

THE IMPACT OF POVERTY AND MALNUTRITION IN CENTRAL SULAWESI PROVINCE

M. Adnan Latief Perwira^{1*}, Lukman Hakim², Akhmad Daerobi³

¹⁻³ Department of Economics and Development Studies, Sebelas Maret University, Indonesia.

*Email corresponding author: latiefperwira@student.uns.ac.id

Abstract

The importance of nutrition for the human body, which every day requires substances from food that are beneficial to health for the food process starting from consumption, digestion, absorption, to utilization by the human body. This study aims to analyze determinants, and map poverty that affects malnutrition in Central Sulawesi using village potential data. The data used is cross-section data from 2021 villages in Central Sulawesi in 2021 with multiple linear regression analysis. The variables analyzed are elementary school, junior high school, high school, health facilities, electricity customers, covid-19, sources of income, and poverty certificates. The results of this multiple linear analysis show that poverty certificates, and elementary school have a positive and significant effect on malnutrition. Health facilities, and sources of income have a significant negative effect on malnutrition. Covid-19, electricity customers, middle and high schools have a positive but not significant effect on malnutrition. This study aims to determine the extent to which improving the quality of education, health, electricity customers, sources of income, covid-19, poverty certificates can reduce the severity of malnutrition in Central Sulawesi. The increasing level of severity of malnutrition in the Central Sulawesi region is expected to be a concern for regional leaders so that the number of poor people can be reduced and malnutrition can decrease.

Keywords: Poverty, Malnutrition, Covid-19, Health, Education

INTRODUCTION

Nutrition is a fundamental aspect in supporting health, and development, and human growth. According to Indrawati, et al (2022) adequate nutritional intake not only plays a role in improving the quality of life of individuals, but also has an impact on the work productivity of citizens as a whole. However, in reality, there are still many groups of people who experience malnutrition problems, especially among the poor. Their economic disadvantage means that they have limited access to nutritious food, health services and education on healthy eating. This condition is exacerbated by the outbreak of the covid-19 virus that has paralysed the global economy, increased unemployment, and limited community mobility in fulfilling basic needs, including food.

The problem of malnutrition is increasing, especially in areas with high levels of poverty. A number of previous studies have examined the relationship between poverty and malnutrition, which are divided into two groups of research results. The first group of research results Sari, et al (2024) in Sukoharjo District, Sukandar, et al (2023) in Central Java Province, Nabila, et al (2021) in Banjar District, Herlina, et al (2019) in Pekanbaru City, Torlesse, et al (2016) in Pati District, Indrawati, et al (2022) in Yogyakarta District, Suherman, et al (2016) in West Java Province, Anugrah, et al (2024) in Sukabumi District. Based on the results of the above studies, it is revealed that the source of income, the number of electricity customers, the number of primary schools, the number of junior high schools, the number of senior high schools, health facilities, letters of indigence, and the covid-19 outbreak can be used as evidence that there has been a decrease in malnutrition in an area.

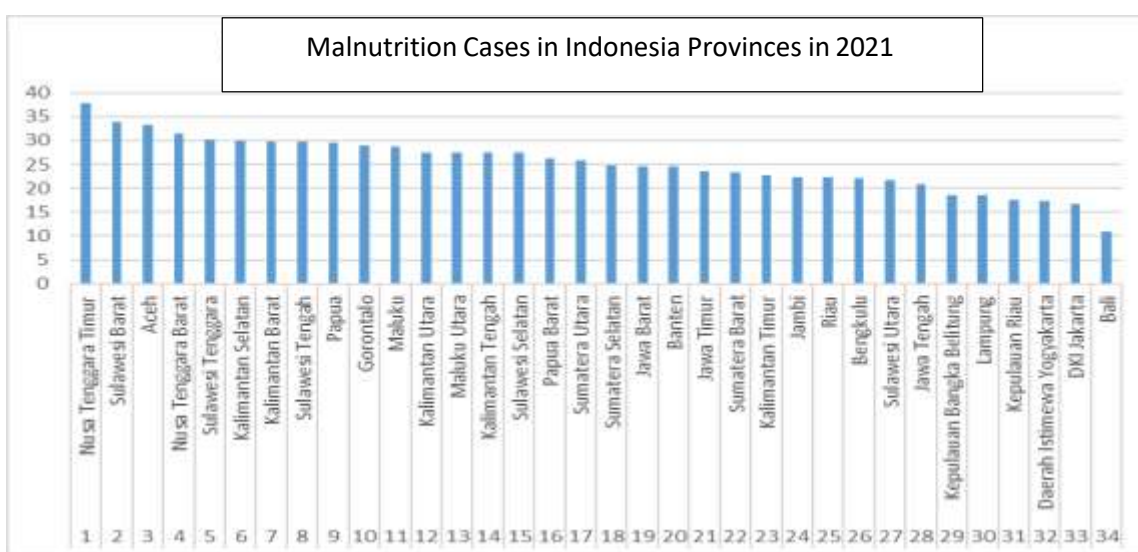
Meanwhile, the second group stated that there were different results from the first group.

The second group revealed that the number of primary schools, the number of junior high schools, the number of senior high schools, health facilities, covid-19, certificate of incapacity, and source of income did not contribute to malnutrition, such as research by Maulani, et all (2016) in West Java Province, Yanti, et all (2021) in Banjar District, Sulistyawati (2019) in Bantul District, Afifah (2019) in Sumenep District, Anaria, et all (2022) in Deli Serdang District, Aaliya, et all (2024) in Karangpapak Village, Sukabumi District, Helda, et all (2023) in West Siau District, Siau Tagulandang Biaro Islands District, North Sulawesi Province. Based on the findings of these two groups, this research will focus on knowing and analysing which findings are most appropriate in explaining the relationship between poverty and malnutrition in Central Sulawesi Province in 2021.

Based on the findings of the two groups of views above about the effect and no effect on malnutrition, there are differences in the findings of the 2 research groups. The difference in findings shows that the problem of malnutrition is a multidimensional problem that is influenced by various interrelated factors, but not just poverty alone. Various studies have shown that the relationship between poverty and malnutrition is still debated in determining the factors that contribute to malnutrition. This phenomenon is also not limited to Indonesia, but has become a global issue, with malnutrition being a problem faced by many countries, especially in developing countries with high levels of poverty. Limited access to nutritious food, health services, and nutrition education are the main causes that exacerbate this condition in various parts of the world.

The rate of malnutrition in Indonesia is still high with large disparities between provinces. East Nusa Tenggara Province has the highest rate of malnutrition at 37.8%. Meanwhile, the lowest malnutrition case in 2021 was in Bali Province, which had a malnutrition rate of 10.9%. In contrast, the province of Central Sulawesi is in eighth place with a malnutrition rate of 29.7%. Figure 1.1 below shows the number of malnutrition cases in various Indonesian provinces in 2021.

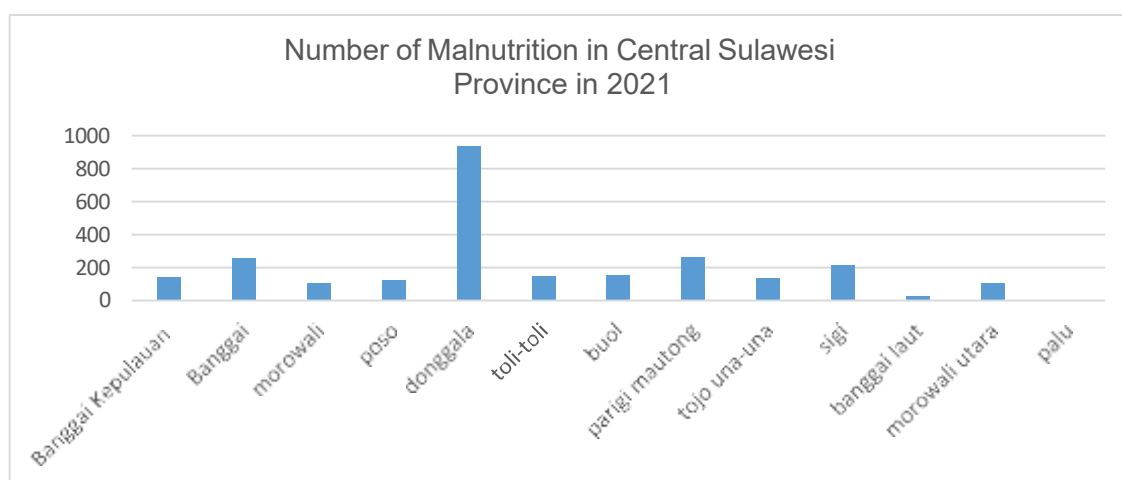
Figure 1.1 Number of Malnutrition Cases in Indonesian Provinces in 2021



Source: Sentral Statistics Agency, Data processed in 2025

Figure 1.2 below shows the number of malnutrition cases in the Central Sulawesi Province in 2021. The incident occurred in the Donggala Regency area which had 938 malnutrition cases. Meanwhile, the lowest number of malnutrition cases in 2021 in Central Sulawesi Province was in Palu City with three malnutrition cases. In this case, there are still many malnutrition problems with high categories that need to be considered by stakeholders, including by parents in providing nutrition to children in everyday social life. The following figure 1.2 below shows the number of malnutrition cases in Central Sulawesi Province in 2021:

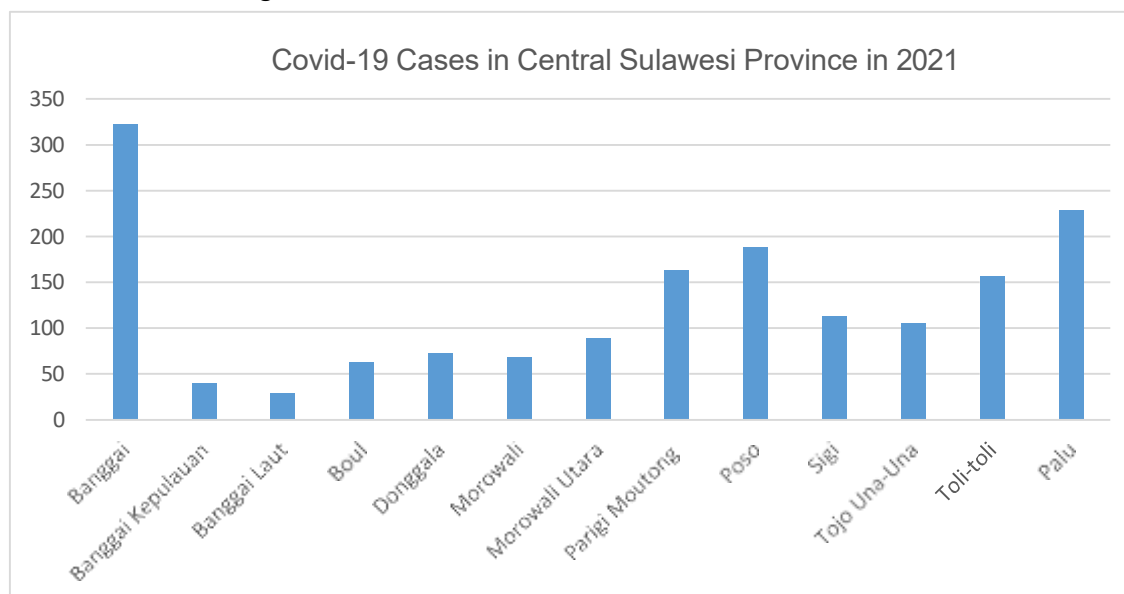
Figure 1.2 Number of Malnutrition Cases in Central Sulawesi Province in 2021



Source: Sentral Statistics Agency, Data processed in 2025

In 2021, Banggai Regency recorded the highest number of cases with a total of 322 people infected with covid-19. Then, Palu City had 229 cases of covid-19, Poso Regency had a total of 188 cases of the covid-19 virus. Meanwhile, Banggai Laut Regency has the lowest number of cases, namely 29 cases. Figure 1.3 below illustrates the number of covid-19 virus cases in the Central Sulawesi Province area in 2021.

Figure 1.3 Covid -19 Cases in Central Sulawesi Province in 2021



Source: Sentral Statistics Agency, Data processed in 2025

Although various previous studies have discussed the relationship between poverty and malnutrition, there are still aspects that have not been studied in depth. Most previous research has focussed more on general economic factors, such as low education, low household income, access to health facilities, without considering administrative aspects such as using a certificate of incapacity

as an indicator of economic inability to access social assistance. In addition, the specific impact of the covid-19 pandemic on malnutrition at the regional level, especially in Central Sulawesi Province, has not been explored.

This study is unique because it examines the certificate of incapacity that reflects the economic limitations of the community, let alone making conditions worse during covid-19. This economic limitation can also be seen from the sources of income obtained, both from agricultural and non- agricultural sector jobs. As a consequence, this condition affects the level of malnutrition. This research also uses technological factors, namely the number of electricity subscribers as a proxy to measure the affordability of infrastructure in a region. This is because electricity use contributes to access to nutritious food and health services. In addition to using various factors such as the number of electricity subscribers, health facilities, and poor certificate, this research also examines the number of schools as a proxy for education to measure one's knowledge in overcoming malnutrition.

The focus of this research discusses the effect of the variable number of electricity customers, the variable number of primary schools, the variable number of junior high schools, the variable number of senior high schools, the variable certificate of incapacity, the variable source of income, the variable health facilities, the covid-19 variable in villages located in the Banggai Regency, Poso Regency, Banggai Laut Regency, North Morowali Regency, Sigi Regency, Morowali Regency, Toli-Toli Regency, Banggai Islands Regency, Parigi Moutong Regency, Tojo Una-Una Regency, Donggala Regency, Buol Regency, Palu City in 2021.

LITERATURE REVIEW AND HYPOTHESIS FORMULATION

1. Nutrition and Nutritional Status

According to Mardalena (2021:1), nutrition is a series of organic processes of food that can be digested by the body to meet the needs of growth, and organ function to maintain a person's life. In this case, in the territory of Indonesia, nutrition is closely related to a number of food ingredients that are used as staple foods. Every day, food is a material that contains nutrients, as well as chemical bonding elements that can be responded to and reacted by the body so that it is useful for the body.

Nutrients are substances needed by the body to produce energy, build, maintain tissues and regulate metabolic processes in a person's life. By consuming a number of foods, a person has actually used nutrients in two forms, namely poor nutrition and good nutrition. According to Mardalena (2021: 7), the role of nutrients in the body is categorised into two forms: nutrients needed by the body are grouped into the following three parts

1. Nutrients as Energy Sources

Nutrients that are included as energy sources, namely carbohydrates, fats, proteins. Oxidation of this substance is used for activity for the body. Quantitatively, the amount is the largest in the provision of food. The substance is referred to as a burning substance.

2. Nutrients for Growth Maintenance of Body Tissue

Nutrients included in this include: protein, minerals, and water. They are part of the body's tissues, and their function is to form new cells, maintain and replace damaged cells. These substances are also referred to as building blocks.

3. Nutrition as a Regulator of Body Processes

Nutrients include protein, minerals, water, and vitamins to regulate body processes. The function of protein as a regulator of water balance in cells acts as a maintainer of body neutrality; forming antibodies against infective organisms of "foreign" materials that enter the body. Minerals and vitamins function to regulate the oxidation process. Water also serves to dissolve materials in the body.

b. Nutritional Status

According to Muharramah (2023: 34), nutritional status is a condition of a person's nutritional adequacy. It is known through general observations to determine the good nutritional status of a population or individual using various methods. According to Wati (2023: 92) nutritional status can be seen from observing changes that occur physically which are correlated with deficiencies or excess nutrients. These physical changes can be seen in a person's skin, eyes, hair, and thyroid gland. With regard to nutritional status, according to Puspita (2023: 111), the nutritional status of infants to children has a meaning that can be used as a reference about the health condition, growth suitability of the child. Determining nutritional status apart from looking at the eyes, skin, hair, and thyroid gland can also be measured by paying attention to anthropometric changes that are carried out periodically. This reference that can be used by health workers can be used to interpret the nutritional status of children with anthropometric standards. The following four parameters of the child's nutritional status with anthropometric standards from the Ministry of Health: (1) weight for age; (2) length or height for age; (3) weight for length or height; (4) body mass index for age.

2. Community Health

Every human being is a social being who needs good health. For this reason, public health is needed by the community as an effort to improve the degree of human health. In order for this condition to be realised, efforts that are based on the community, including oriented towards prevention, as well as improving health status is needed. According to Efendi, et al (2020: 6) and Makhfudli, et al (2020) that public health can be applied for the sake of improving the degree of public health in general.

In line with Mustar, et al (2020: 8) and Sumiati (2016), public health aims for every citizen to achieve the highest degree of health, both physically, mentally, and socially, even humans are expected to live long. Therefore, according to Hasnidar, et al (2020: 8), public health does not only examine one science, but studies various sciences, namely: (1) epidemiology, (2) biostatistics, (3) public health, (4) health education, (5) public nutrition, and (6) occupational health. However, according to Pattola, et al (2020:12) and Sumiati (2016), factors that affect public health consist of 4 factors, namely the environment, behaviour, health services, and heredity.

3. Poverty

According to Adji, et al (2020: 11), poverty is the inability of people to meet economic, social, and even other standard needs such as not being able to get an education, difficulty paying for health, lack of savings, and no investment. If this is experienced by a person or group of people, based on Article 34 paragraph 1 of the Constitution, it turns out that the poor are the responsibility of the state. For this reason, the state's responsibility can be realised through social welfare programmes, and other programmes from other ministries.

a) Monetary Poverty: Relative and absolute

According to Adji, et al (2020: 11), relative poverty can be described as a gap in income distribution. In this case, there is the term poorest population which is difficult to overcome. Generally, the "poorest" group of people are in, for example, the lowest 20 per cent or 40 per cent of the total population that has been sorted according to income/expenditure.

In contrast to this, according to Adji, et al (2020: 11), there is still absolute poverty in society. Those who are classified as experiencing absolute poverty are related to the minimum standard of living that is considered appropriate in one area at a certain time. In this case, absolute poverty occurs because there is a difference between a person's income level and the level of income needed to fulfil basic needs. A person can be called poor, according to the concept of absolute poverty, if they cannot fulfil their minimum basic needs, such as food, clothing, health, housing, and education.

b) Multidimensional Poverty

According to Adjii, et al (2020: 11) multidimensional poverty is a citizen who experiences it usually knows a concept in a country, and is even on the path to fulfilling the millennium development goals. According to Pinontoan (2020: 5), multidimensional poverty has the following characteristics: (1) inability to fulfil basic consumption needs (food, clothing, and shelter); (2) lack of access to other basic life needs (health, education, sanitation, clean water and transportation); (3) lack of future guarantees because there is no investment for education, and family; (4) vulnerability to individual or mass shocks;

(5) low quality of human resources, and limited natural resources; (6) lack of involvement in community social activities; (7) inability to do business due to physical and mental disabilities; (8) lack of access to employment/natural resources.

Based on poverty theory, poverty is seen as a deprivation of basic capabilities rather than simply low income which is the criterion in a standard to be able to identify the poverty of a person. The ability of people experiencing poverty does not reject the view that it is due to low income. That is one of the of the main causes of poverty. However, a lack of income can be a major reason for a person experiencing capability deprivation. When income is inadequate, poverty is a strong predisposing condition for poor living.

Multidimensional poverty measurement is a field that has grown rapidly in recent years. Among the various approaches that have been proposed to measure multidimensional poverty is the Alkire- Foster (AF) approach. In this regard, Alkire and Foster (2015) have attracted the attention of most researchers, policy makers. Calculation measures, such as the Alkire Foster approach, are based on a deprivation profile for a specific unit of identification, i.e. an individual or household, as well as a deprivation profile that is used to create a deprivation score for each unit of identification (Alkire, et al 2015).

Multidimensional poverty includes various deprivations experienced by the poor in their daily lives. Multidimensional poverty measurement can include a set of indicators that capture the complexity of the phenomenon to inform appropriate policies to reduce poverty. In addition, multidimensional poverty indicators are closely linked to indicators in the SDGs (Muthia and Barikha, 2021).

However, multidimensional poverty indicators vary depending on the policies adopted to address deprivation. To illustrate, Costa Rica's poverty features dimensions of housing, internet access, education, health, and social protection. In this context, the relative contribution to multidimensional poverty of the "Health" dimension is significantly higher in rural than in urban areas while the opposite is true for the remaining dimensions. These results reflect that rural households in Costa Rica are relatively poorer than urban households in terms of the various indicators included in the "Health" dimension of the national multidimensional poverty index (INEC, 2020).

The OPHI often shows how indicators from different dimensions contribute to the multidimensional poverty index in rural and urban areas. OPHI presents nutrition, child mortality, years of schooling, school attendance, cooking fuel, sanitation, drinking water, electricity availability, housing, and assets; as indicators of multidimensional poverty (OPHI, 2020). As illustrated in the case of Nigeria, nutrition, child mortality and cooking fuel contribute relatively more (FAO, 2021).

According to FAO (2021) all poverty profiles should include information on demographic characteristics and basic education. Examples of common variables include gender, age, years of education, ethnic characteristics, household size, number of children, and dependency ratio. In some cases, these variables are reported at the individual level by taking the average of all individuals e.g. age, sex, education. In other cases, information is reported at the household level (e.g. household size, number of children, or household composition). Finally, some poverty profiles report the average of the same individual variables twice: for the total population (or some specific groups, such as the adult population) and for those identified by the household as the "head of household".

4. The Face of Village Poverty

According to Palupi, et al (2021), the face of rural poverty has always been inherent in rural communities where there is a lack of knowledge and skills regarding businesses that can increase family income in order to increase employment. The general level of knowledge of rural communities is very low. This can be seen from the lack of community skills in increasing their income, generally only focused on agriculture both in rice fields and gardens.

The face of rural poverty can be seen from various aspects, namely education, technology, health, economy. The education aspect is a very important aspect related to the level of knowledge, abilities, and skills of the community to do something that has added value to family life or to the life of the community in general. From the aspect of education, the face of poverty is seen in the village, which only reaches the junior high school level. The reason for this is the welfare of the parents, which requires children to work like their parents as farm labourers.

The electricity aspect makes the face of poverty clearly visible. This aspect also determines and benchmarks the welfare of a region. Areas that have not been electrified are often labelled as underdeveloped areas. Groups of people who have not been able to enjoy electricity are often in the underprivileged economic class.

The health aspect can illustrate the face of poverty in a village. In relation to that, the people who experience it are seen to have limited access to health facilities, lack of health facilities, limited human resources so that the health of the village community decreases. In addition, the community has no income, which further clarifies the face of poverty in accessing health facilities provided by the government. The economic aspect can show the face of poverty in villages where the majority of jobs are in the agricultural sector. The low income in the agricultural sector makes a person unable to reach the regional minimum wage.

5. Poverty and Malnutrition

Poverty directly contributes to malnutrition through several channels, including:

- Certificate of Incapacity: a certificate of inadequacy can help poor families obtain government assistance that can improve their access to nutritious food that keeps the family out of malnutrition (Lestari, et al 2024).
- Electricity Subscribers: Access to electricity allows for better food storage, supporting family food security (Harijono, et al 2020). The higher food security keeps families away from the malnutrition effects of eating less nutritious food.
- Number of Educational Facilities: Access to formal education improves nutrition knowledge in the community (Arifin, et al 2020). The higher the level of education of individuals in society, the individual knows how to increase nutritional knowledge to avoid malnutrition such as eating a nutritionally balanced diet.
- Source of Income: A stable income increases a family's ability to purchase nutritious food. The source of income is obtained from the individual's work. A stable job can generate a stable income. The more stable a family's income is, the more it can buy nutritionally balanced food to avoid malnutrition.
- Health Facilities: The availability of health facilities supports efforts to prevent and treat malnutrition (Mustar, et al 2020). Health facilities are definitely needed by the wider community to avoid disease. When someone is malnourished, the community can seek treatment such as: hospitals, health centres, polindes, posyandu, and health facilities so that malnutrition can be overcome by the medical team.
- Covid-19: The pandemic increases the risk of malnutrition due to decreased income and limited access to food (Indrawati, et al 2022). The pandemic that occurred in 2019 to 2021 made people stay at home more often to be able to break the covid-19 disease. However, people in Indonesia work more in the private sector, which makes people who work in the private sector affected by decreased community income. Decreased income can experience malnutrition when unable to buy nutritionally balanced food and limited access to food.

This study has the following research hypothesis:

1. The variable of certificate of incapacity is suspected to have a negative influence on malnutrition in Central Sulawesi in 2021.
2. The variable electricity customer is predicted to have a negative influence on malnutrition in Central Sulawesi in 2021.
3. The variable number of primary schools is predicted to have a negative effect on malnutrition in Central Sulawesi in 2021.
4. The variable number of junior high schools has a negative effect on malnutrition in Central Sulawesi in 2021.
5. The variable number of senior high schools has a negative effect on malnutrition in Central Sulawesi in 2021.
6. The variable of income source is predicted to have a negative influence on malnutrition in Central Sulawesi in 2021.
7. The covid - 19 variable is predicted to have a negative effect on malnutrition in Central Sulawesi in 2021.
8. The variable number of health facilities is predicted to have a negative effect on malnutrition in Central Sulawesi in 2021.

RESEARCH METHODS

This research is a type of quantitative research with statistical analysis. Data collection was carried out in 2021, the population and data sample of this study took 2020 villages in Central Sulawesi. The type of data used is secondary data originating from the Central Bureau of Statistics in 2021 and processed using gretl software.

The dependent variable in the study is malnutrition per village, while the independent variables are certificate of poverty, number of electricity customers, number of primary schools, number of junior high schools, number of senior high schools, covid-19, source of income, health facilities. The cross-section data regression model in this study is as follows:

$$Y = \alpha + \beta_1 SKTM + \beta_2 JPL + \beta_3 SP + \beta_4 JSMP + \beta_5 JSMA + \beta_6 C + \beta_7 JSD + \beta_8 JSR + \epsilon$$

Description:

SKTM : Variable number of certificate of incapacity

JSD: Variable number of primary schools

JSMP : Variable number of junior high schools

JSMA : Variable number of senior high schools

C : Covid variable - 19

JSR : Variable number of hospitals

SP: Source of income variable

JPL: Number of electricity customers

RESULTS AND DISCUSSION

This study analyses the influence of independent variables, among others: poor certificate variable, electricity customer variable, primary school variable, senior high school variable, junior high school variable, income source variable, health facility variable on the dependent variable, namely malnutrition. The analysis used is multiple linear regression with 2021 cross-section data processed using the gretl application. The following is table 1 regression results that can show variables that affect and do not affect.

Table 1. Multiple Linear Regression Results

Variabel	Coefficient	Probability
C	0,716613	0,0004***
Certificate of Incapacity	0,002935	0,0895*
Customer Electricity	0,000408	0,2828
Number of Schools Elementary	0,577563	0,0000***
Number of Junior high Schools	0,047235	0,8223
Number of High Schools	0,130541	0,7115
Covid-19	0,259930	0,3542
Source Income	-0,161295	0,0035***
Facilities Health	-0,22851	0,0025***

Notes: *** p < 0.01; **p < 0.05; *p < 0.10

Source: Central Bureau of Statistics, Data processed in years 2025

Based on table 1 above, the multiple linear regression estimation results are obtained as follows:

Malnutrition: $0.716613 + 0.002935 \text{ * Certificate of Incapacity (X1)} + 0.000408 \text{ * Electricity Customer (X2)} + 0.577563 \text{ * Primary School (X3)} + 0.047235 \text{ * Junior High School (X4)} + 0.130541 \text{ * Senior High School (X5)} - 0.161295 \text{ Source of Income (X6)} + 0.259930 \text{ * Covid-19 (X7)} - 0.228512 \text{ Health Facilities (X8)}$.

Based on the results of multiple linear regression table 1, there are several important findings related to the determinants of malnutrition in Central Sulawesi that can be explained from the independent variables on malnutrition as follows

1. The certificate of incapacity has a positive and significant effect on malnutrition at the 10% significance level ($p = 0.0895$). The coefficient value of the variable certificate of incapacity is 0.002935. Based on the coefficient value of the certificate of incapacity variable in Table 1, this study has not been able to answer the first hypothesis regarding the direction of the negative effect on malnutrition. When the certificate of incapacity variable increases by 1 unit, malnutrition increases by 1 unit. This contradicts the initial hypothesis, which states that the fewer people who ask, the more malnutrition will occur in the community.

However, the results are very different from the initial hypothesis in this study. This is because the number of people receiving the certificate of incapacity is not followed by the distribution of nutrition. The increasing number of people requesting the certificate of incapacity may mean that the area is indeed very poor and therefore prone to malnutrition. The certificate of incapacity could have been given to people who were not poor. Poverty is indeed a direct risk factor for malnutrition. In this case, existing interventions have not been effective enough to reverse the trend.

2. The multiple linear regression results in Table 1 show a positive coefficient of 0.000408 with a significance level of 0.2828, which means that it is not statistically significant in influencing the level of malnutrition in Central Sulawesi. The coefficient value of the variable number of electricity customers based on table one has not been able to answer the second hypothesis related to the negative direction of influence on malnutrition in Central Sulawesi Province. When the variable number of electricity customers increases by 1 customer, malnutrition cases decrease for every one customer. This does not answer the second hypothesis in this study which states that the more people who become electricity customers, the decrease in malnutrition cases. .

This result is not in line with the second hypothesis of the study which predicts that access to electricity to the community as an indicator of welfare and basic infrastructure should contribute to the decline in malnutrition. This discrepancy could be due to the following factors: access to electricity does not directly impact the nutritional condition of the community or the number of electricity subscribers does not yet reflect the equitable distribution of electricity. In addition, factors such as household consumption patterns, the quality of nutritional intake, and mothers' knowledge of nutrition are more dominant in influencing nutrition than infrastructure variables such as electricity.

3. The number of primary schools has a positive and highly significant effect on malnutrition with a probability value of 0.0000 ($p < 0.01$). The probability value of the number of primary schools can be assumed to have a significant influence with a positive direction on the malnutrition variable in the Central Sulawesi Province area in 2021. The variable coefficient value of the number of primary schools is 0.577563. Based on the coefficient value of table 1. this study has not been able to answer the third hypothesis regarding the direction of its negative effect on malnutrition.

Hypothesis 3 of this study states that when there are only a few primary schools in the area, an increase in malnutrition cases occurs in the area. However, in reality, the regression results showed that the variable number of primary schools has a positive effect on malnutrition. Based on the results, the direction of the effect is very different from the third hypothesis. The reason this is not appropriate is because the government tends to increase the number of primary schools in underdeveloped or malnutrition-prone areas to improve the quality of education and child health.

The number of schools does not guarantee access to good nutrition if the quality of services in schools is low, there are no nutrition programmes, health efforts, or health services. There are no nutrition programmes, school health efforts are not active, teaching staff are not trained in health issues. More effective school programmes including the provision of healthy school meals have more influence on nutrition than just the physical availability of schools.

4. The variable number of junior secondary schools has a positive coefficient of 0.047235 and a probability value of 0.8223, indicating that its effect on malnutrition is not statistically significant. Hypothesis 4 of this study is that the presence of only a small number of junior secondary schools in the area leads to an increase in malnutrition cases in the area. However, in fact, the regression results of this study found that the number of junior high schools has no effect with a positive direction on malnutrition. Based on this result, it is very different from the fourth hypothesis. The reason is because even though the number of junior secondary schools has increased, it is not certain that children in the area can access them.

The results of this study are supported by Sulistyawati's (2019) research in Bantul Regency which found that increasing secondary education facilities did not have a direct impact on children's nutritional status due to low school participation at the junior secondary level in low-income families. A high number of schools does not guarantee that nutrition education materials are taught effectively. Without school health programme interventions such as school health efforts, supplementary feeding, or dietary education, the presence of secondary schools has no impact on improving nutrition awareness.

5. The variable number of senior secondary schools has a positive coefficient of 0.130541 with a probability of 0.7115, which is also not statistically significant. Based on the coefficient values in Table 1, this study has not been able to answer the fifth hypothesis. Hypothesis five of this study is

that the presence of only a small number of senior high schools in the area leads to an increase in malnutrition cases in the area. However, in fact the regression results of this study found that the variable number of senior high schools has no effect with a positive direction on malnutrition. Based on the results of the study, it is very different from hypothesis five.

The reason is because the existence of educational facilities such as senior high schools does not necessarily guarantee an increase in the quality of nutritional knowledge in the community if it is not followed by the active participation of the community in this education. This is reinforced by researchers Putri, et al. (2017) and Sulistyawati (2019) who mentioned that even though parents have a high level of education, it does not necessarily have a direct effect on the nutritional status of children if it is not accompanied by good parenting and nutritional knowledge. Socioeconomic factors such as parents' income and occupation, as well as access to nutritious food, may be more dominant in influencing nutritional status than the number of educational facilities available in an area.

Many senior high schools in underdeveloped areas cannot provide explicit nutrition education, so the presence of senior high schools may not be an effective instrument in improving the community's understanding of the importance of balanced nutrition. Similar findings were also shown by Maulani, et al. (2016) and Aaliya, et al. (2024), which state that variables such as formal education or educational infrastructure are not always significantly correlated with the decline in malnutrition rates.

6. Source of Income has a negative and significant effect that the probability value of the income source variable is 0.0035 ($p < 0.01$) on malnutrition. The coefficient value on the income source variable is - 0.161295. Based on the coefficient value in table 1, this study has been able to answer the sixth hypothesis. The higher or better the source of income of rural villagers, the level of malnutrition tends to decrease.

The results are consistent with the initial hypothesis of the study which states that an increase in income will reduce the malnutrition rate. This finding can be explained theoretically through the basic concept of welfare economics, which states that income plays an important role in improving access to nutritious food and health services. In the context of rural communities, people who have a steady source of income from agriculture or non-agriculture tend to have better financial capacity to purchase nutritious food and access health services needed by the community.

In contrast, people with low incomes are often forced to eat cheap food with low nutritional quality, have difficulty accessing health services, and are at higher risk of malnutrition. This research is reinforced by the findings of previous studies, such as those conducted by Suherman et al. (2016), Hananti, et al. (2023), and Hastono et al. (2020) which showed that low income sources were significantly correlated with high levels of malnutrition. This study confirms that income is one of the main determinants in the nutritional status of the community.

However, not all research results support this finding. Research conducted by Afifah, et al. (2019), Jufri et al. (2017) showed that the source of income does not significant effect on malnutrition. The difference in these results is the presence of intervening factors such as parenting, education level, environmental conditions that mediate the relationship between income and nutrition. In some cases, even if income is sufficient, a lack of nutrition education or family prioritisation of spending can lead to unbalanced food intake.

7. Based on table 1 the results of the data processing above through the gretl program can be analysed as follows that the probability value of the covid-19 variable is 0.3542. The value of the probability in the covid-19 variable can be assumed to have no significant effect in a positive direction on the malnutrition variable in Central Sulawesi Province in 2021. This covid-19 variable has a coefficient value of 0.259930. Based on the value of the coefficient in table 1, this study has not been able to answer the seventh hypothesis.

The seventh hypothesis of this study states that when Covid-19 increases, there is also an increase in malnutrition cases in the area. The results of this study can be interpreted that although theoretically the Covid-19 virus can worsen economic conditions, limit access to nutritious food,

health services, and these effects are not directly reflected in the malnutrition rates reported at the village level.

8. The health facility variable has a significant negative effect with a probability value in the health facility variable of 0.0025 ($p < 0.01$). The coefficient value on the income source variable is -0.228512. Based on the coefficient value of the health facility variable in table 1, this study has been able to answer the eighth hypothesis. The more the presence of health facilities in the village, the malnutrition rate tends to decrease.

The results are in line with public health theory, which states that the presence of adequate health facilities, namely health centres, posyandu, clinics, and nutrition service facilities can play an important role in the prevention and handling of malnutrition cases, especially in vulnerable groups such as toddlers and pregnant women. With health facilities that are easily accessible to the community, people can obtain nutritional examination services, education on healthy eating patterns, immunisation, and nutritional interventions in a timely and sustainable manner. This finding is supported by research by Holid et al. (2017) in West Java Province which showed that the presence of health facilities contributed significantly to reducing the prevalence of malnutrition through promotive and preventive approaches.

Similar results were also found by Agustina, et al. (2022), who stated that improving access and quality of health services had a direct impact on reducing malnutrition among under-fives. The interpretation of these regression results indicates that health facilities are one of the important instruments in efforts to overcome malnutrition at the village level, and need to be a major concern in the formulation of regional health development policies. Increasing the number and quality of health facilities in areas with high levels of malnutrition is a highly relevant and evidence-based strategy.

CONCLUSION

The findings highlight that economic and health factors have a dominant influence on the level of malnutrition in these areas compared to formal education and electricity infrastructure. This emphasises the importance of a multidimensional approach in addressing malnutrition, involving efforts to improve economic welfare, access to health facilities, and the quality of community education.

The implication of this study is the need for integrated policies to reduce malnutrition rates in Central Sulawesi. Local governments are advised to:

- Increase economic empowerment programmes for rural communities to increase family income.
- Expand and improve the quality of health services, especially in rural and remote areas.
- Improve the quality of basic education, not only by increasing the number of schools but also by strengthening the nutrition education curriculum.
- Structuring social assistance policies based on certificates of inadequacy more effectively so that beneficiaries actually receive support that can improve family food security.

The limitations of this study open up opportunities for more in-depth research in the future using longitudinal or qualitative data approaches to understand the mechanisms behind the relationships found. The following are the limitations of this study:

- The data used is cross-section, so it can only show the simultaneous relationship between variables, not the long-term cause-and-effect relationship.
- The education variable is only measured by the number of formal schools, not the quality of education or the level of community participation in education.
- The impact of the Covid-19 pandemic in this study may not be fully revealed, given the presence of social assistance mitigation factors that are not specifically measured.
- Cultural factors, household consumption behaviour, and aspects of health facility quality were not included in the analysis model.

Based on these limitations, some suggestions for future research are:

- Use panel or longitudinal data to see the dynamics of changes in malnutrition over a longer period of time.
- Include variables on education quality, health facility quality, and food consumption behaviour for a more comprehensive analysis.
- Conduct in-depth qualitative studies on community perceptions of nutrition and socio-cultural factors that influence dietary patterns.
- Specifically examine the effectiveness of various forms of social assistance.

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