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Adolescent depression: A current and growing public health problem

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Abstract

Depression is a serious global public health problem that is causing increasing concern due to its growing prevalence in all age groups, particularly when begins during adolescence. Generally interpreted as a natural consequence of modern life, depression can manifest itself with a wide variety of symptoms that affect somatic, cognitive, affective, and social processes, compromising people's development, functionality, quality of life, and even survival. Adolescence, in turn, is a particular phase of human physical, emotional, cognitive, and social development, marked by major changes in body structure - especially reproductive capacity - in the central nervous system, and in emotional and personality maturation. It is recognised as a window of vulnerability for the emergence of physical and emotional illnesses that can last into adulthood. This article presents some characteristics of the development of the central nervous system and emotional evolution of adolescents and aspects related to the onset of depression, highlighting its clinical manifestations, associated factors, consequences, screening and diagnostic methods, as well as currently recommended therapeutic proposals and preventive actions.

Keywords: Adolescent, adolescence, depression, mental health, mood disorder

Introduction

Depression is a serious public health problem that has been causing growing concern due to its increasing prevalence in all age groups, particularly among adolescents who are undergoing rapid physical, emotional, social and cognitive development and experiencing important transitions to adulthood. Often identified as a natural consequence of modern life, depression can evolve into regression, recurrence or persistence, presenting a wide variety of symptoms that affect somatic, cognitive, affective and social processes, compromising development, functionality, quality of life and even survival ^[1, 2]

The conceptualisation of depressive disorder, according to the criteria established in the Diagnostic and Statistical Manual of Mental Disorders-5 (DSM-5) and the International Classification of Diseases-11 (ICD-11), is largely the same in adolescents and adults. It is a complex and multifactorial disease whose symptoms include bad mood, worthlessness, anhedonia, appetite changes, fatigue, sleep problems, psychomotor changes, impaired concentration or thinking ability, hopelessness, and even suicidal ideation ^[3, 4].

Adolescence, puberty and brain development

Adolescence is a particular stage of human physical, emotional, cognitive, and social development, marked by major changes in body structure and, particularly, in reproductive capacity and the central nervous system. At this stage of life, a remarkable event occurs: puberty, a process that begins with physical changes driven by the action of adrenal and gonadal hormones, directly related to the development of secondary sexual characteristics and with a great influence on brain function ^[5, 6, 7].

The central nervous system begins its development from the neural neuroectoderm which, at the end of the fourth week of embryonic life, triggers the formation of primitive brain vesicles (telencephalon, diencephalon, prosencephalon, mesencephalon, and rhombencephalon) that will evolve and complete the maturation process around the third decade of life ^[8]. During puberty, several hormones are responsible for actions that cause structural and functional changes in the brain, playing a fundamental role in the reorganisation of neural circuits and initiating processes such as synaptic pruning, myelination, and neural reorganisation. In the adolescent brain, while the subcortical systems

are already developed, the cortical systems have not yet undergone the maturation process [6, 9, 10, 11].

Adolescence is a critical period marked by high neuroplasticity, which makes it a privileged window for brain development driven by environmental experiences and stimuli [9]. Plasticity refers to the nervous system's ability to adapt its structure and function in response to physiological changes, experiences, and environmental demands [12]. However, neuroplasticity tends to make adolescents particularly vulnerable to environmental stressors, which can impact neural development and contribute to onset of mental disorders in early adolescence, such as anxiety and depression. Stress can cause changes in brain maturation processes and is considered a factor in the onset, maintenance, and severity of mood disorders. The prefrontal cortex is particularly vulnerable to stress, and decreased activity in this area is related to depression [12, 13].

It is suggested that cognitive development during adolescence is associated with progressive efficiency in affective modulation, given that increased activity in the prefrontal regions of the brain is observed during this stage of life as an indicator of maturity. During adolescence, women exhibit more intense negative affective responses to

stress compared to men, and consequently greater emotional distress. Therefore, the emotional and social challenges associated with changes in the development of the endocrine and nervous systems make adolescence a period of vulnerability and high risk for emotional disorders [5].

Prevalence and associated factors

Depression in adolescence is a growing problem worldwide, with prevalence rates ranging from 8% in different European countries, 13% in the USA, and up to 20% in other regions of Latin America and Asia (2,14-18), corresponding to almost one-third of the world's adolescent population (3,19,20). Females are more affected, at a ratio of approximately 2:1 [15, 16, 18, 19-21], and girls generally experience depression earlier, with longer depressive episodes and higher rates of comorbidity with anxiety disorders compared to boys suffering from depression. This disparity is likely due to the action of gonadal hormones, which play a crucial role in mood regulation and susceptibility to depressive disorders [5].

Several risk factors can be identified in the multifactorial and complex origin of depression, which act alone or in combination, as shown in Table 1 [1, 6, 14, 16, 19, 22-31].

Table 1: Risk factors associated with depression in adolescents

Biological	Psychological	Environmental
Female gender, low birth weight, prematurity, excess weight, early onset of puberty, chronic diseases, family history of depression, high-functioning autism, difficulties in defining gender identification, polymorphism in serotonin, dopamine or monoamine oxidase genes, sleep disturbances or deprivation, inflammatory body's response.	Body dissatisfaction, low self-esteem and self-compassion, more than two hours/day of leisure screen time and/or addiction to internet or video games, inappropriate use of social media, dysfunctional and emotional regulation, negative thinking and memory styles, less attachment to parents and peers, difficult relationships with peers, academic and learning difficulties, concern about grades or assessments, associated mental and behavioural problems, drug use, alcohol, smoking.	Exposure to natural disasters, chronic adversity, loss of a loved one, being victimised or bullied, or witnessing physical, sexual, or emotional violence, abuse, or neglect, bullying, low economic status, family discord, parental rejection or low parental involvement, family dysfunction and/or caregiver depression, reduced physical activity and sports, greater pollution exposure, disruptive behaviour, victim of mistreatment.

Modified from Selph S et al [22]

Adolescents with depression are at high risk for other psychopathologies including anxiety, higher rates of conversion from depression to bipolar affective disorder, eating disorders, and functional somatic symptoms. They may also be prone to risky behaviours such as alcohol, nicotine, and psychoactive drug use, risky sexual activity, and increased suicide attempts [32-34].

On the other hand, some studies have shown that physical activity practised with other people, which offers social support, increases endorphin levels, promotes socialisation and group belonging, and helps improve self-esteem and body image perception, is a factor that can be associated with treatment [2, 35]. The complex relationships between depression and diet should also be highlighted, with influences on mood caused by an imbalance in the gut microbiota [1, 36], the modulation of inflammatory processes, and stress reduction [37]. Other protective factors that can contribute to reducing the vulnerability of adolescents, promoting well-being and resilience, are: strong family relationships and family cohesion, positive parenting, social support from peers, high self-esteem, emotional competence, and positive cognitive and social skills [38, 40].

Pathophysiology

It has recently been suggested that depression disorder that develops in adolescence is characterised by changes in functional connectivity between various regions of the brain involved in emotion processing, particularly in the anterior

cingulate cortex and amygdala, during a period when these structures are still developing [42]. The imbalance in neurotransmitter activity at this stage of life is another factor that should be highlighted in the pathophysiology of depression, since serotonin, norepinephrine, and dopamine have a significant impact on brain circuits involved in motivation, emotional regulation, cognitive performance, and responses to stress [1]. These events are part of a set of biological and social changes characteristic of the post-pubertal phase, such as self-awareness and social understanding, changes in the brain circuits involved in responses to reward and risk, and increased stress levels [19]. Hormonal dysregulation, particularly when it occurs in the hypothalamic-pituitary-adrenal (HPA) axis, is also associated with depression, as neuroendocrine responses to stress have been observed in adolescents with depression, suggesting that the HPA axis may be dysregulated in these individuals [1]. Cortisol, which is the main hormone of the HPA axis and the main glucocorticoid produced in response to stress, regulates neuronal survival and neurogenesis. One hypothesis suggests that high levels of circulating cortisol may lead to reduced neurogenesis, which in turn may contribute to symptoms of depression [7].

Clinical manifestations

Although symptoms and signs may not be easily identified at this stage of life, the clinical presentation of depression in adolescence varies according to the severity of the case and the characteristics of the individuals. There is a difference

between genders, with female adolescents reporting feelings of irritability, loneliness, sadness, pessimism, self-hatred, and eating disorders, while among males, anhedonia, restlessness, reduced ability to concentrate and reflect, lack of decision-making skills, and somatic complaints are more common [19]. Symptoms such as insomnia or hypersomnia, fatigue, changes in appetite, weight loss or gain, agitation or psychomotor retardation, loss of interest in general activities, school and sports that were previously enjoyable, propensity for angry outbursts with dangerous ideas, as well as suicidal ideation and attempts can also be observed [23, 43, 44].

Screening and diagnosis

Due to the high prevalence of the disease, the heterogeneity of the clinical picture, and the consequences that delays in identifying depression can cause (given that the time between the onset of clinical manifestations and the diagnosis can be many months) several guidelines and instruments have been designed and used to increase both the sensitivity and specificity of diagnostic assessments. Currently, the following can be highlighted: SSHADESS Questionnaire (strengths, school, home, activities, drugs and substance use, emotions, eating and depression), Child Depression Inventory (CDI), the Depression Screener for Teenagers (DesTeen), Hamilton Depression Scale (HAMD), the Centre for Epidemiologic Studies Depression Scale (CES-D), the Reynolds Adolescent Depression Scales (RADs), the Children's Depression Inventory (CDI), the Kutcher Adolescent Depression Scale (KADS), the Patient Health Questionnaire for Adolescents (PHQ-A) and the Beck Depression Inventory (BDI), the latter two being the most commonly used in clinical practice [14, 19, 45, 46].

The diagnosis of depression in adolescents should be established according to one of the most commonly used classification systems for emotional health problems, which are: the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5) and the International Classification of Diseases, 11th Revision (ICD-11). The DSM-5 includes additional criteria to specifically define major depressive disorder in adolescents, i.e., symptoms of irritability may be considered in place of depressed mood, and failure to achieve expected weight gain may be considered in place of weight loss [47].

In order to establish a differential diagnosis of depression, a variety of emotional problems must be considered, such as adjustment disorder with depressed mood, sadness or irritability related to situational stressors, persistent depressive disorder (without a history of major depressive episodes), bipolar disorder, schizophrenia, adjustment disorder, dysthymic disorder, disruptive mood dysregulation disorder and post-traumatic stress disorder [14, 19, 22].

In addition to mental disorders, the possibility of using medications and pharmacologically active substances that may contribute to the onset of symptoms should be kept in mind [14]. Some physical health problems can also mimic primary depressive disorder, notably vitamin deficiency, hypothyroidism, anaemia, mononucleosis, traumatic brain injury, and autoimmune diseases [22].

Comorbidities and consequences

More than half of adolescents with depression have at least one diagnosis of an associated mental health problem, most commonly: anxiety disorders, attention deficit hyperactivity disorder, oppositional defiant disorder, conduct disorder, disorders due to psychoactive substance use, eating disorders, and learning difficulties. Long-term physical

illnesses, including chronic pain, neurological disorders, and autoimmune or inflammatory diseases, can also be found in patients with depressive symptoms [14, 48].

Adolescence is a vital period for human physical and mental development, and depression affecting individuals during this stage of life can have profound long-term impacts, resulting in interrupted education with poor academic results, diminished social skills and relationships, and even compromising future prospects for quality of life and professional activity engagement [1]. Early-onset depression often recurs and can persist into adulthood, especially when left untreated, and may signal the development of more serious mental illnesses later in life [49]. Furthermore, when left untreated, depression in adolescents is associated with an increased risk of illicit substance use, compromised social relationships, a high risk of suicidal behaviour, and a greater likelihood of cardiovascular disease and obesity [2, 19].

In family and social context, depression in adolescents can trigger feelings of insecurity and helplessness in parents, as they may feel unable to assume their parental role due to their limited knowledge about the disease. Such feelings highlight the difficulty family members have in dealing with the disease and the patient, which usually causes stress, family disharmony, and conflicts [17, 18].

Treatment

Several treatment options (non-pharmacological, pharmacological, and combined) are available for adolescent depression, but they need to be thoroughly evaluated for each patient, as different levels of depression may require different interventions. A treatment plan for adolescents with depression should begin with establishing a relationship of trust between doctor and patient, involving family members and including psychoeducation, psychotherapy, lifestyle management and consideration of medication use [14]. In most cases, adolescents are first seen and treated by a primary care health professional rather than a mental health specialist. Although these professionals may have received general training for most health problems, formal skills for managing emotional disorders are extremely necessary to achieve better results [50].

Psychoeducation, as an initial treatment process, provides adolescents and their families with an understanding of the factors that may be related to the disease and its progression, diagnosis, treatment, and prognosis. Complete understanding by all parties is essential for adherence to treatment, as the realisation that the illness, although recurrent, is perfectly treatable paves the way for therapeutic success [14, 22]. As episodes of early-onset depression have been associated with a worse prognosis for the future course of the illness, early and successful response to treatment is among the highest priorities for improving mental health [19]. The main types of treatment proposed for depression in adolescents are:

1 psychotherapy

a) Cognitive behavioural therapy is the most appropriate choice, as it's a form of therapy that focuses on identifying cognitive distortions that can lead to depressed mood, using behavioural activation methods and problem-solving techniques, as well as emotional regulation and other skills to correct flawed or potentially harmful thinking patterns. In this approach, adolescents are taught to identify negative thoughts and reframe them as realistic thoughts, weighing the evidence that supports or denies them [1, 14, 51].

b) Interpersonal psychotherapy focuses on improving

interpersonal relationships with the goal of increasing communication skills, problem-solving, social engagement, and stress reduction by teaching patients to recognize their emotions and improving interpersonal communication and problem-solving skills ^[1, 22, 51].

c) Family therapy, which can be defined as a psychotherapeutic approach that focuses on changing relationships between family members and aims to improve the functioning of the family unit, or its subsystems, and/or the functioning of each family member. The main objective is to work with participants and their family members to break away from destructive forms of communication and seek to reduce symptoms of depression ^[52].

2) Drug treatment: this has been a hotly debated topic for decades due to its low efficacy and effectiveness and the risk of side effects, particularly suicide (1,53). The most commonly used drugs are selective serotonin reuptake inhibitors, and their use must be strictly indicated and monitored by specialists, with patients monitored for involvement in risky activities ^[55].

3) a combination of psychotherapy and medication, which should be prescribed by specialists according to the type of patient, the severity of each case, the risks of complications, and the presence of comorbidities.

Prevention

The prevention of depressive disorder is fundamental due to the significant impact this disease on patients, their families, and the entire community. Considering the consequences on health and the high direct and indirect social and financial costs caused by depression, and given that in many regions of the world there is notable inequality in access to health services, prevention also contributes to avoiding the emergence of other possible comorbidities ^[18, 54].

To this end, it is important to understand the risk and protective factors involved in the development of the disease, such as the high neuroplasticity characteristic of adolescence, which represents an excellent opportunity for intervention and prevention efforts aimed at promoting positive developmental outcomes ^[9]. In this sense, better training of primary care professionals, who are the first contact with patients, is essential for the early identification of emotional changes and the initiation of treatment or referral to a specialist ^[19, 40, 55].

Primary prevention measures for depression can be implemented at both the individual and collective levels through programmes that raise awareness of the problem with educational activities in schools (where adolescents spend much of their time), helping to develop effective, targeted interventions that can result in greater resilience among adolescents in the face of adversity ^[39]. By involving service clubs, the media, and the whole society, these interventions should target the general public or the community, regardless of risk, with the aim of uniting all efforts to address this serious public health problem.

Conclusion

Due to the great importance of depression in the context of global public health, all efforts should be directed towards its prevention, whenever possible, or early identification, establishing a correct diagnosis and differential diagnosis with other psychiatric disorders, in order to refer patients for appropriate treatment ^[19]. Considering the growing trends in depression and suicide rates among adolescents, there is an urgent need to direct resources to screening and prevention programmes, as well as to develop new safe therapeutic options ^[20]. Furthermore, investing in the development of

tools and biomarkers that can help define the diagnosis and treatment of early-onset depression seems essential to improve the prognosis of the future course of the disease (56). To address this challenge, proactive measures such as comprehensive mental health education in schools, early screening programmes in primary care settings, and the integration of mental health professionals into community health initiatives are mandatory (5), highlighting that psychoeducational interventions can help strengthen prevention measures and resilience in vulnerable groups, reducing the impact on individuals and society.

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