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Risk Factors Associated with Stunting Incidents in Children Aged 2-5 Years in the Pasar Sentral Health Center Area, Mimika Regency, Central Papua Province

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A B S T R A C T

The present study analyzes the risk factors for stunting in children aged 2–5 years in the Pasar Sentral Health Center area, Mimika Regency. The research employing a correlational descriptive design with a cross-sectional approach with a sample of 120 children from 21 posyandu. The data were collected through the questionnaires, medical records, and analyzed using the chi-square test. The prevalence of stunting was found to be 91.7%. A multitude of factors have been identified as being significantly associated with stunting, including a history of infectious diseases, a number of antenatal care (ANC) visits falling below the threshold of six, incomplete immunization, non-exclusive breastfeeding, and a history of low birth weight (LBW). The following factors were found to be non-significantly associated: maternal age, maternal education, early breastfeeding initiation (IMD), parity, and pregnancy spacing. The most significant factor identified was a history of infectious diseases, which increased the likelihood of stunting by 2.674 times. It is recommended that interventions prioritize the following: the control of infectious diseases, the enhancement of the quality of ANC, the augmentation of immunization coverage, the promotion of exclusive breastfeeding, and the prevention of LBW.

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INTRODUCTION

Optimal child growth serves as an instrumental metric for evaluating the nutritional and health status of a population, thereby reflecting the quality of human resources. The nutrition levels of under-five children serve as a sensitive indicator of the overall nutritional status of a society. Stunting, a term used to describe the failure of children to reach their full potential height-wise due to nutritional deficiencies, is identified by a Z score that is less than -2 SD based on the height-for-age index (TB/U). This indicates that the child has suffered from chronic nutritional problems due to nutritional deficiencies over a long period (Rihi Leo, 2018).

Prenatal stunting, defined as undernourishment during the first 1000 days of life, has been demonstrated to exert a detrimental effect on both immediate and long-term functionality. The immediate consequences of lead exposure include disruption of brain development, impaired learning ability, and compromised immune system function. Concomitantly, the long-term repercussions encompass diminished productivity, motor-sensory impairments, elevated susceptibility to chronic diseases, and augmented risk of morbidity and mortality (Junha et al., 2015). Consequently, it is imperative to prioritize the nutritional status of mothers from the onset of pregnancy until the child reaches the age of two, in order to avert the occurrence of stunting.

According WHO (2021), stunting is a condition of chronic malnutrition that impedes children's growth at the age of five, which is evaluated based on body length or height. According to the World Health Organization (2015), toddlers who experience malnutrition are more susceptible to mortality compared to those with adequate nutritional intake. Factors that contribute to stunting include exclusive breastfeeding, low birth weight (LBW), history of infection, genetic factors, maternal age, chronic energy deficiency (CED) in the mother, education level, number of children, socio-economic conditions, diet, environmental sanitation, and access to health services such as immunization and posyandu.

WHO data in 2020 shows that Indonesia is ranked 115th out of 151 countries in stunting prevalence (Ministry of Health, 2020). In Central Papua, the prevalence of stunting reached 39.2% (Riskesdas, 2021), one of Indonesia's highest figures. Even though various interventions have been carried out, the lack of monitoring and evaluation of family health practices is still a significant obstacle in dealing with stunting. The Indonesian government targets a reduction in stunting prevalence by up to 14% by 2024 through collaborative efforts between the central, regional, and other stakeholders.

The Mimika Regency has exhibited a substantial decline in the prevalence of stunting. In the initial semester of 2024, the prevalence of stunting in Mimika Regency was recorded at 10.99%, affecting 2,031 toddlers out of a total population of 18,486. (Mimika District Health Office, 2024). The working area of the Pasar Sentral Health Center covers two districts, namely Mimika Baru District and Wania District, which serve five sub-districts and one village, with 21 posyandu and 2,450 toddlers. Based on the E-PPGM report, as many as 342 toddlers

(10.23%) experienced stunting, which is still a health problem that requires special attention.

Various previous studies have identified factors that contribute to the incidence of stunting. Research by Alfa Risi et al. (2019) in Central Lampung Regency shows that apart from the nutritional status of toddlers, factors that influence stunting are the mother's diet during pregnancy and the practice of giving food according to the toddler's age. Another study by Aurelia and Amelia (2023) at the Poncol Health Center in Semarang City stated that the dominant factors causing stunting were body length at birth, mother's education level, and exclusive breastfeeding. In addition, deficiencies in macronutrients such as protein and carbohydrates and micronutrients such as vitamins and minerals can inhibit growth hormone production, thereby contributing to stunting (Joetjiningsih, 2014; Suharto, 2019). Based on the description above, this study aims to analyze the risk factors associated with stunting in children aged 2-5 years in the Pasar Sentral Health Center area, Mimika Regency, Central Papua Province.

THEORETICAL REVIEW

Stunting is a nutritional problem that manifests as linear growth disorders caused by a lack of nutritional intake or chronic infectious diseases (Raden, 2015). The quality of human resources, as determined by physical growth and intelligence, is contingent upon age, with children under five years of age being particularly vulnerable (Bening et al., 2018). Nutritional status is a pivotal factor in this regard, as it plays a crucial role in supporting optimal physical development and cognitive function in children. According to the Indonesian Ministry of Health (2020), the occurrence of stunting is defined as the presence of a Z score that is less than -2 SD based on the TB/U index. This indicates the presence of chronic nutritional problems, stemming from nutritional deficiencies that have persisted over an extended period. toddlers are categorized as short (stunting) if the z-score value is between -3 SD and -2 SD, and as very short if the z-score value is less than -3 SD. The nutritional status of toddlers is determined by their age-appropriate length or height.

Stunting in children has been demonstrated to result in a decrease in the body's immune system and an increase in the risk of contracting infectious diseases. The issue of stunting at an early age, particularly during the 1000 HPK period, will have a detrimental effect on the quality of human resources (HR). Stunting impedes the optimal growth and development of the body's organs. It is estimated that children under five who suffer from stunting are responsible for 1.5 million deaths worldwide, constituting 15% of child fatalities (Ministry of National Development Planning/Bappenas, 2018). Furthermore, stunting contributes to 55 million disability-adjusted life years (DALS), signifying the loss of potential healthy life span annually.

In the short term, stunting has been shown to result in impaired growth, as well as in obstacles to cognitive and motor development. Furthermore, it has been demonstrated to lead to suboptimal physical body size and metabolic disorders. The long-term repercussions of stunting are multifaceted, encompassing a decline

in cognitive capacity, a permanent disruption in the structure and function of nerves and brain cells, and an impaired ability to absorb educational material during school age, which in turn can adversely impact productivity in adulthood. Moreover, stunting has been associated with an increased risk of developing non-communicable diseases (Ministry of National Development Planning/Bappenas, 2018).

Stunting Risk Factors

The risk factors for stunting are very complex and interrelated. Some of the main factors that contribute to stunting include:

Exclusive Breastfeeding

Breast milk is widely regarded as the optimal sustenance for newborns up to six months of age. Breast milk is a comprehensive source of essential nutrients for infants, naturally equipped with milk-digesting enzymes that facilitate efficient digestion and absorption of nutrients by the baby's digestive system (Putri, 2018). Exclusive breastfeeding plays a pivotal role in the nutritional status and health of toddlers because it provides all the nutritional needs of the child. According to WHO, breast milk is an important nutrient for babies to improve development and growth so that they do not contract stunting. Exclusive breastfeeding can reduce morbidity and mortality due to diarrhea and respiratory tract infections, reduce the risk of obesity in children, and reduce the risk of diabetes and excess cholesterol in adulthood (Cunha et al., 2015). It has been demonstrated that toddlers who are not exclusively breastfed are more susceptible to stunting compared to those who are breastfed exclusively.

Nutritional Status

The prevalence of stunting is associated with inadequate nutrition, characterized by a deficiency in both quality and quantity of food intake. The intake of children's food is frequently deficient in both quantity and quality. The consumption of nutritionally balanced meals is a pivotal aspect of a child's dietary regimen, as it provides essential nutrients such as carbohydrates, lipids, proteins, and minerals, including zinc and calcium, which are crucial for optimal growth and development. Research on children aged 6-12 months in Bogor indicated that growth disorders may be caused by deficiencies of micronutrients, such as zinc and calcium, either individually or in combination (Anshori, 2013).

Low Birth Weight (LBW)

Low birth weight indicates that the fetus is experiencing malnutrition in the womb. The birth of a baby with a body weight below normal (less than 2500 grams) is three times slower in development and growth than a baby born with a normal body weight. The incidence of LBW is an indicator of public health because it is closely related to mortality, morbidity and malnutrition in the future (Rosa et al., 2013). The size of the baby at birth is related to the child's linear growth. LBW indicates growth retardation in the uterus, both acute and chronic. Most babies with LBW have the possibility of experiencing growth disorders during childhood because they are more susceptible to diarrhea and infectious diseases (Putri, 2018).

Infection History

Infection is a primary cause of stunting, particularly in children under five. These children are more susceptible to infections such as worms, diarrhea, acute respiratory infections, and other diseases associated with the quality of health services. These services include factors such as immunization, environmental facilities, and healthy living behaviors. Children with a history of LBW have demonstrated an increased risk of malnutrition, with this risk being ten times greater in comparison to children without a history of LBW (Septikasari, 2016).

Maternal Factors

Mothers with stunting are not always caused by genetic factors, but because they lack of chronic energy or repeated chronic and repeated infectious diseases. Short mothers are at greater risk of giving birth to stunted children compared to mothers of normal height. Mothers with stunting caused by genetic factors will experience impaired fetal growth and development as well as organ function (Pokhrel, 2024). Mothers whose height is less than 145 cm is associated with SGA (Small For Gestational Age) or fetal growth retardation. Babies will be at risk of experiencing growth disorders during the first two years of life.

Chronic Energy Deficiency (CED)

During the first trimester, pregnant women with a normal body mass index (BMI) should consume 1,800 calories per day. This requirement increases to 2,200 calories during the second trimester and 2,400 calories during the third trimester. Malnutrition can cause stunting. Pregnant women who experience CED in the first trimester are more likely to continue to the next trimester. Mothers with a lower pre-pregnancy weight must gain more weight than mothers with a higher pre-pregnancy weight (Ariani et al., 2012). CED in the mother will reduce the expansion of blood volume which results in insufficient blood pumping from the heart (cardiac output). Thus, blood flow to the placenta is reduced, resulting in suboptimal placental size and a reduction in the distribution of nutrients to the fetus, which causes fetal growth to be hampered (Karima & Achadi, 2012).

Mother's Age

The age of 20-35 years is a mature age for giving birth and caring for children both physically and psychologically (Damayanti and Sri, 2020). As mothers get older, their thinking patterns and understanding will develop and their knowledge will improve. Young people tend not to immediately receive information and will ignore it first. The mother's age will influence her competence and experience in providing nutritional intake to children (Pokhrel, 2024). Adolescents under the age of 20 are susceptible to childbirth complications characterized by LBW in their infants., which accounts for around 20% of stunting (Ministry of Health, 2018). Physiologically, the group of mothers under 20 years of age are still in the process of growing in both height and weight, resulting in nutritional competition between the mother and fetus (Ananda et al., 2017).

Pregnancy History

The 2010 integrated antenatal care guidelines define health services aimed at mothers during pregnancy as antenatal care (ANC). ANC services are used to detect early high risks in pregnancy and childbirth, monitor fetal development, and reduce maternal mortality. ANC visits should be carried out regularly so that any abnormalities that arise are known and can be treated immediately. Activities during pregnancy can directly affect good nutrition. Pregnancy-related examinations are conducted a minimum of four times. Pregnancy checks are a crucial component of maternal and infant health monitoring, as they facilitate the supervision of fetal growth and the assessment of maternal and fetal well-being. Blood supplement tablets (TTD) are given to mothers during pregnancy as a preventive measure to prevent anemia and ensure optimal fetal growth.

Number of Children (Parity)

Mothers can make plans regarding pregnancy spacing by carrying out a family planning (KB) program. The BKKBN's role in preventing stunting is to carry out a program to control the distance and number of births with family planning after giving birth. The ideal pregnancy spacing (more than 36 months) can reduce the occurrence of unwanted pregnancies, thereby reducing the prevalence of stunting (Rahmadini, 2021). The provision of food for the family, which is also related to the family's income in providing food. A large number of children is at risk of malnutrition in families with low economic status. Children who live in low economic conditions will tend to be malnourished, and an increase in the number of family members will have a corresponding effect on the amount of food available.

Socioeconomics and Diet

The low economic status of parents still has an impact on stunting. Apart from that, economic status will influence the food choices that will be given to the family, and often the food menu chosen is the same for several days so that children's nutritional intake is uneven.

The term "diet" is defined as an effort to regulate the amount and type of food consumed, accompanied by descriptive information. The phenomenon of stunting can be attributed to a variety of underlying factors, including but not limited to prolonged exposure to economic disadvantage, detrimental parenting practices, and recurrent health challenges stemming from suboptimal hygiene and sanitation conditions.

METHODOLOGY

The present study constitutes a quantitative investigation, employing a correlative descriptive design. That is to say, observations are made of a number of characteristics (variables) of the research subject according to the circumstances as they are, without the researcher manipulating (intervening) the subject. The approach employed is cross-sectional, wherein data concerning the independent and dependent variables is examined concurrently (Notoatmodjo, 2014).

The research was conducted from March to April of 2025 in the operational area of the Central Market Health Center, Mimika Regency, Central Papua Province. This area includes 21 posyandu spread across five sub-districts (Pasar Sentral, Timika Indah, Perintis, Inauga, and Sempan) and one village (Mandiri Jaya). The research population was all children under five aged 2-5 years in the Central Market Health Center area of Mimika Regency, totaling 2,450 toddlers. The research sample consisted of 120 respondents selected using proportional sampling technique from 21 posyandu. Each posyandu was sampled using random sampling using a lottery, where each child who attended was given a lottery number and then drawn. The number that comes out is the number that is the research sample representing the posyandu.

Data collection was carried out through structured questionnaires, anthropometric measurements, and review of medical record documentation. Data collected included respondent characteristics (maternal age, maternal education), history of infectious diseases, ANC visits, immunization history, exclusive breastfeeding, IMD implementation, LBW history, parity, and pregnancy spacing.

Data processing goes through the stages of editing (checking data completeness), cleaning (cleaning data), scoring (giving scores to question items), data entry (entering data into a computer program), and presenting data in tabular and written form. Univariate data analysis was conducted to describe the characteristics of the respondents, while bivariate analysis employed the chi-square test to ascertain the relationship between the independent variables and the dependent variable, with a significance level of α=0.05. The extent of the relationship's strength is established through the application of the Prevalence Ratio (RP) and the 95% Confidence Interval (CI).

RESEARCH RESULTS

General Description of Research Locations

Pasar Sentral Health Center is an expansion of the Timika Health Center which was established in 2015. This health center is located in the city, precisely on Jalan Hasanuddin Gang Flora and is included in the Mimika Baru District. The working area of the Pasar Sentral Health Center consists of 5 sub-districts (Pasar Sentral, Inauga, Sempan, Timika Indah, Perintis) and 1 village (Mandiri Jaya). The transportation used to access all work areas can be reached by road.

The population in the Central Market Health Center working area based on 2024 Population Service data is 52,774 people. Compared with the previous 4 years, the population growth rate until 2024 has experienced significant growth. This is because many residents are not settled and urbanization is also possible to find work with higher wages.

Characteristics of Research Respondents

The respondents based on maternal age were dominated by the 20-35 year age group with 78 people (65%), followed by the <20 year age group with 30 people (25%), and the >35 year age group with 12 people (10%). The highest level of education of respondents was high school/equivalent with 45 people (37.5%),

followed by junior high school/equivalent with 29 people (24.2%), elementary school/equivalent with 28 people (23.3%), no school with 11 people (9.2%), and college with 7 people (5.8%).

Based on the history of infectious diseases, the majority of children had a history of ARI, 52 children (43.3%), followed by diarrhea, 34 children (28.3%), TB, 20 children (16.7%), heart disease, 3 children (2.5%), and 11 children (9.2%) who had no history of infectious disease.

Judging from ANC visits, the majority of mothers made ANC visits less than 6 times, namely 78 people (65%), while those who made complete ANC visits were 42 people (35%). Regarding the history of immunization, the majority of children did not receive complete immunization, namely 74 children (61.7%), while those who received complete immunization were 46 children (38.3%).

In terms of a history of exclusive breastfeeding, the majority of children did not receive exclusive breastfeeding, namely 77 children (64.2%), while those who received exclusive breastfeeding were 43 children (35.8%). For early initiation of breastfeeding (IMD), the majority of mothers did not practice IMD, 70 people (58.3%), while 50 people did IMD (41.7%).

Based on the incidence of LBW, the majority of children had a history of LBW (≤2500 grams) as many as 72 children (60%), while those with normal birth weight (>2500 grams) were 48 children (40%). For the number of births (parity), the majority of mothers were multiparous (2-4 births) as many as 80 people (66.7%), followed by grandemultipara (>4 births) as many as 24 people (20%), and primipara (<2 births) as many as 16 people (13.3%).

In terms of pregnancy spacing, the majority of mothers had a pregnancy spacing of 2-5 years as many as 84 people (70%), followed by a pregnancy spacing <2 years as many as 20 people (16.7%), and a pregnancy spacing >5 years as many as 16 people (13.3%). For the incidence of stunting, the majority of children experienced stunting, 110 children (91.7%), while those who did not experience stunting (normal) were 10 children (8.3%).

Relationship between Maternal Age and Incidence of Stunting

The anaysis showed that of the 42 mothers who were at high risk (<20 and >35 years), there were 39 (92.9%) mothers with stunted children and 3 (7.1%) mothers with normal children. Meanwhile, of the 78 mothers of normal age (20-35 years), there were 71 (91.0%) mothers with stunted children and 7 (9.0%) mothers with normal children. The chi-square test results obtained p-value = 1,000 > α = 0.05; RP = 1.020 with 95% CI = 0.915 – 1.138, so it can be concluded that there is no relationship between maternal age and the incidence of stunting.

Relationship between Maternal Education Level and Incidence of Stunting

Of the 113 mothers with low education, there were 105 (92.9%) mothers with stunted children and 8 (7.1%) mothers with normal children. Meanwhile, of the 7 mothers with higher education, there were 5 (71.4%) mothers with stunted children and 2 (28.6%) mothers with normal children. The chi-square test results obtained p-value = 0.105 > α = 0.05; RP = 1.301 with 95% CI = 0.812 – 2.084, so it can be concluded that there is no relationship between the mother's education level and the incidence of stunting.

Relationship between History of Infectious Disease and Incidence of Stunting

The results showed that of the 109 children who had a history of infectious diseases, 106 (97.2%) children were found to be stunted and 3 (7.1%) children had normal nutritional status. Meanwhile, of the 11 children who had no history of infectious diseases, 4 (36.4%) children were found to be stunted and 7 (63.6%) children had normal nutritional status.

The chi-square test results obtained p-value = 0.000 < α = 0.05; RP = 2.674 with 95% CI = 1.223 – 5.848. Therefore, it is reasonable to conclude that a correlation exists between a documented history of infectious diseases and the occurrence of stunting. Children with a documented history of infectious diseases exhibit a 2.674-fold increased risk of stunting compared to children without such a medical background.

The Relationship between ANC Visits and Stunting Incidents

Of the 78 mothers who had fewer ANC visits during pregnancy (<6 times), there were 75 (96.2%) mothers with stunted children and 3 (3.8%) mothers with children with normal nutritional status. Meanwhile, of the 42 mothers who completed ANC visits during pregnancy (6 times), there were 35 (83.3%) mothers with stunted children and 7 (16.7%) mothers with children with normal nutritional status.

The chi-square test results obtained p-value = 0.032 < α = 0.05; RP = 1.154 with 95% CI = 1.001 – 1.330, so it can be concluded that there is a relationship between ANC visits during pregnancy and the incidence of stunting. Mothers who do not make enough ANC visits during pregnancy are 1.154 times more likely to have stunted children than mothers who complete ANC visits during pregnancy.

Relationship between Immunization History and Stunting Events

The results showed that of the 74 children who did not receive complete immunization, 72 (97.3%) children were found to be stunted and 2 (2.7%) children had normal nutritional status. Meanwhile, of the 46 children who received complete immunization, 38 (82.6%) children were found to be stunted and 8 (17.4%) children had normal nutritional status.

The results of the chi-square test yielded a p-value of 0.007, which is less than the critical value α = 0.05. This indicates a rejection of the null hypothesis, and the randomization probability (RP) was calculated to be 1.178. The 95% confidence interval (CI) was determined to be 1.026–1.352, suggesting a potential relationship between immunization history and the incidence of stunting. The likelihood of stunting is 1.178 times higher among children who do not receive complete immunizations compared to children who do.

The Relationship between Exclusive Breastfeeding and Stunting

Of the 77 children who did not receive exclusive breastfeeding, 74 (96.1%) children were found to be stunted and 3 (3.9%) children had normal nutritional status. Meanwhile, of the 43 children who received exclusive breastfeeding, 36

(83.7%) children were found to be stunted and 7 (16.3%) children had normal nutritional status.

The chi-square test results obtained p-value = 0.034 < α = 0.05; RP = 1.148 with 95% CI = 0.999 – 1.319. Therefore, it can be posited that a correlation exists between exclusive breastfeeding and the prevalence of stunting. It has been demonstrated that children who do not receive exclusive breast milk are 1.148 times more likely to experience stunting than children who receive exclusive breast milk.

Relationship between Early Initiation of Breastfeeding and Stunting

The results of the study showed that of the 70 mothers who did not initiate early breastfeeding, there were 67 (95.7%) mothers with stunted children and 3 (4.3%) mothers with children with normal nutritional status. Meanwhile, of the 50 mothers who initiated early breastfeeding, there were 43 (86.0%) mothers with stunted children and 7 (14.0%) mothers with children with normal nutritional status. The chi-square test results obtained p-value = 0.091 > α = 0.05; RP = 1.113 with 95% CI = 0.985 – 1.258. It can be posited that an association does not exist between the initiation of breastfeeding in early stages of life and the prevalence of stunting.

Relationship between LBW history and stunting

Of the 72 children who had a history of LBW (≤2500 grams), 70 (97.2%) children were found to be stunted and 2 (2.8%) children had normal nutritional status. Meanwhile, of the 48 children who had normal birth weight (>2500 grams), 40 (83.3%) children were found to be stunted and 8 (16.7%) children had normal nutritional status.

The chi-square test results obtained p-value = 0.014 < α = 0.05; RP = 1.167 with 95% CI = 1.022 – 1.332. A correlation between a history of low-birth-weight (LBW) and stunting has been determined. A history of LBW has been demonstrated to be a risk factor for stunting, with children who have experienced LBW being observed to have an 1.167 times higher probability of developing stunting compared to their peers with a standard birth weight.

Relationship between Number of Births (Parity) and Incidence of Stunting

The results of the study showed that of the 40 mothers with primiparous/grandemultiparous parity, 39 (97.5%) mothers had stunted children and 1 (2.5%) mother had normal nutritional status. Meanwhile, of the 80 multiparous mothers, 71 (88.8%) mothers had stunted children and 9 (11.3%) mothers had normal nutritional status. The chi-square test results obtained p-value = 0.162 > α = 0.05; RP = 1.099 with 95% CI = 1.002 – 1.205, and there is no correlation the number of births (parity) and the stunting.

Relationship between Pregnancy Distance and Stunting Events

Of the 36 mothers with high risk pregnancy intervals (<2 and >5 years), 35 (97.2%) mothers were found to have stunted children and 1 (2.8%) mother had a normal nutritional status child. Meanwhile, of the 84 mothers with ideal pregnancy intervals (2-5 years), 75 (89.3%) mothers were found to have stunted

children and 9 (10.7%) mothers with children with normal nutritional status. The chi-square test results obtained p-value = 0.278 > α = 0.05; RP = 1.089 with 95% CI = 0.993 – 1.194. The present study found no correlation between pregnancy spacing and the incidence of stunting.

DISCUSSION

Relationship between History of Infectious Disease and Incidence of Stunting

The findings of the study indicated a substantial correlation between a child's history of infection and the prevalence of stunting (p=0.000), with a risk that was 2.674 times higher in children with a documented history of infection. This finding is in line with research by Lestari et al. (2023) in Maluku, Fauzan et al. (2023) in West Sumatra, and Nababan et al. (2024) in Papua who concluded that repeated infections increase the risk of stunting due to impaired nutrient absorption and increased body energy requirements.

The mechanism is that infectious diseases cause an increase in nutritional needs for cell repair and body defense, while on the other hand infections also interfere with the absorption of nutrients, reduce appetite and worsen the child's nutritional status. Chronic diarrheal disease in particular can cause malabsorption of nutrients and loss of fluids and electrolytes which have an impact on children's linear growth (Septikasari, 2016). Acute respiratory infections can also cause anorexia and increased metabolic demands that interfere with nutritional intake. Recurrent infections are an important factor that worsens children's nutritional status and increases the risk of children experiencing stunting. Therefore, effective prevention and treatment of infectious diseases is a key factor in preventing stunting in children.

The Relationship between ANC Visits and Stunting Incidents

The findings indicated a substantial correlation between reduced ANC visits and the occurrence of stunting in children (p = 0.032), with a risk that was 1.154 times higher. This is consistent with research by Rahmi et al. (2024) in South Sulawesi, Ningsih and Baransano (2023) in West Papua, and Ramadhani et al. (2023) in West Nusa Tenggara, who concluded that ANC visits that were not up to standard (<4 times) increased the risk of fetal growth disorders. Adequate pregnancy checks enable early detection and management of various pregnancy complications, monitoring fetal growth, providing nutritional supplementation, and providing education regarding maternal health.

Mothers who make regular ANC visits also tend to be more aware of the importance of health during pregnancy, which has a positive impact on fetal growth and the child's nutritional status after birth (Ariani, 2017). Adequate ANC visits have been demonstrated to enable the early detection of pregnancy complications and the monitoring of fetal growth, thereby reducing the risk of stunting. Therefore, increasing the coverage and quality of ANC services needs to be a priority in efforts to prevent stunting.

Relationship between Immunization History and Stunting Events

This research revealed a significant relationship between immunization history and the incidence of stunting (p=0.007), where children with incomplete immunization were 1.178 times more likely to experience stunting. This finding is supported by research by Hidayat et al. (2023) in Jakarta, Permatasari et al. (2024) in South Sumatra, and Syahrizal et al. (2024) in Central Kalimantan which shows that complete immunization plays a role in preventing serious infections which can worsen the risk of stunting.

Immunization is a preventive effort to protect children from infectious diseases that can interfere with growth. Children who receive complete immunization have better body resistance to infectious diseases, thereby reducing the frequency of illnesses that can hinder growth. This shows the importance of a complete basic immunization program as part of a stunting prevention strategy. Complete immunization is an important protective factor against stunting by reducing the incidence of serious infections that can hinder children's growth. Therefore, increasing immunization coverage must be a priority in stunting prevention programs.

The Relationship between Exclusive Breastfeeding and Stunting

The present study indicates a substantial correlation between the practice of breastfeeding and the occurrence of stunting (p = 0.034), with a risk that is 1.148 times greater. These results are in line with research by Salimah et al. (2023) in West Java, Wahyuni et al. (2024) in Papua, and Mandasari et al. (2023) in Bali who concluded that exclusive breastfeeding for the first six months has a substantial impact on the mitigation of stunting.

Breast milk contains complete nutrients and antibodies which are important for the growth and development of babies, as well as protecting against infectious diseases. Exclusive breastfeeding also increases the bond between mother and child, which can influence proper parenting and feeding patterns. Cunha et al. (2015) stated that exclusive breastfeeding can reduce morbidity and mortality due to diarrhea and respiratory tract infections, which are risk factors for stunting. Exclusive breastfeeding can provide important nutritional and immunological substances that prevent infection and support the baby's optimal growth. Therefore, promotion and support for exclusive breastfeeding needs to be a priority in efforts to prevent stunting.

The Relationship between LBW History and Stunting Events

The results of the study demonstrated a statistically significant correlation between a history of LBW and the incidence of stunting (p = 0.014), with a risk 1.167 times greater. This finding is consistent with research by Dwi et al. (2024) in Yogyakarta, Ambarwati et al. (2023) in Central Papua, and Syafrida et al. (2024) in Aceh who concluded that babies with LBW are at higher risk of experiencing stunting. LBW is an indicator of intrauterine malnutrition and reflects stunted fetal growth. Babies with LBW have lower nutritional reserves and an immune system that is not yet optimal, so they are more susceptible to infectious diseases and growth disorders.

Rosa et al. (2013) found that babies with LBW were three times slower in growth and development compared to babies born with normal weight. Babies with LBW need to receive growth and development monitoring and intensive nutritional intervention to prevent stunting. Therefore, efforts to prevent LBW through improving the health of pregnant women and intensively monitoring the growth of LBW babies need to be a priority in stunting prevention programs.

Factors that are not Related to the Incidence of Stunting

The present study did not identify a significant relationship between maternal age, maternal education level, early initiation of breastfeeding, parity, and pregnancy spacing with the incidence of stunting. This finding is inconsistent with the results of several previous studies that identified a correlation between these factors and stunting. These differences may be due to sample characteristics, local cultural factors, or interventions that have been implemented in the study area.

However, descriptively there is still a tendency that these factors have a higher percentage of stunting in the risk category. For example, stunting was more common in children of mothers with low education (92.9%) than with high education (71.4%), although this was not statistically significant. This indicates that these factors still need to be considered in efforts to prevent stunting.

Several previous studies such as Sari et al. (2024), Pratiwi and Maulana (2023), and Yuliani and Setyawati (2023) have demonstrated a correlation between maternal age and education and the prevalence of stunting., where mothers with extreme ages (<20 and >35 years) and low education have more children who experience stunting. This difference in results may be caused by interventions that have been carried out in the study area or other factors that are more dominant in influencing the incidence of stunting in that area. Thus, although several factors did not show a statistically significant relationship in this study, efforts to prevent stunting need to still pay attention to these factors comprehensively.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of research on factors related to the incidence of stunting in the Mimika Regency Central Market Health Center Working Area, it can be concluded that the prevalence of stunting in children aged 2-5 years in the research area is quite high, reaching 91.7%. Then, there are five factors that are significantly related to the incidence of stunting, namely:

1. History of infectious disease (p=0.000; RP=2.674), where children with a history of infection are at 2.674 times greater risk of experiencing stunting.
2. Less ANC visits (p=0.032; RP=1.154), where mothers with less ANC visits are 1.154 times more likely to have stunted children.
3. Incomplete immunization (p=0.007; RP=1.178), where children with incomplete immunization are 1.178 times more likely to experience stunting.

4. Not exclusively breastfed (p=0.034; RP=1.148), where children who do not receive exclusive breast milk have a 1.148 times greater risk of experiencing stunting.
5. History of LBW (p=0.014; RP=1.167), where children with a history of LBW are 1.167 times more likely to experience stunting.

Furthermore, there are five factors that do not have a significant relationship with the incidence of stunting, namely maternal age, maternal education level, early initiation of breastfeeding, parity, and pregnancy spacing. A history of infectious disease is the most dominant risk factor for stunting with a 2.674 times greater chance of experiencing stunting than children without a history of infection.

Based on the results of research on factors related to stunting incidents in the Pasar Sentral Health Center Work Area of Mimika Regency, it is recommended that health workers at the Pasar Sentral Health Center increase education for pregnant and breastfeeding mothers about the importance of pregnancy planning at the ideal age (20-35 years) and the risks of pregnancy at extreme ages. In addition, the Mimika Regency Government needs to strengthen community-based policies and interventions to prevent stunting, especially in increasing access to maternal education and promoting reproductive health.

FURTHER STUDY

This study has limitations in that the research duration is limited to March to April and the aim is to investigate the relationship between risk factors for stunting. With these limitations, further research can be conducted using longitudinal methods to monitor children's development from birth to age 5 years in relation to risk factors for stunting. In addition, future research can develop more specific research on household environmental factors, sanitation and family diet as additional determinants of the incidence of stunting.

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