Analyzing Risk Factors for Schizophrenia: Genetic Aspects to Environmental Influences

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Abstract

Background. Schizophrenia is a complex and multifactorial mental disorder, influenced by the interaction between genetic and environmental factors. This study aims to analyze the risk factors for schizophrenia from genetic aspects to environmental influences.

Methods. used in writing this scientific article, as for some of the steps used, is a literature search strategy, then data collection.

Discussion. genetic factors, such as family history, have a significant influence on the risk of schizophrenia. In addition, environmental factors such as psychosocial stress, psychoactive substance use, and socioeconomic conditions also contribute to the development of this disorder. That the combination of genetic predisposition and environmental stressors can increase an individual's vulnerability to schizophrenia.

Conclusions. of this study emphasize the importance of comprehensive interventions, including primary prevention aimed at high-risk individuals. Efforts to increase public awareness of schizophrenia risk factors and stress management strategies may help to reduce the incidence of this disorder. Further research is needed to explore the relationship between these factors and the underlying biological mechanisms.

Keywords. Schizophrenia; Risk Factors

Introduction

Mental health has become one of the issues that must be addressed, but Indonesians still often overlook the importance of mental health.[1] Increased feelings of loneliness and decreased social interaction can be risk factors for mental disorders, including schizophrenia and major depression. Mental disorders are becoming a serious health problem due to the increasing number of illnesses, including chronic diseases that require a long recovery time. Mental disorders can be classified into two categories: mild mental disorders and severe mental disorders. One of the dangerous and uncontrollable mental disorders is schizophrenia.[6]

Schizophrenia is a psychiatric disorder and medical condition that affects the functioning of the human brain, affecting normal cognitive functions, affecting emotions and behavior. Characteristics that appear in the form of chaos in thinking patterns, perceptual processes, affection and social behavior. Patients diagnosed with schizophrenia generally show positive symptoms, such as hallucinations and delusions, as well as negative symptoms, such as isolation from the social environment, self-neglect, loss of motivation and initiative, and flat emotions.[1]

Data from the America Psychiatric Association (APA) in 1995 states that 1% of the world's population suffers from schizophrenia and 75% of schizophrenia sufferers can occur at the age of 16-25 years.[4] Prevalence data for schizophrenia in Indonesia ranges from 0.3% to 1%, with the disease generally appearing at the age of 18 to 45 years. However, there are also cases where individuals aged 11 to 12 years old already have schizophrenia.[2]

The presence of individuals with schizophrenia in society is often perceived as a threat. Many people with schizophrenia are hidden or ostracized, and not taken for medical treatment due to shame. In some parts of Indonesia, people with schizophrenia are even shackled. According to the 2014 Basic Health Research, schizophrenia is a public health problem of concern because the impact of schizophrenia is not only felt by sufferers and their families but also the community and government.[4]

Schizophrenia can be recognized through four main symptoms, known as the 4A's: (1) Association, which is a disturbance in the relationship between thoughts often referred to as thought disorder and loose association; (2) Affect, which refers to flat or inappropriate emotional responses; (3) Ambivalence, where individuals feel mixed feelings towards others, such as simultaneously loving and hating a partner; (4) Autism, which is the withdrawal into a personal fantasy world that is not bound by logic. Schizophrenic disorder is divided into 3 types, namely disorganized, catatonic and paranoid schizophrenia.

There are many factors that contribute to the occurrence of schizophrenia, including genetic, biological, biochemical factors, as well as social and economic status, stress, and substance abuse. Individuals with low economic status have a 6.00 times greater risk of developing the mental disorder schizophrenia than those with high economic status. In addition, people who are not employed have a 6.2 times higher risk of schizophrenia than those who are employed.

The purpose of this paper is to understand and identify the various risk factors that contribute to the development of schizophrenia, with a focus on the interaction between genetic and environmental factors, and the implications for individual mental health.

Methods

The method used in writing this scientific article is by searching for articles that discuss the risk factors of schizophrenia. With the database used for literature searches PubMed, Google Scholar, ResearchGate by including keywords and search phrases used to find articles related to schizophrenia risk factors, the keywords used are Schizophrenia; risk factors. Risk factors used from genetic and environmental aspects.

Collecting several articles obtained then selected articles obtained, relevant articles based on inclusion and exclusion criteria. Organize the selected articles based on the theme of the scientific article written.

Discussion

Schizophrenia is a serious mental disorder, characterized by disturbances in perception, thinking, and behavior. Individuals suffering from schizophrenia often experience hallucinations (such as hearing voices that do not exist), delusions (unfounded beliefs), as well as problems in thinking that can affect their interactions with the environment. Although the causes of schizophrenia are not fully clear, there is a belief that both genetic and environmental factors play a significant role in the development of this disorder.

The disorder usually appears in young adulthood and can result in various difficulties in daily life, including challenges in maintaining social relationships, functioning at work, and leading a productive life. Treatment of schizophrenia generally involves a combination of medical therapy, such as the use of antipsychotics, as well as psychological and social support.[2]

Risk factors for schizophrenia involve complex interactions between genetic and environmental elements. Genetic predisposition provides the basis for individuals to be more susceptible to the disorder, while environmental factors-including early life experiences,

substance use, stress, and trauma-can serve as triggers or exacerbate symptoms. This article will take an in-depth look at the various aspects of risk that contribute to the development of schizophrenia, ranging from genetic influences to environmental factors.[5]

Genetic Aspects

Genetic factors are considered as one of the most significant elements in schizophrenia risk. Research shows that about 60-80% of the variation in schizophrenia risk is due to heredity. The risk of schizophrenia increases drastically in individuals who have family members with a history of this disorder. In families with a history of schizophrenia, the probability of a child developing the disease can be as high as 10%, much higher compared to the general population which is only about 1%. Family, adoption and twin studies have long shown that genetic factors play a major role in predisposition to schizophrenia. Studies of identical twins, for example, found that if one identical twin has schizophrenia, the likelihood that the other twin will also develop the disorder reaches 40-50%.[2] In contrast, in non-identical twins, the risk decreases to about 10-15%, indicating that genetic and environmental factors together determine risk. In addition to twin studies, advances in genomic technology have allowed researchers to identify many genes involved in schizophrenia risk. Whole Genome Association Studies (GWAS) have found more than 100 genetic loci associated with the disease, including genes related to neurotransmitter function such as COMT (Catechol-O-Methyltransferase) and DISC1 (Disrupted in Schizophrenia 1). These genes play an important role in neurochemical processes and brain neuroplasticity, contributing to imbalances in neurotransmitters such as dopamine, which are often associated with symptoms of schizophrenia.[7]

Schizophrenia Risk Genes: Discoveries from Genome Studies

Although twin and family studies suggest that genetic factors have a significant role in schizophrenia, molecular genomic research has identified specific genes involved. Several genes associated with schizophrenia risk have been discovered, including genes that affect neurotransmitter function and brain development. Among these genes are:

1. COMT (Catechol-O-Methyltransferase) gene: This gene plays a role in dopamine metabolism in the prefrontal cortex, the part of the brain responsible for decision-making, planning and impulse control. Dopamine is an important neurotransmitter associated with emotion regulation and motivation, and is known to play a role in the development of psychotic symptoms in schizophrenia. Variants in the COMT gene may interfere with dopamine metabolism, increasing the risk of this disorder.

2. DISC1 (Disrupted in Schizophrenia 1) gene: This gene was first discovered in families with a high prevalence of schizophrenia and other mental disorders. DISC1 is known to play a

role in neuronal development and neuroplasticity processes, which are important for healthy brain function. Mutations in this gene can affect brain structure and function, increasing susceptibility to schizophrenia.

3. NRG1 (Neuregulin 1) gene: This gene is involved in synaptogenesis, the process of forming synapses in the brain. Synapses are important structures that enable communication between neurons. Disruptions in NRG1 can affect communication between neurons in the brain, which in turn can contribute to schizophrenia symptoms such as hallucinations and delusions.[7]

Whole Genome Association Studies (GWAS) is a technique used to scan the entire genome in an effort to find genetic variations that are common in individuals with schizophrenia. Through this approach, over 100 genetic loci have been identified in association with schizophrenia. Most of the genes identified are related to synaptic function, neurotransmitters, and neuroplasticity, all of which play important roles in normal brain function.

Heritability of Schizophrenia

Heritability is a measure of how much variation in a trait can be explained by genetic factors. For schizophrenia, the heritability is estimated to be around 60-80%, which means that most of the risk for this disorder comes from genetic factors. However, it also suggests that there is about 20-40% of the variation in risk that is influenced by non-genetic factors, such as the environment or certain life experiences.

The high heritability of schizophrenia also suggests that prevention or treatment strategies may require a personalized approach based on an individual's genetic profile. For example, individuals with a family history of schizophrenia may need to avoid certain environmental risk factors, such as psychoactive substance use or exposure to extreme stress, to reduce the likelihood of developing schizophrenia symptoms.

Environmental Influences

While genetic factors play a significant role, environmental factors also make an important contribution to schizophrenia risk. The environment often acts as a trigger for individuals who already have a genetic predisposition. These environmental factors can be either prenatal or postnatal, encompassing a variety of elements that can affect a person's brain development and mental health.

One of the most important environmental risk factors is prenatal stress, such as infections or malnutrition experienced by the mother during pregnancy. Research shows that children whose mothers had viral infections in the second trimester of pregnancy have a higher

risk of developing schizophrenia later in life. These prenatal infections are thought to disrupt fetal brain development and cause structural changes that increase susceptibility to mental disorders.

In addition, exposure to malnutrition during pregnancy has also been linked to an increased risk of schizophrenia. For example, a study of individuals born during the Dutch Hunger Winter showed that those born to mothers who were malnourished during pregnancy had a higher risk of developing schizophrenia. This suggests that inadequate nutrition in the early stages of brain development can have a long-term impact on mental health.

Another relevant factor is the use of psychoactive substances, especially during adolescence. Abuse of substances such as cannabis, especially in high doses and at a young age, is consistently associated with an increased risk of schizophrenia. Cannabis is known to affect the dopamine system in the brain, which plays a role in mood regulation and perception of reality. Some studies suggest that adolescent cannabis use may trigger the first psychotic episode in individuals with a genetic predisposition to schizophrenia. This research emphasizes the importance of controlling illicit substance use, especially in individuals with high genetic risk.

Social environment and urbanization factors have also been identified as significant risk factors for schizophrenia. Individuals who grow up in urban environments tend to have a higher risk of developing schizophrenia than those who live in rural areas. Research shows that urban living can trigger greater social stressors, such as discrimination, poverty, social isolation, and community fragmentation-all of which are significant risk factors for mental disorders. These factors highlight the importance of social interaction and community support in maintaining mental health.

Neurobiology of Schizophrenia

In addition to genetic and environmental factors, the understanding of the neurobiology of schizophrenia has also evolved significantly. Schizophrenia is often associated with imbalances in neurotransmitters, particularly dopamine and glutamate, which are involved in the regulation of emotion, cognition, and perception. The dopamine theory states that increased dopamine activity in certain areas of the brain, such as the striatum, can lead to psychotic symptoms such as delusions and hallucinations. Meanwhile, dopamine deficits in the prefrontal cortex can lead to negative symptoms, such as decreased motivation and the inability to feel happiness.

In addition to neurotransmitter imbalances, there is evidence to suggest that individuals with schizophrenia often have structural abnormalities in the brain, such as decreased gray

matter volume in the prefrontal cortex, basal ganglia and hippocampus. These abnormalities can affect a person's ability to think clearly, plan and interact socially.

Intervention and Prevention

Given the complexity of risk factors associated with schizophrenia, it is important to design comprehensive interventions. One of the most effective approaches is primary prevention, which targets high-risk individuals before schizophrenia symptoms appear. Early detection in those with a family history of schizophrenia, as well as stress management during pregnancy, can help reduce the likelihood of developing the disorder.

In addition, educational campaigns aimed at preventing the use of psychoactive substances among adolescents, especially marijuana, can play a crucial role in lowering the risk of schizophrenia. Interventions that focus on reducing social stress, especially in urban environments, can also contribute to preventing this mental disorder.

A healthy lifestyle plays an important role in reducing the risk of schizophrenia, especially for individuals who have a genetic predisposition. Some aspects of lifestyle that can help lower the risk include:

1. Balanced Nutrition, good nutrition is essential not only during pregnancy, but also throughout life to support brain and mental health. A diet rich in omega-3 fatty acids, vitamins and essential minerals can contribute to optimal brain function and reduce the risk of mental disorders.
2. Regular Physical Exercise, physical activity is proven to improve overall mental health. Exercise helps relieve stress, improves mood, and contributes to the balance of neurochemical systems essential for brain health.
3. Get Adequate Sleep Sleep disorders are often linked to an increased risk of mental disorders, including schizophrenia. Adequate sleep helps maintain hormonal balance and brain health, and supports good cognitive and emotional function.

Conclusions

The results suggest that schizophrenia is a mental illness that is influenced by a complex interaction between genetic, psychosocial, and environmental variables. People who have genetic factors associated with schizophrenia have a higher risk of developing this disorder compared to people who do not have such genetic factors. there is a high probability that genetic factors play a role in the development of schizophrenia.

The risk of developing schizophrenia is also influenced by environmental factors. Socially stressful housing, poverty, or social stigma can affect a person's mental health.

Emotionally unstable environments and the stresses of daily life can worsen the mental state of vulnerable people.

Overall, it shows that schizophrenia is a mental illness influenced by the interaction between genetic, psychosocial and environmental factors. Genetic factors predispose people to schizophrenia, but unfavorable psychosocial and environmental stressors can cause symptoms to appear. As a result, interventions to prevent and control schizophrenia must consider all three components. It is crucial to understand how these factors affect each other so that we can create better prevention and treatment plans to reduce the effects of this disorder.

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