RISK FACTORS OF ASD (AUTISM SPECTRUM DISORDER) IN CHILDREN IN SURABAYA CITY

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Abstract. *Autism spectrum disorder* is a brain development disorder in children aged 2-3 years that causes children to experience impaired communication, social interaction, and behavior. In East Java Province as many as 20,521 children have autism and in Surabaya City as many as 1,556 children. The purpose of this study was to determine risk factors for *autism spectrum disorder* in children in Surabaya City. The method uses a descriptive method with a retrospective type of research. The sample was set at 30 cases with non-probability purposive sampling technique. The variables of this study were genetic factors, age of mother pregnancy, preeclampsia, antepartum hemorrhage, seafood, history of asphyxia, and low birth weight. This research will be conducted in Surabaya from June to July 2023. This research instrument used a questionnaire with a guttman scale. The results of research showed that risk factors for *autism spectrum disorder* are mostly genetic factors, almost entirely age of mother pregnancy 20-35 years, most history of preeclampsia, and history of antepartum hemorrhage, almost entirely seafood, most history of asphyxia, and history of low birth weight. It can be concluded genetic, prenatal, and postnatal in this study affect risk of *autism spectrum disorder*. It's recommended, for parents to do regular check-ups during pregnancy, starting from early to late trimester of pregnancy, examination of growth and development of children aged 0-24 months, and use nearest health facilities to get information about a*utism spectrum disorder* in children. It's hoped that parents, especially mothers, can prevent risk of autism *spectrum disorder*.

Keywords: Risk factors of ASD, Children.

1 INTRODUCTION

Children with ASD are often found at age of 2-3 years, but children with ASD will have an impact until a later age, usually seen in adolescence to adulthood. This makes a topic of health problems in children that are happening in Indonesia. Some risk factors that can cause ASD include genetic factors tuberous sclerosis and fragile x, prenatal factors such as maternal age, antepartum hemorrhage, preeclampsia, and seafood, and postnatal factors such as a history of asphyxia and low birth weight (Hodges H, 2020; Gerges et al., 2020).

Incidence of ASD shows an increasing number in last 1 period, namely in 2020-2021. WHO (World Health Organization) one in 160 children in world suffers from ASD while in Indonesia there is an increase of 500 people every year (Ministry of Health RI, 2020). States that students with autism in Indonesia reached 143,810 children with highest number, namely in West Java Province with 24,520 children, followed by East Java Province with 20,521 children, and third place with Central Java Province with 19,080 children. In Surabaya City, 45 special schools have been registered with a total of 1,556 students (Ministry of Education and Culture, 2020).

Children with ASD are born due to genetic factors caused by chromosomal abnormalities usually found in male sex and role of DNA mutations that play a role in

occurrence of ASD. ASD isn't only caused by genetic factors but from related factors such as prenatal factors. Prenatal factors are maternal age, antepartum hemorrhage, preeclampsia, and seafood. Age of mothers who exceed limit for pregnancy is more at risk of autism to death due to high rates of complications both during labor and birth caused by lack of blood and oxygen supply during pregnancy and decreased maternal autoimmunity so that mother is vulnerable to infection. Antepartum hemorrhage can also cause children to be born with ASD caused by bleeding during pregnancy which results in a lack of oxygen and glucose in body, causing complications during pregnancy such as respiratory disorders and risk to fetus. Preeclampsia that occurs due to imbalance between utero placenta and fetal needs. As a result of imbalance, it causes problems for fetus receives less oxygen and nutrient supply so that fetal development becomes disrupted, emergence of neurological disorders and possibility of autism (Wang et al., 2017; Eissa et al., 2018).

Seafood that needs special attention, because this is a factor that is less known by pregnant women during pregnancy that can cause risks to fetus. Seafood consumed in excess results in risk of children experiencing ASD, because seafood that contains high lead and mercury can interfere with brain development in fetus. Seafood with high lead and mercury such as clams, mackerel, tuna or cob, lobster, and salmon (Jama, 2020; Emberti et al., 2019). Postnatal factors consisting of asphyxia and low weight. Asphyxia is caused by impaired gas and oxygen exchange during pregnancy that affects cells in body. Gas and oxygen exchange occurs due to amount of carbon dioxide in lungs and disruption of oxygen supply to fetal development which can then cause asphyxia and risk of fetus being born with autism. BBLR, condition of baby is born with a weight condition below normal limit or <2500 grams. This happens because gestational age of <36 weeks and age of mother pregnancy <20 years are susceptible to diseases that cause developmental disorders in fetus. Developmental disorders in fetus aren't only diseases owned by mother pregnancy but can be found during newborns such as risk of anemia, weak infant immunity, and risk of autism and onset of other diseases (Wang et al., 2017; Hornig et al., 2018).

Although autism doesn't cause death, autism can have a negative impact on people with ASD, families, environment, and country. This happens because children with ASD experience impairments in aspects of social interaction, communication, language, and behavior. It's necessary to increase public awareness in efforts to early detect occurrence of ASD in children. Efforts that can be given to community such as education programs for children with ASD and preventive and health promotion programs about ASD (Lubis, 2017; Karimi et al., 2017; Levine et al., 2018). It's necessary to conduct research on how occurrence of risk factors for ASD in children in Surabaya City which aims to determine genetic factors, age of mother pregnancy, preeclampsia, antepartum hemorrhage, seafood, history of asphyxia, and BBLR.

2 METHOD

Research method uses descriptive with a retrospective type of research that aims to conduct research by describing factors of ASD in children in Surabaya City based on past history or looking back from consequences that have occurred in samples of mothers who have children with ASD (Notoatmodjo, 2018). Sample criteria used mothers who had children with ASD, children aged 6-12 years, and male and female genders as many as 30 cases obtained at autism therapy site at Akasa Center Surabaya City. Sampling technique uses purposive sampling non probability. Variables consist of genetic factors, age of mother pregnancy, preeclampsia, antepartum hemorrhage, seafood, history of asphyxia, and low birth weight. This research was conducted at Akasa Center Surabaya City and conducted from June to July 2023. Sampling process was carried out by means of interviews and questionnaires on mothers who had children with ASD. Sampling results were collected and tabulated in order to determine risk factors for ASD in children in Surabaya City. Furthermore, factors can be added according to each factor and can be used as a discussion of risk factors for ASD in children in Surabaya City.

3 RESULTS AND DISCUSSION

Table 1. Risk Factors for ASD (Autism Spectrum Disorder) in Children in Surabaya City

Characteristic	Category	Frequency	Presentated%
Age	<20 Years	0	0
	20-35 Years	11	36,7
	>35 Years	19	63,3
Total		**30**	**100**
Education	Elementary School	0	0
	Junior High School	0	0
	Senior High School	16	53,3
	University	14	46,7
Total		**30**	**100**
Work	Housewive	15	50
	PNS/TNI/POLRI	4	13,3
	Self Employed	9	30
	Entreprenurial	2	6,7
Total		**30**	**100**
Income	0	15	50
	<1.000.000,-	0	0
	1.000.000. - 2.000.000,-	6	20
	>3.000.000,-		
		9	30
Total		**30**	**100**

Table 1 showed most (63.3%) mothers aged >35 years and almost half (36.7%) mothers aged 20-35 years, most (53.3%) mothers had last high school education and

almost half (46.7%) mothers had college education, half (50%) mothers as housewives and a small part (6.7%) mothers as entrepreneurs, half (50%) of mothers don't earn and a small percentage (20%) of mothers earn 1,000,000.-2,000,000 or middle to lower.

Table 2. Risk Factors for ASD (Autism Spectrum Disorder) in Children in Surabaya City.

Characteristic	Category	Frequency	Presentated%
Genetic Factors	Yes	16	53,3
	No	14	46,7
Total		**30**	**100**
Age of Mother Pregnancy	<20 Years	0	0
	20-35 Years	27	90
	>35 Years	3	10
Total		**30**	**100**
Preeclampsia	Yes	16	53,3
	No	14	46,7
Total		**30**	**100**
Antepartum	Yes	16	53,3
Hemorrhage	No	14	46,7
Total		**30**	**100**
Seafood	Yes	28	93,3
	No	2	6,7
Total		**30**	**100**
History of	Yes	16	53,3
Asphyxia	No	14	46,7
Total		**30**	**100**
Low Birth Weight	Yes	18	60
	No	12	40
Total		**30**	**100**

Table 2 showed most (53.3%) have a history of genetic factors and almost half (46.7%) have no history of genetic factors, almost all (90%) of age of mother pregnancy aged 20-35 years and a small part (10%) of age of mother pregnancy >35 years, Most (53.3%) had a history of preeclampsia and almost half (46.7%) had no history of preeclampsia, most (53.3%) had antepartum hemorrhage and nearly half (46.7%) had no antepartum hemorrhage, almost all (93.3%) consumed seafood and a small percentage (6.7%) didn't consume seafood, most (53.3%) had a history of asphyxia and almost half (46.7%) had no history of asphyxia, most (60%) <2,500 grams were born with low birth weight and almost half (40%) were born not with low birth weight >2,500 grams or normaly.

Genetic Factors

The results showed that most (53.3%) had a genetic history and almost half (46.7%) had no genetic history. It's stated that genetic factors occur due to a hereditary or

hereditary history of one of families who experience autism. Mothers who had children with ASD had a genetic history. The results of research conducted by Desi, Widiyanti. (2016) showing genetic factors totaling 44 people, most of whom (63.6%) have a genetic history of autism, while 44 autistic children who aren't autistic almost entirely (84.1%) have no genetic history. Genetic factors are caused by genetic disorders tuberous sclerosis and fragile x, chromosomes play an important role in determining human sex. Genetic tuberous sclerosis is found in several parts of body such as spinal cord. Meanwhile, fragile x is a type of chromosome that mutates in DNA. Genetic or chromosomal disorders aren't only one of causes of genetic factors but cause of genetic factors can be caused by offspring suffering from genetic disorders such as siblings and other close family (Bethesda, 2022; Tye et al., 2018).

The results showed that most of children with ASD had a genetic history and almost half had no genetic history. Genetic factors are still main factor causing children to causing experience ASD and genetic factors are also not one of causes ASD but other external factors that can cause children to experience ASD such as pregnancy. Occurrence of this genetic factors is caused by genetics that are passed down to family such as genetics in fathers, mothers, grandparents, and grandmothers who are still related by blood from two generations. It's hoped that parents can prevent occurrence of ASD early so that children born can be born with normal conditions, before having children. It's recommended that parents can do genetic or chromosomal examinations of both father and mother and maternal health checks regularly.

Age of Mother Pregnancy

The results showed that almost all (90%) of age of mother pregnancy aged 20-25 years and a small part (10%) of age of mother pregnancy aged >35 years. It's stated that age of mother pregnancy occurs at age of <20 years and >35 years. Mothers who had children with ASD at age of mother pregnancy were known to be 20-35 years old. This is precisely because ASD can occur because in addition to age of mother pregnancy, such as families who have a genetic history. The results of research conducted by Hastuty Y.D. (2020) showing that age of majority of mothers aged 30-34 years (58.92%) from total sample with age range that is almost close to high risk and affects incidence of autism. Parents, especially mothers, are encouraged to reproduce at age of 20-35 years. This age is a limit that isn't risk for mothers to reproduce, age of mother pregnancy has an impact on mother and fetus until child is born. This is very high risk for complications both during pregnancy until delivery is complete, complications cause impaired uterine muscle function which results in fetal development. Age of mother pregnancy also affects mother's immunity which will decrease and mother's vulnerability to other infections, there by activate in mother's immunity with increased cytokine hormones that have an impact on fetus and possibility of ASD (Tabahila, 2022).

The results showed that almost all age of mother pregnancy 20-35 years and a small part of age of mother pregnancy >35 years. Age of mother pregnancy >35 years is at high risk of mother experiencing complications, increasing age of mother higher mother's risk for complications in mother and adverse effects on fetus, initially when mother enters pregnancy until child is born. Frequent complications such as preeclampsia, antepartum hemorrhage, diabetes mellitus and other diseases. Not only at age of >35 years but at age of 20-35 years mothers can also develop ASD caused by other factors such as multiple pregnancies, food consumed, and congenital diseases. Age of mother pregnancy >35 years is recommended for parents, especially mothers when they want to have children, they can consider pregnancy plans both from calculating age of mother and father, gestational age, and pregnancy distance so that there is a small possibility of risk of child being born with ASD and if you already have two children, it's recommended that parents can do recommended birth control program.

Preeclampsia

The results showed that most (53.3%) had a history of preeclampsia and almost half (46.7%) had no history of preeclampsia. It's stated that preeclampsia occurs because of having a history of preeclampsia or experiencing preeclampsia when pregnant women. Mothers who had children with ASD had a history of preeclampsia. The results of research conducted by Tahta, Alfinna. (2019) showing that mothers who experience preeclampsia are born with ASD children by (29.5%) greater when compared to mothers of children who don't have ASD (9.1%), while mothers who don't experience preeclampsia and give birth to children with ASD by (70.5%) are smaller when compared to mothers of children who don't have ASD by (90%). Preeclampsia is a disease that occurs during pregnancy at >20 weeks' gestation, preeclampsia has two types, namely mild and severe preeclampsia with different symptoms. Preeclampsia is severe preeclampsia. Mothers who have preeclampsia are at risk for their fetuses to be born because there is an imbalance between oxygen supply and fetal needs. This results in inflammation in pregnancy which then occurs oxidative stress, activating immune cells and cytokine hormones in fetus characterized by symptoms of preeclampsia. Disruption of invasion of spiral arteries into trophoblast results in placental perfusion, causing hypoxia in fetus. Decreased oxygen supply to fetus results in neurological developmental disorders and allows children to be born with ASD conditions (Dachew et al., 2018).

The results showed that most of preeclampsia and almost half of preeclampsia. Preeclampsia results in children born with ASD not only caused by preeclampsia factors but also followed by complications of other diseases such as antepartum hemorrhage, diabetes mellitus, and acute kidney failure. Pregnant women who have a history of preeclampsia or have just experienced preeclampsia during pregnancy are also at risk of children born with ASD. Preeclampsia experienced by mothers during pregnancy is advised to be able to prevent high-risk pregnancies so as not to have an impact on fetus

until child is born. Examination during pregnancy is recommended to be routinely carried out in order to determine development of maternal and child health and this is an effort to reduce incidence of morbidity and mortality in mothers and fetuses.

Antepartum Hemorrhage

The results showed that most (53.3%) have a history of antepartum hemorrhage and almost half (46.7%) have no history of antepartum hemorrhage. It's stated that antepartum hemorrhage occurs due to bleeding during pregnancy at 7 months gestation or 3rd trimester. Mothers who had children with ASD had a history of antepartum hemorrhage. The results of research conducted by Tahta, Alfinna. (2019) showing antepartum hemorrhage giving birth to children with ASD is greater (38.6%) when compared to mothers of children who don't have ASD (6.8%,) while mothers who don't have antepartum hemorrhage and giving birth to children with ASD (61.4%) are smaller when compared to mothers of children who don't have ASD (93.2%). Antepartum hemorrhage occurs after 28 weeks gestation, Antepartum hemorrhage often occurs due to complications in placenta. Placenta plays an important role in blood circulation and maternal nutrition that will be channeled to fetus, if there is a disruption in placenta, supply of oxygen with fetus will be disrupted and then cause impaired brain growth in womb and cell division from one cell to another. This results in anaerobic metabolism, lack of ATP, and lactic acid accumulation which accelerates process of damage to brain cells and causes ion pump damage and depolarization resulting in potassium exit and sodium and water entry. Finally causing oedema which results in brain cell damage in fetus and when baby is born possibility of neurological disorders in children and occurrence of ASD (Lubis, 2017).

The results showed that most had a history of antepartum hemorrhage and almost half had no history of antepartum hemorrhage. Antepartum hemorrhage can occur in presence of complications of other diseases such as preeclampsia and diabetes mellitus. It's recommended for pregnant women who experience antepartum hemorrhage or pregnancy period is advised to be immediately taken to nearest health facility so that treatment can be given and prevent more serious bleeding. In addition, ANC examination in early pregnancy needs to be done until end of pregnancy HPHT. It can also reduce morbidity and mortality rates in mothers and fetuses.

Seafood

The results showed that almost all (93.3%) consume seafood and a small percentage (6.7%) don't consume seafood. It's mentioned that Kenjeran Coast is a seafood industry area and at same time largest seafood producer in Surabaya City. It can be possible for people to consume seafood from Kenjeran Coastal area which is spread through sellers in markets or fish shops. Seafood consumed may contain polluted waste compounds from rest of factory waste that goes to sea. It's seafood

containing waste compounds associated with incidence of ASD. Mothers who had children with ASD liked to consume seafood during pregnancy. The results of research conducted by Skogheim T, (2021) showed that there was a positive relationship or increased risk of ASD in second quartile of arsenic [(OR=1.77 (CI:1.26, 2.49)] and fourth quartile of cadmium and manganese [(OR=1.57 (CI:1.07 2.31); OR OR=1.84 (CI:1.30, 2.59)]. Research conducted by Environmental Welfare Engineering Center in collaboration with East Java revealed average heavy metal content in mercury shells was 11.35 ppb, copper content was 1,276.16 ppb, and lead content was 913,369 ppb. Other researchers pointed to previous studies that against mercury exposure in raw fish, it was found that concentration of mercury exposure in fish and shellfish in Kenjeran Beach of Surabaya was still higher (0.898 ppm) than normal limit allowed by WHO (0.5-0.8 ppm) (Mahmudiono T, 2020). It can be concluded that there is a relationship between metal levels and pregnancy period with occurrence of ASD. Kenjeran Beach is a water area and fish producer in Surabaya City and in development of rapidly developing industry resulting in environmental problems caused by industrial waste. Industrial waste produced will be discharged into river and flow into waters of Kenjeran Beach in Surabaya City, allowing waste pollution (Junaidi, 2019).

Polluted waste pollution around coast of Kenjeran Beach in Surabaya City causes toxins to marine fish accumulated from food chain process. Higher level of a food chain in water, higher accumulation of heavy metals in marine fish (Fitriyah, 2016). Seafood is rich in protein and nutrients that can help growth and development of fetus and child, but seafood can also cause children to be born with ASD. During pregnancy, pregnant women are recommended to consume seafood every week only one time and if you don't limit seafood, it may pose a risk to fetus where seafood contains waste compounds such as lead, mercury, manganese, and cadmium found in fish on beach such as shellfish, mackerel, lobster, and tuna. When seafood is consumed by mother, nutrients will enter fetus by carrying waste compounds that have been consumed, this doesn't appear to be visible during pregnancy but has an impact after child is born by following growth and development of children aged 0-24 months. When you reach that age and get a child with signs of ASD, this can be possible that child has ASD. (P Jama, 2020).

The results showed that almost all of them consumed seafood and a small percentage didn't consume seafood. Seafood if consumed with a high level of consumption and no limit to consume may pose a risk of children experiencing ASD. This doesn't appear to be seen during pregnancy but has an impact after child is born by following growth and development of children aged 0-24 months. When mothers consume seafood, pregnant women are advised to limit their intake of seafood and consult with health workers or other experts who allow children to be born with ASD. In addition, mothers can check levels of waste compounds so that mothers know results of levels of waste compounds in body. This can reduce risk early when mother knows dangers of consuming seafood that contains waste compounds.

History of Asphyxia

The results showed that most (53.3%) had a history of asphyxia and almost half (46.7%) had no history of asphyxia. It's mentioned that a history of asphyxia occurs due to complications experienced by mother during pregnancy and condition of fetus during labor. Mothers who had children with ASD had a history of asphyxia experienced by their children. The results of research conducted by Pangestu, Ningrum. (2017) showing that a history of asphyxia has a greater risk (71.7%) of experiencing ASD when compared to children who don't have asphyxia (28.9%) showing a relationship between asphyxia and ASD. History of asphyxia is an event experienced by fetus after birth, in this condition newborns experience signs of symptoms of shortness of breath or gasping breath, cyanosis, and paleness. When child experiences above symptom signs, child will be given ventilator assistance to keep breathing. Asphyxia is a disorder of oxygen exchange needed by fetus during pregnancy and childbirth. Lack of oxygen supply into body will affect oxygenation in body cells and consequently experience impaired cell function. At beginning of asphyxia, it causes respiratory acidosis in body and this reduces oxygen and interferes with fetal development until child has been born (Pangestu and Fibriana, 2017).

The results showed that most had a history of asphyxia and almost half had no history of asphyxia. Asphyxia is caused by many events such as preeclampsia, antepartum hemorrhage, childbirth. BBLR, and others who are at risk of newborn children experiencing asphyxia. It's recommended for parents to routinely do pregnancy checks in early-late trimester and are also supported by using regular ultrasound examinations so that mothers can find out possible risks that can occur in children.

BBLR (Low Birth Weight)

The results showed that most (60%) were born with a low birth weight of <2,500 grams and almost half (40%) were born not with a low or normal birth weight of >2,500 grams. It's stated that BBLR occurs due to complications experienced by mothers during pregnancy and lack of enough months of pregnancy or <36 weeks. Mothers who had children with ASD had a history of low birth weight of <2,500 grams experienced by their children after birth. The results of research conducted by Tahta, Alfinna. (2019) showing that BBLR is at risk of <2500 grams, which is as many as 17 children or (38.6%), children born with a birth weight of >2500 grams as many as 27 children or (30.7%) show a relationship between low birth weight and ASD, children born with a body weight of <2,500 grams are at greater risk of developing ASD compared to children born weighing >2,500 grams. BBLR is a condition of newborns weighing <2,500 grams and low birth weight is caused by several factors such as age of mother pregnancy who is >35 years or <20 years, gestational age <36 weeks, preeclampsia, multiple pregnancies and fetal distress. The vulnerability of mother's condition results in fetus being vulnerable to other diseases

and decreasing immune system so that fetus experiences impaired growth and development during pregnancy (Saroukhani, 2021).

The results showed that most of babies to be born with low birth weight <2,500 grams and almost half not with low birth weight >2,500 grams. BBLR is a risk that occurs in postnatal phase as a result of during pregnancy, fetus experiences disruptions in growth and development so that fetus can experience autism, possible disorders that can be known such as communication, socializing, and behavioral disorders. Parents are advised to do an ANC examination which aims to detect early problems in pregnancy so that it doesn't have a more serious impact when child is born. Examination is carried out so that mothers can find out good nutrition during pregnancy and avoid risk of birth with low birth weight.

4 CONCLUSION

It can be concluded that mostly have a history of genetic factors, almost all of age of mother pregnancy aged 21-35 years, most have a history of preeclampsia, most have a history of antepartum hemorrhage, almost entirely consume seafood when pregnant women, most babies have a history of asphyxia, and most babies have a history of low birth weight <2,500 grams. It's recommended that parents can do regular check-ups during pregnancy both from early to late trimester gestation, examination of growth and development of children aged 0-24 months, and use nearest health facilities to get information about ASD in children. It's hoped that parents, especially mothers, can prevent risk of ASD events.

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