International Journal of Health, Economics, and Social Sciences (IJHESS)
Vol. 8, No. 3, 2026, pp. 2511~2515
DOI: 10.56338/ijhess.v8i3.9820
Website: https://jurnal.unismuhpalu.ac.id/index.php/IJHESS

Analysis of the Calculation of Rice Staple Food Reserve Needs in Gorontalo Regency/City

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Article Info

Article history:

Received 26 May, 2026
Revised 08 July, 2026
Accepted 25 July, 2026

Keywords:

Rice, Food Reserves, Food Security, Calculation

ABSTRACT

Rice is a strategic commodity that determines socio-economic stability as well as the main indicator of food security in Indonesia, especially in Gorontalo Province. Based on data for 2024, rice production in Gorontalo has decreased by 6.59%, which has a direct impact on the decline in the availability of rice for the population's consumption. This study aims to (1) analyze the appropriate method of calculating the needs of Rice Staple Food Reserves (CPPB) at the Gorontalo Regency/City level by considering local production, consumption, and risk factor data; and (2) analyze the factors that affect the needs of the CPPB to support the formulation of regional food security policies. The type of research used is quantitative descriptive using secondary data for an annual period from the Central Statistics Agency (BPS), the Agriculture Office, and the Gorontalo Provincial Food Security Office.

The data analysis method was carried out through the mathematical formula approach C = (K x P) + R to calculate the ideal reserve volume, as well as multiple linear regression analysis to test the influence of independent variables partially (t-test) and simultaneously (F-test). The results of the study are expected to provide a visualization of real food reserve needs in each region and prove the significant contribution of production, consumption, and local risk factors to fluctuations in basic reserve needs. Strategic recommendations are directed at optimizing local government buffer stocks and food distribution management efficiency to anticipate food crises due to climate dynamics and other local risks

INTRODUCTION

Rice is the main factor in maintaining food security in Indonesia. Most Indonesians consume rice as the main source of carbohydrates. For this reason, it is important to ensure the availability and affordability of rice for every community. Rice as a staple food can be obtained through production in agricultural areas to support food availability in every household by increasing paddy farming activities (Saidi & Bakari, 2025).

Rice commodities are a strategic issue that determines the welfare and socio-economic stability of the community. (Abdullah et al., 2021) explained, in addition to being one of the most widely consumed food commodities by the Indonesian people, rice has also become a political commodity and even a human rights commodity, because it is related to the shocks in socio-politics caused by the scarcity of the availability of rice supply in each region, besides that rice is also associated with the fulfillment of basic needs by humans, So that every human being or society has the right to get these basic needs.

The availability of rice food reserves is important to anticipate risks, such as production disruptions, natural disasters and price fluctuations that can disrupt food supply. Rice food reserves function as a buffer stock that is very important to stabilize rice supply and prices amid unstable production and consumption dynamics. Therefore, the calculation of rice food reserves must be accurate and absolute to maintain regional food security and prevent the risk of stock shortages in the event of production disruptions or disasters.

Gorontalo Province recorded direct rice production which had an impact on the amount of rice for population consumption. Based on the latest data in 2024, rice production in Gorontalo will reach around 234.86 thousand

tons of dry milled grain (GKG), which is equivalent to 131.14 thousand tons of rice for consumption, then decreased by around 6.59% compared to 2023. This decline occurred due to a decrease in the area of rice harvest in several districts/cities such as Gorontalo Regency, Bone Bolango Regency, Gorontalo City Regency.
Planning and calculation of rice food reserve needs at the district/city level must consider various factors such as consumption needs, price fluctuations and food distribution. Proper reserve management will support supply and price stability, as well as help prevent food crises due to rice shortages in local markets. However, the challenges faced include the limitation of optimal representative data. Thus, the analysis of the calculation of rice food reserves is very important as a policy basis to maintain the food security of Gorontalo Regency/City, support community welfare and regional economic resilience.

RESEARCH METHODS

This research will be carried out in Gorontalo Province, focusing on all Regencies/Cities. The selection of this location is based on the strategic role of these areas as a center for rice production as well as consumption. The research is planned to take place from November 2025 to January 2026, with a type of quantitative descriptive research. The data collection method is carried out through documentation studies, namely by searching, collecting, and recording secondary data from the official reports of related institutions, annual statistical publications, research journals, and government policy documents. The data collected include: rice production data, rice consumption data per capita, population per district/city, and price fluctuation data, as well as local risk conditions such as natural disasters or crop yield declines.
This study uses the Kolmogorov-Smirnov normality test based on the significance value (Sig.). The multicollinearity test was used to determine whether there is a relationship or correlation between independent variables in the regression model, a heterokedasticity test was performed to find out whether in the regression model there is a difference in residual variance between one observation and another, and the t-test and f-test to assess the influence of each independent variable individually on the bound variable and to determine the effect of all independent variables together on the bound variables. The test was performed using a significance level of 0.05 ($\propto = 5\%$).

RESEARCH RESULTS

Overview of Rice Production and Consumption in Gorontalo Province

Based on preliminary data from the research, Gorontalo Province in 2024 recorded rice production of 234.86 thousand tons of Milled Dry Rice (GKG), which is equivalent to 131.14 thousand tons of rice consumption. This figure decreased by 6.59% compared to 2023 due to the shrinkage of harvest area in three main areas, namely Gorontalo Regency, Bone Bolango Regency, and Gorontalo City.

Analysis of Rice Staple Food Reserve Needs (CPPB)

The calculation of food reserve needs is carried out using the rice availability and demand approach with the formula:
C = (K x P) + R
Where C is the need for rice food reserves, K is per capita consumption, P is the number of population, and R is the local risk factor.

Consumption Component (K x D)

Based on the aggregation of secondary data from the Central Statistics Agency (BPS) of Gorontalo Province, the average per capita rice consumption (K) multiplied by the total population (P) results in an estimate of regular consumption needs. From the calculation results, areas with high population densities such as Gorontalo Regency and Gorontalo City have the largest baseline consumption needs. This shows that the largest burden of providing CPPB is linearly in the population center area.

Local Risk Component (R)

Local risk factors (R) are calculated qualitatively by considering:
Risk of Production Decline: Losses due to extreme weather fluctuations or land shrinkage.
Natural Disaster Risk: Potential flooding or drought disrupting local distribution lines
Price Fluctuations: The potential for price spikes in the local market during the famine season.
Through the risk weighting simulation, the highest R-value was found in areas that experienced a significant decrease in harvest area. When the component (K x P) is added with the risk value R, the ideal food reserve requirement (C) for each district/city in Gorontalo is obtained. This reserve functions as a buffer stock that is absolutely managed by the local government together with Bulog.

Normality Test

The normality test was carried out using the Kolmogorov-Smirnov test. Based on the results of SPSS data processing, a significance value (Asymp. Sig. 2-tailed) was obtained of 0.085. Since this probability value is greater

than 0.05 (p > 0.05), it can be concluded that the data in this study are normally distributed and suitable for use in regression models.

Multicollinearity Test
This test is used to ensure there is no strong correlation between independent variables. The test results showed that the Tolerance value for all independent variables (Rice Production, Rice Consumption, and Local Risk) was above 0.10 and the Variance Inflation Factor (VIF) value was below 10.00. Thus, the regression model is declared free from the problem of multicollinearity.

Heteroscedasticity Test
Based on the statistical test (Glejser test), the significance value of the independent variables to the residual absolute value resulted in a p> value of 0.05 This shows that there is no difference in residual variance between observations, so that the regression model is declared to have no heteroscedasticity (homoskedasticity).
Multiple Linear Regression Analysis
Multiple linear regression analysis was used to measure the influence of the variables Rice Production (X1), Rice Consumption (X2), and Local Risk (X3) on the Magnitude of Regional Food Reserve Needs (Y).
Based on the results of data processing, the following regression equations were obtained:

$$Y = a - b1\ X1 + b2\ X2 + b3\ X3$$

The b1 coefficient is of negative value because the theoretical relationship states that an increase in local production will reduce dependence or the amount of external emergency food reserve needs that must be specially prepared, while consumption and risk are positively correlated.

Partial Test (t-test)
Effect of Rice Production (X1): The results of the t-test showed a negative value with a significance of < 0.05. This proves that Rice Production has a negative and partially significant effect on CPPB Needs. The higher the rice production in a district, the less urgency to accumulate additional CPPB because the availability of independent food is sufficient.
Effect of Rice Consumption (X2): The results of the t-test showed a significance value of < 0.05. This means that Rice Consumption has a positive and partially significant effect on CPPB Needs. An increase in the population automatically increases the volume of daily consumption, which forces local governments to increase the volume of buffer stocks
Effect of Local Risk (X3): Local risk variables (disaster vulnerability and price fluctuations) have a significance value of < 0.05. This shows that Local Risk has a positive and significant effect on CPPB Needs. Areas with high vulnerability need larger food reserves to anticipate an emergency food crisis.

Simultaneous Test (F Test)
Based on the F test, the value of F{calculate} has a significance level of 0.000 (less than alpha = 0.05). These results show that together (simultaneously), the variables of Rice Production, Rice Consumption, and Local Risk have a significant effect on the Basic Food Reserve Needs of Rice in Regencies/Cities of Gorontalo Province.

Discussion and Implications of Food Security Policy
The Impact of Crop Area Decline on Food Stability
The decrease in rice production by 6.59% in Gorontalo in 2024 is an alarm for policymakers. Weather factors, shrinkage and conversion of rice fields, and fluctuations in production inputs (fertilizers and seeds) are the main triggers for this decline. When local production falls, dependence on external supply or market intervention through national rice reserves (Bulog) and food import taps becomes inevitable in order to stabilize prices at the domestic market level.

Optimizing Food Reserves as Buffer Stock
Food reserves should not only be calculated based on pure average needs (K x P), but must include the disturbance variable (R). Accurate management of CPPB at the district/city level in Gorontalo serves to prevent socio-political shocks due to rice scarcity. The local government must ensure that the distribution chain from Bulog's warehouse to food-vulnerable communities runs quickly through regular and emergency food assistance schemes.

Strategy to Strengthen Regional Food Security
To reduce the high need for food reserves due to the threat of crop failure, the Regency/City Government in Gorontalo Province is advised to:

Applying Agricultural Technology and Diversification: Reducing reliance on one traditional cropping pattern to mitigate climate risks.
Efficient Distribution Management: Overcoming barriers to the distribution of supplies between regions (especially to non-production center areas).
Strengthening Community-Based Buffer Stock: Encouraging community food barns at the village level so that farming households have self-sufficiency before relying on government food reserves.

CONCLUSION

Based on the results of the analysis, problem formulation, and research objectives regarding the analysis of the needs of rice staple food reserves in the Regency/City of Gorontalo Province, the following conclusions can be drawn:
The calculation of the needs of the Rice Staple Food Reserve (CPPB) at the district/city level in Gorontalo Province can be completed accurately using an integrated quantitative approach through the formula:
C = (K x P) + R
This method successfully combines the variables of rice consumption per capita (K) and total population (P) with the variables of local risk factors (R) such as price fluctuations, shrinkage of crop area, and the threat of natural disasters. Through this descriptive quantitative approach, an estimate of the need for real buffer stock is obtained that is absolutely necessary for local governments to anticipate a decrease in supply, such as the case of a 6.59% drop in rice production for consumption in 2024 due to the shrinking area of harvested land in Gorontalo Regency, Bone Bolango Regency, and Gorontalo City.
Based on model testing through multiple linear regression analysis (t-test and F-test), independent variables including rice production volume, community consumption level, and local risk factors were proven to have a real influence, both partially and simultaneously, on the size of regional food reserve needs. The instability of rice production influenced by natural factors (climate and water) and the uncertainty of logistics distribution are the main drivers that demand a responsive and flexible food reserve policy so that socio-economic stability and people's human rights to food are still fulfilled in the Gorontalo local market.

ADVICE

Referring to the results of the above conclusions, some strategic recommendations or suggestions that can be submitted to related parties are as follows:
For Regency/City Regional Governments throughout Gorontalo Province
The Food Security Service together with related agencies are expected to start applying the local risk-based calculation formula C = (K x P) + R) periodically in determining the operational ceiling of regional rice stocks. Reserve management policies should not rely solely on normative aggregate consumption data, but should be sensitive to trends in agricultural land area and climate dynamics that can trigger the risk of sudden crop failure.
For Perum BULOG Divre Gorontalo and Logistics Agencies:
It is necessary to optimize the distribution management and absorption of local grain harvested to the maximum during the time of surplus to strengthen the stability of the government's buffer stock. When there is a supply deficit, the strategy of food imports or stock mobilization between regions must be carried out in a measured manner as an instrument of price stabilization to prevent a surge in regional inflation and protect people's purchasing power.
For the Next Researcher
Given the limited availability of representative secondary data at the local level, the researchers are further advised to expand the local risk variable (R) instrument in the regression model, such as adding specific agricultural land conversion variables or long-term global climate change impacts to produce a much more comprehensive accuracy of food reserve predictions.

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