that traumatic experiences in childhood concerning the sexual sphere (harassment, rape) increased the frequency of eating disorders (Pilarczyk, 2016). According to Kiembłowski (2002), there are significant differences between women and men concerning predicted self-destructive behaviours occurring as a result of sexual abuse. In women, eating disorders are more frequent, whereas in the case of men, suicidal thoughts have been observed more commonly (Kiembłowski, 2002). Other studies (Hilbert et al., 2014) also confirmed that the frequency of eating disorders was much higher among people with a history of sexual abuse. This phenomenon is independent of the duration of violence – it may occur either after a single or chronic experience of sexual violence (Hall and Hall, 2011; Platt et al., 2018). A meta-analysis by Solmi et al. (2021) reported that there was highly suggestive evidence of an association between childhood sexual abuse and the onset of bulimia nervosa. For other eating disorders, this meta-analysis failed to find similarly highly suggestive evidence.

Another important aspect is the co-occurrence of eating disorders and personality disorders. According to the literature, the prevalence of personality disorders among patients with various forms of eating disorders ranges from 23% to 80% (Fumagalli and Margola, 2022; Khosravi, 2020). These significant differences are due to different survey methodologies and locations. Furthermore, patients with severe forms of eating disorders who required inpatient treatment had a higher prevalence of personality disorders than those who received outpatient treatment. In patients with restrictive forms of eating disorders (anorexia nervosa, pregorexia, permarexia), personality with anxiety traits – obsessive-compulsive, dependent and avoidant – was observed (Fumagalli and Margola, 2022). In contrast, borderline and histrionic personality traits were very commonly observed in patients who overeat and/or use compensatory methods. It has also been proven that the presence of borderline personality prolongs the duration of treatment, while patients are more likely to discontinue therapy, refuse to cooperate, and engage in risky and self-destructive behaviours (Miller et al., 2021). The literature also draws attention to the division of patients into three groups based on personality type: psychotic, neurotic, and borderline. Neurotic personality has been shown to be the highest risk factor for eating disorders, while high self-esteem, self-confidence, and family support are among protective factors (Mikołajczyk and Samochowiec, 2004).

In the analysis of personality traits, it has also been noted that patients with restrictive forms of eating disorders are characterised by an external locus of control. These patients adopt a passive attitude toward their environment, adapting to it and trying to meet all expectations. They do not believe they can have a say in their lives and, as a result, they become compliant and dependent on others. In addition, they avoid confronting difficult and stressful situations, and seek solace and satisfaction in dreams and fantasies. They tend to be distanced from other people, so they do not build lasting relationships with others and reject the efforts of people who want to establish close contact. This aspect makes it particularly difficult to gain their trust during psychotherapy and to build an appropriate therapeutic relationship (Castejón and Berengüí, 2020; de Oliveira Gonzalez et al., 2020). Achieving success or realisation of plans does not give a sense of happiness, and a sense of randomness of life and lack of self-acceptance dominate. This constant feeling of external control creates the need to gain independence in at least one aspect, so this independence is transferred to food and all aspects related to it (Castejón and Berengüí, 2020; Khosravi, 2020).

In patients with eating disorders of the bulimic type, impulsivity, a lack of orderliness, and a desire to gain approval from those around them are considered the predominant factors. These patients not only need stronger stimuli but also more stimulation than control subjects to achieve satisfaction and contentment. Low self-esteem and low sense of attractiveness are observed, which favours the occurrence of behaviours aiming at pleasing others and gaining approval from family and friends (Levallius et al., 2020). In addition, functioning under high levels of stress, tendency to affective disorders, seeking social approval and co-occurrence of borderline personality disorder promote suicidal behaviour (Khosravi, 2020).

It has also been found that people with eating disorders, regardless of the type of illness, experience higher feelings of anxiety than those in the control group. Hinrichsen et al. (2004) have shown that in addition to the prevalence of obsessive-compulsive disorder, social anxiety and agoraphobia are common among individuals with eating disorders. This supports the hypothesis that both social anxiety and agoraphobia may be functionally related to eating psychopathology and associated psychological characteristics. Abnormal eating attitudes and behaviours are claimed to be specifically associated with social anxiety, whereas unhealthy eating attitudes are associated with both social anxiety and agoraphobia. This is important in clinical practice because it shows that social anxiety should be routinely assessed when working with patients with eating disorders, and anxiety should be evaluated more comprehensively when patients report low self-esteem, distrust of others, or difficulty expressing their thoughts or emotions.

Among individual factors, there is highly suggestive evidence that being a victim of peer violence is a significant risk factor for developing an eating disorder. Lie et al. (2019) have

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shown that appearance-related teasing as well as unflattering, ridiculing comments about appearance are among the main factors influencing the onset of eating disorders. There is also some evidence that an APGAR score <7 points after 5 minutes and a diagnosis of attention-deficit/hyperactivity disorder increase the risk of developing an eating disorder (Nazar et al., 2016; Solmi et al., 2021). Weak evidence has also been found linking substance abuse and type 1 diabetes mellitus to the development of bulimia nervosa (Solmi et al., 2021). Many researchers have suggested that factors predisposing to eating disorders include preterm birth, caesarean section and early onset of menstruation in girls. Despite this, to date, no evidence has been found linking delivery before 37 weeks' gestation, delivery by caesarean section or early onset of menstruation with the development of eating disorders (Solmi et al., 2021; Zhang et al., 2019).

SOCIAL AND CULTURAL FACTORS

Social and cultural factors are becoming increasingly separated. They show potentially destructive effects of the mass media, especially on young men, who do not yet have a fully developed personality (Funez-Sokoła et al., 2018). Attempts to measure up to the prevailing ideal of beauty, by both women and men, have led to the emergence of so-called cultural anorexia (anorexia resulting from the inner need to adapt to mass culture). It is particularly dangerous to promote an early return to the pre-pregnancy body shape among women who have recently become mothers (Funez-Sokoła et al., 2018). This trend very quickly ravages the body that is already affected by pregnancy, which consequently becomes a direct threat to the health of the mother and the child (Bjelica et al., 2018). The literature also describes a phenomenon called pregorexia, i.e. anorexia occurring during the pregnancy (Harasim-Piszczatowska and Krajewska-Kułak, 2017). Recently, a pathological interest in appearance has also been noted among men (Nowogrodzka and Piasecki, 2012). Initially, it was believed that the phenomenon was characteristic only of rich societies, however, studies have shown that they occur all over the world regardless of people's material status (Sangha et al., 2019). The delivery of a TV set with a transmitter to one of the Philippine Islands was shown to have increased the incidence of eating disorders among young boys in this region five times (Rabe-Jabłońska, 2012). Attention has also been drawn to the fact of how many times the image of the ideal man promoted by the media has changed. For several years, bodybuilders and physical exercise practitioners were promoted, while now "neutral" or even feminine men are regarded as the male standard of beauty (Sangha et al., 2019). For many years, it was thought that eating disorders were only prevalent in Western cultures, such as the United States and Western European countries. Now, many studies report that they occur in areas where they did not previously exist, such as many countries in Asia and Africa (Melisse et al., 2020; Nakai et al., 2021). An example of such a country is Japan, which has recently seen an exponential increase in the prevalence of eating disorders. Between 1868 and 1944, only a few reports of a diagnosis of anorexia nervosa in this country were found. The situation changed a few years after World War II, when the process of "westernisation" began. An increase in the number of people suffering from eating disorders was noted then. The number of these patients steadily rose, with patients reporting a fear of fat, avoiding food or overeating, and exercising excessively. Nevertheless, the growing number of patients was never as large as it is today. It is currently estimated that the prevalence of eating disorders in Japan is not different from that in Western countries (Nakai et al., 2021). A meta-analysis by Alfalahi et al. (2021) found that the prevalence of selected eating disorders has increased in West Asian countries. According to the available data that were analysed, anorexia nervosa was present in about 1.59% of the respondents, bulimia nervosa in 2.41% of the respondents, and eating disorders not otherwise specified in 3.51% of the West Asian population. In addition, it was noted that for the first time since research in this area had commenced, the overall prevalence rate of eating disorders in West Asia was found to be slightly higher than the global prevalence rate. An alarming upward trend in the prevalence of eating disorders was also noted by Wu et al. (2020). A global increase in the prevalence of eating disorders of 0.66 points was shown in the years covered by the study (1990–2017). In general, the prevalence of these disorders continues to be higher in women, but in recent years it is men who have been experiencing a dynamic increase in the risk of developing an eating disorder (there is a large percentage increase in men among new patients compared to previous years). In 2017, the highest burden of eating disorders was observed in regions with high socio-demographics, especially in Australasia, Western Europe, and North America (regions with the highest per capita income). However, the most significant increase in the eating disorder burden was observed in East Asia and South Asia. Most countries or territories showed an upward trend in the burden of eating disorders at the national level. The countries with the three highest increasing trends included Equatorial Guinea, Bosnia and Herzegovina, and China (Wu et al., 2020). Furthermore, Pike et al. (2021) indicate that the incidence of anorexia nervosa and eating disorders not otherwise specified is relatively constant across all regions worldwide, while some changes in the prevalence of bulimia nervosa are observed. The researchers demonstrate that the actual prevalence of bulimia nervosa is decreasing among European and non-Latino Americans, while increasing among Asian and Africans (Pike et al., 2021).

Major changes have also occurred in the Arab world, which, because of its culture, used to be considered a place without an eating disorder problem. The socio-cultural changes that have occurred in the Arab countries have increased the risk of developing eating disorders. Some factors that favour this process have been identified, and these include increased affluence, access to media and social media, Western

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influences, and obesity. A diagnosis of an eating disorder has also been associated with a desire to be slim, body dissatisfaction, and disordered eating behaviours (Melisse et al., 2020).

There may be many reasons for this phenomenon, but one of the most widely reported is the rise of social media. Several years ago, mental health professionals were already concerned that the growing popularity of social networking sites might have a negative impact on mental health, increase body dissatisfaction, and promote the occurrence of eating disorders (Marks et al., 2020). It has been criticised that seemingly educational content about diet and nutrition is based on faulty assumptions, which can have consequences such as alternating periods of weight loss and gain, intense feelings of stress or lowered mood. Much of the content promoted by social networks shows unrealistic and retouched images of idealised bodies and "miraculous diets." As currently known, there are three most common risk factors recognised as precursors to eating disorders, including early dieting and extreme weight loss, depression and body dissatisfaction, and internalising media (Lenza, 2020). Marks et al. (2020) demonstrated that social media use is closely related to body image and the occurrence of eating disorders. Lup et al. (2015) examined the effects of watching strangers on Instagram on negative social comparisons and depressive symptoms. This study found that watching more people was associated with higher levels of negative social comparison. Social comparison theory was used as an explanation, according to which people give too much value to their own inadequacies when comparing themselves to others, resulting in dissatisfaction. Similar results were found in a study by Meier and Gray (2014) who assessed time spent viewing, commenting, and posting pictures on Facebook among adolescent girls, and found that increased exposure to image-based content was associated with body dissatisfaction and internalisation of the skinny ideal of beauty. Moreover, for a certain period, social networking sites promoted pathological thinness. These practices were banned by Instagram in 2012, but then replaced by people promoting physical activity and fitness. It would seem that this would have a beneficial effect on people, but in fact nothing could be further from the truth. As has been shown, "fitspiration" (from the words "fitness" and "inspiration") negatively affects body image and increases the risk of developing an eating disorder (Fardouly et al., 2018). It is disturbing that these behaviours are not subject to any control. Widespread access to the Internet has resulted in social network users being able to observe other people regardless of location or distance. In doing so, the barrier of individual differences and variety associated with the specific characteristics of the inhabitants of a particular region of the world is broken. This factor is considered one of the main reasons for the "westernisation," i.e. the adoption of certain Western characteristics, by Eastern countries and the dynamic growth of eating disorders in Eastern regions of the world (Marks et al., 2020; Nakai et al., 2021).

There is also a perceived paradox, as many snacks that are considered unhealthy and excessively high in calories are advertised by young and slim people, creating a certain dissonance. Excessive use of high-energy products consequently leads to weight gain, which contradicts the image of the advertised product (Fardouly et al., 2018).

Other socio-cultural factors that are known to interact with eating disorders include underdeveloped social support networks, high career pressure, inappropriate relationships at work and at school, and critical comments about weight, body shape or food intake.

Pike et al. (2021) conducted a study that compared the levels of exposure to selected socio-demographic factors among Japanese and American women. They found some consistent risk factors that were independent of the geographical region. These included lack of friends, adverse changes in the immediate family, strong social pressures, and the development of social media. In addition to these common elements, they also revealed some differences. Physical and sexual abuse, and weight and eating problems in other family members, did not emerge as risk factors for anorexia nervosa and bulimia nervosa in Japan. These specific differences may reflect enduring socio-cultural differences between Japan and the United States, cultural differences in the conduct of scientific research, or differences in population health, including metabolic diseases such as obesity (Pike et al., 2021).

The impact of critical comments from friends and family was also addressed in a study that compared risk factors in patients who developed eating disorders during childhood and those who developed them during adolescence. Kwok et al. (2020) noted that critical comments and verbal taunts were among the main predictors of eating disorders, especially in the youngest group of patients. They noted that resilience to critical comments does not develop until around the age of 14, so children need to be protected from excessive criticism in the their immediate environment. The study also highlighted some differences. For example, patients with anorexia nervosa with an onset in childhood were more likely to have untreated illness, less likely to report symptoms of overeating, and to have longer hospital stays than patients who developed the illness in adolescence or later. It was also noted that more limited knowledge and less awareness of the disease increased the risk of developing the illness and worsened the prognosis.

Although the above article considers factors that contribute to the onset of eating disorders, it is worth mentioning protective factors that relate to social and cultural issues. Wacker and Dolbin-MacNab (2020) studied a group of women who identified with the feminist movement and were socially active. From the study, the researchers concluded that there were some protective factors against eating disorders. These included: (1) people who provide emotional and real support, (2) support from people who counteract eating disorders, (3) a sense of agency, and (4) activism and community involvement. The literature reports that a higher degree

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of feminist traits is associated with a lower risk of developing an eating disorder.

BIOLOGICAL FACTORS

Genetics

Studies conducted by Nunn et al. (2012) and Rask-Anderson et al. (2010) provide significant evidence for the genetic background of eating disorders. They deal with the polymorphism of genes of receptor or transporter proteins, including appetite regulation, systems related to mental disorders, hunger and satiation systems, systems of metabolism regulation, immune system, inflammatory response, and hormonal system (Wasik et al., 2012). In the course of the study, it was not possible to identify a single gene that would cause eating disorders. However, more attention has been paid to the polygenic model, in which the key role is attributed to an interplay of many genes with a low effect (Nunn et al., 2012; Rask-Anderson et al., 2010). In the case of multi-genetic inheritance, there is an interaction between genes, where one gene may intensify or suppress the information it carries (Karlik et al., 2008). Although the findings of studies on the genetic background of eating disorders are not unequivocal, most of them have shown that morbidity increases if they occur among relatives (especially first-degree relatives). It has also been proven that their incidence in monozygotic twins is 57% and in dizygotic twins, it is only 12% (Chen and Couturier, 2019). Moreover, it has been shown that anorexia nervosa is determined by genetic factors in 33–84% (Funez-Sokoła et al., 2018). What is more, individual eating disorders have been found to be associated with chromosomes 1, 4, 11, 13, and 15. The analysis of feedback showed that there are several specific areas of the chromosome occupied by the gene (loci) that may be related to eating disorders (Rabe-Jabłońska, 2012).

The long arm of chromosome 1 (1p33–36), where the genes of the opioid delta receptor (*OPRD1*) and the gene encoding the 1D serotonin receptor are found, were indicated in families with the restrictive type of anorexia nervosa (Karlik et al., 2008). Epidemiology shows that eating disorders are much more common among women than men, but genetic studies have not determined the difference (Przewoźnik, 2013; Rantala et al., 2019). Some researchers suggest that genes of susceptibility, e.g. to anorexia nervosa, may be passed on to the offspring by the mother and/or father, but the expression of the phenotype for unknown reasons occurs mainly in women (Monteleone and Brambilla, 2009).

Neuroregulation

Modern researchers have been attempting to find a relationship between the occurrence of eating disorders and the functioning of neuroregulation (Chen and Couturier, 2019; Rantala et al., 2019). People with eating disorders suffer from disorders of the basic neurotransmitter systems: serotonin (5-HT), dopamine (DA), and noradrenergic (NA) (Wasik et al., 2012). Dopamine and serotonin play a particularly important role, influencing the functioning of the nervous system and regulating the behaviours crucial for eating disorders, including obsessive thoughts, strong anxiety, and anorexia (in the case of restrictive type disorders). Their abnormal functioning results in a disturbed image of one's own body, which leads to excessive physical activity self-starvation, as well as irregularities within the reward system (Wasik et al., 2012). A certain concept of anorexia based on neurotransmission disorders was put forward by Nunn et al. (2012). According to their thesis, anorexia results from genetic disorders in the noradrenergic system which is associated with increased anxiety, regional cerebral hypoperfusion, and impaired neuroplasticity. These deviations are manifested by abnormal body image and fear of gaining weight, which lead to a restrictive diet. Dietary restrictions cause a significant decrease in the supply of noradrenaline precursors from food, which reduces the feeling of anxiety and results in an increased commitment to diet. A further increase in the number of noradrenaline precursors cause an increased adrenergic response and an increased feeling of anxiety, which discourages the development of normal nutritional behaviour and at the same time increases anorexic behaviour (Nunn et al., 2012). Patients with anorexia nervosa may suffer from serotonergic dysfunction of the serotonergic system, which occurs during starvation, even after reaching normal body weight (Barbarich et al., 2003). This may cause anxiety during the treatment and the recurrence of the disease after its completion. Transmission disorders in the hypothalamus affect not only the nervous system but also the functioning of other systems. As a result of these abnormalities, all neuroendocrine axes are disturbed – deficiency of oestrogens and progesterone and excess growth hormone and cortisol (Chen and Couturier, 2019). There are dysfunctions of the hypothalamic–pituitary–adrenal axis, manifested by excessive secretion of corticoliberin (CRH). Additionally, starvation causes disturbances in regional metabolism – a decrease in thyrotropin (TSH) and triiodothyronine (T3) levels, abnormal thyroxine to triiodothyronine conversion, and disturbances in androgen and cortisol metabolism (Chen and Couturier, 2019).

The discovery of neuropeptides, which have a double effect – either stimulating or inhibiting appetite, and also influencing systemic processes – was the theory of high hopes (Chen and Couturier, 2019). These substances include neuropeptide Y, peptide YY, ghrelin, galanin, beta-endorphins, leptin, and orexin A and B (Śliwińska-Mossoń et al., 2013). They show a wide range of effects, e.g. neuropeptide Y apart from appetite regulation (mainly craving of sweets) has an anti-anxiety and anticonvulsant effect, improves memory, facilitates the control of circadian rhythms, and also regulates the synthesis and release of hormones (Chen and Couturier, 2019). Its level increases during hunger (chronic or temporary), which is manifested by an increased

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process of fat formation and unrestrained appetite for carbohydrates (Galusca et al., 2015; Kocełak et al., 2009). It has also been shown that neuropeptide Y levels increase as a result of very restrictive diets. Physiologically, its concentration increases in the morning and decreases in the evening (Galusca et al., 2015). The opposite neuromodulator is the YY peptide, which inhibits the feeling of hunger. The stimulus stimulating its release into the cardiovascular system is the ingested food (Śliwińska-Mossoń et al., 2013). The YY peptide inhibits intestinal motility, thus reducing hunger and appetite (Galusca et al., 2015). Its concentration increases after a meal and remains at a high level for several hours afterwards (Śliwińska-Mossoń et al., 2013). However, it has been demonstrated that serum concentrations of these two substances are similar both in healthy and dysfunctional individuals, which limits their clinical use (Chen and Couturier, 2019).

The difference in plasma ghrelin concentrations in patients with anorexia and the control group (healthy individuals) has also been demonstrated (Chen and Couturier, 2019). Its concentration in patients with anorexia remains high even after two hours of food intake and corresponds to the concentration found in healthy individuals right after a meal (Schalla and Stengel, 2018). Its determination in blood serum may serve as an indicator of treatment efficacy because, after weight gain and proper diet, its level normalises and increases only in response to meal intake (Chen and Couturier, 2019).

Other appetite neuromodulators (e.g. leptin and orexin A and B) were also evaluated, but their role in the occurrence of eating disorders has not yet been recognised (Chen and Couturier, 2019). Despite advances in science and diagnostic methods, the knowledge of disorders in the field of hunger and satiation neuromodulators does not translate into the effectiveness of therapy.

Microbiota

Many articles have shown that intestinal microbiota affects human mood and behaviour (Jiang et al., 2015; Naseribafrouei et al., 2014). Moreover, it has been proven that microbiota modification, through the consumption of probiotic bacteria, reduces some psychiatric symptoms (reduces anxiety and depression) (Castrillo et al., 2017; Marchesi et al., 2016). Microbiota is a term used to describe all microorganisms living in the human body (commensal, symbiotic and pathogenic) (Donaldson et al., 2016). They represent a very diverse pool of species, and their number in the intestines is about 10^{13}–10^{14} of microorganisms (Karakuła-Juchnowicz et al., 2017). Under physiological conditions, they occur in specific quantities and proportions (Świerczyńska, 2020). Their abnormal composition or abnormal mutual relationship, called dysbiosis, prevents normal functioning of microbiota and contributes to the development of pathological processes (Fond et al., 2015). Dysbiosis affects the functioning of many organs and systems, including the central nervous system, through numerous interactions taking place along the pathway of the gut–brain axis (especially through increased permeability of the intestinal barrier) (Donaldson et al., 2016; Fond et al., 2015). Leaky intestinal epithelium enables the free flow of proinflammatory bacterial endotoxins, which affects the neuronal activity of the brain (in the limbic system) (Jiang et al., 2015; Marchesi et al., 2016). Lipopolysaccharides cause activation of proinflammatory cytokines and microglia, which contributes to a generalised inflammatory reaction occurring in most mental disorders (Castrillo et al., 2017). This observation contributed to the study of the relationship between the occurrence of eating disorders and host microbiota.

Queipo-Ortuño et al. (2013) conducted a rat study in which they demonstrated that the composition of microbiota in anorexic individuals was different from that of healthy individuals. It was also shown that microbiota affected appetite neuromodulators – leptin and ghrelin, which suggests that microbiota influences the regulation of hunger and satiation (Queipo-Ortuño et al., 2013). Dysbiosis was also found in human studies. Morita et al. (2015) examined 46 women (two groups: 25 women with anorexia nervosa, 21 women as a research sample) to compare them in terms of microbiota. The study showed significant differences between the two groups, however, in the group of women suffering from anorexia nervosa the total number of intestinal bacteria was significantly lower and the proportion of particular species was disturbed (reduced proportion of *Clostridium coccoides*, *Clostridium leptum*, and *Bacteroides fragilis*) in comparison to healthy women (Morita et al., 2015).

In another study (Kleiman et al., 2015), a total of 28 patients (16 patients with anorexia and 12 healthy individuals) were examined. In this case, the composition of the intestinal microbiota before and after the treatment (i.e. after weight gain) and the differences between the two groups were compared. The obtained results indicate that in patients with anorexia nervosa the total number of intestinal bacteria and their species diversity was much lower before the commencement of treatment and much lower in comparison to the control group. Both of these indicators improved among the patients after the end of therapy but were still significantly lower than in the healthy subjects (Karakuła-Juchnowicz et al., 2017). In this study, psychopathological symptoms (depression symptoms and anxiety disorders) in both groups were also evaluated. The findings show that both anxiety disorders and depression were more severe among people with poorer bacterial flora, and they improved after the increase in the number and species diversity of intestinal bacteria (Kleiman et al., 2015).

FINAL REMARKS

In recent years, there has been an evolution of research focus in the field of eating disorder risk factors. Many years ago, the impact of an inappropriate relationship with the

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mother on the prevalence of eating disorders was highlighted, but current research trends tend to be focusing on fathers and the impact of the father–child relationship on the psychological development of the offspring. The impact of traumatic episodes (e.g., rape, sexual abuse) on the risk of developing an eating disorder has long been recognised, and the coexistence of eating disorders with depression or obsessive-compulsive disorder has also been conclusively demonstrated. Currently, the coexistence of eating disorders with personality disorders or specific phobias, e.g. agoraphobia, is widely discussed. Moreover, special attention is paid to the use of social media, progressive cultural changes, including the adoption of Western characteristics by Eastern countries, neuroregulation disorders or dysbiosis. Almost all publications report that eating disorders are a diverse group of diseases with a complex aetiology. Both in the available literature and clinical practice, a multifactor model of these diseases is observed. It seems that only a comprehensive approach to eating disorders can contribute to improving the success rates of treatment. In the course of therapy, it is important to focus on personality factors, family factors, and socio-cultural factors, which are modified during psychotherapy, as well as biological factors, which can be partly controlled using pharmacotherapy.

Conflict of interest

The authors report no conflicts of interests.

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