

Food consumption and coping strategy of local community facing the climate change issue

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ABSTRACT

The quality of a human's life is influenced by the nutrients they consume. In line with this statement, climate change, such as extreme rainfall or prolonged dry seasons, impacts crop yields and agricultural productivity. It is suspected that this will change food consumption levels because it affects local food availability and community income from agricultural products. This study aims to determine the level of food consumption and the adaptation strategies in the Research area, Polewali Mandar Regency, West Sulawesi, Indonesia. The analysis used the Food Consumption Score (FCS) and the Coping Strategy Index (CSI). The results show that all households have a FCS in the high category, with an average value of 81. Despite this, food consumption is still dominated by cereals, especially rice, and animal protein sources such as fish, while other food groups, such as fruits, nuts, and dairy products, are still low in frequency. The most common CSI for the local community in the midst of climate change issues is reducing food consumption, replacing food with cheaper alternatives, borrowing food from family and relatives, and taking on additional work. Another strategy is for the local community to encourage family members to work outside the community.

Keywords:

Climate change, Coping mechanism, Food consumption, Local community

1. Introduction

Food plays a crucial role in ensuring the survival of the people life. Therefore, the Indonesian government set a target to achieve national resilience, which includes self-sufficiency in food and energy. Strengthening food and energy self-sufficiency as part of national resilience reflects a new paradigm and the recognition that food and energy security are key components in building comprehensive food security [1].

Food is a basic human need and is a fundamental right guaranteed by the 1945 Constitution of the Republic of Indonesia. The quality of human resources is influenced by the nutrients consumed, thus impacting people's lives. An individual nutritional status is also determined by food consumption and the body's ability to utilize nutrients [2]. Food not only serves to meet basic physical needs and prevent hunger, but also plays a vital role in improving the quality of human life. The nutritional content of food contributes significantly to the creation of healthy, active, and productive individuals [3].

Indonesia, with a population of over 270 million, still faces various challenges in meeting its food needs, such as limited access to food, malnutrition, gender inequality, the impacts of climate change, and vulnerability to natural hazards. These conditions are further exacerbated by mobility restrictions, business closures, and economic instability, which make it difficult for many people to obtain adequate food. As a result, the rate of food insufficiency has increased, from 6% in 2019 to 8% after the pandemic hit the country [4].



The percentage of Indonesia's population experiencing food insecurity is showing an increasing trend. In 2020, the figure was recorded at 8.34%, rising slightly to 8.49% in 2021. A significant spike occurred in 2022, when the prevalence of undernutrition reached 10.21%, an increase of approximately 20.26% compared to the previous year. This increase in the prevalence of undernutrition rate reflects the growing number of people experiencing inadequate food intake [5].

This situation cannot be separated from the various challenges facing the food sector, one of which is climate change. This global phenomenon has increasingly significant impacts on various aspects of life, including the agricultural sector. Rising global temperatures, changing rainfall patterns, and extreme weather events such as floods and droughts are all manifestations of climate change, which have direct implications for food crops [6].

The impacts of climate change on food systems are not only felt globally but are also increasingly evident at the local level, including at the research sites in Polewali Mandar. Climate change, particularly in the agricultural sector, requires a comprehensive, integrated, and holistic approach. One approach introduced to address the impacts of climate change is adaptation [7]. In the context of this research, adaptation is understood as a response to the impacts of climate change so that various potential adaptation options have been proposed, particularly for developing countries, considering the serious impacts caused by climate change [8]. Much literature identifies adaptation as a policy option to address the impacts of climate change, where adaptation efforts can increase food resilience.

Furthermore, community adaptation strategies in response to climate change are key to maintaining local food security. Various studies show that locally based adaptations, such as business diversification, water resource management, and community capacity building, can be solutions to mitigate the impacts of climate change [9]. However, such strategies require a more comprehensive understanding of the socio-economic conditions, culture, and capacities of local communities. The existence of climate change such as extreme rainfall or prolonged dry seasons, affects crop yields and agricultural productivity in Polewali Mandar, so it is suspected that this will cause changes in food consumption levels, impacting local food availability and community income from agricultural products.

2. Methods

This research was conducted in Polewali Mandar Regency, West Sulawesi Province, specifically in Pappandangan Village, considering that has distinctive geographic and socio-economic characteristics, particularly in terms of community food consumption and adaptation strategies to climate change. This region is located in a hilly area prone to extreme weather changes, making it a relevant location to study how communities adapt to meet their food needs amidst the challenges of environmental change. The study was conducted from July to December 2025.

The number of populations in this study was all households in the village with total 432 households, using the Slovin formula (1).

$$n = \frac{N}{1 + N \times e^2} \quad (1)$$

n = Total of sample

N = Total of population

e = Margin error (10%)

The calculation resulted in 81 selected respondents. Data were collected using questionnaires distributed directly to each household, and secondary data were obtained from journals, the Central Statistics Agency, and other sources relevant to the research issue.

2.1. Analysis of Food Consumption Score (FCS)

In this study, the FCS was used to measure the level of community food consumption. The FCS is an indicator developed by the World Food Programme (WFP) to measure the diversity, frequency, and nutritional value of household food consumption over the past seven days. Calculation steps:

- 1) The calculation begins by grouping all food items into specific food group categories based on consumption frequency data over the past seven days.
- 2) The consumption frequencies of foods within the same group are summed, and if the total exceeds seven, the value is recoded to score of seven.
- 3) Each food group score is then multiplied by a predetermined weight to obtain a weighted food group score.
- 4) All weighted food group scores are summed to produce an FCS.
- 5) The continuous FCS score is then converted into a categorical variable using an appropriate threshold.

Table 1. Standard of food groups and standard of weights

Food Groups	Food Categories	Weight
Cereals and tubers	Rice, bread, corn, sweet potatoes, cassava	2
Nuts	Peanuts, green beans, soybeans	3
Vegetables	Spinach, carrots, mustard greens, tomatoes	1
Fruits	Banana, mango, papaya, etc	1
Meat and fish	Beef, chicken, fish	4
Milk and dairy products	Milk, cheese, yogurt	4
Sugar and sweets	Sugar, candy, sweet cakes	0.5
Oil and fat	Cooking oil, butter, coconut milk	0.5

This study measured the community's food consumption levels using the FCS [10]. The FCS is an indicator developed by the World Food Programme (WFP) to measure the diversity, frequency, and nutritional value of household food consumption over the past 7 days during the study.

Table 2. FCS categories

Food Consumption Score (FCS)	Profile
0–21	Bad
21.5–35	Moderate
>35	Good

2.2. Analysis Coping Strategy Index (CSI)

This study used the CSI analysis tool developed by Maxwell et al. [11] to assess community adaptation strategies to food insecurity caused by climate change, as shown in equation (2). The CSI is a tool that measures the coping strategies used by households when facing food shortages. This index is based on two main components of frequency and severity. Frequency reflects how often a strategy was implemented in the past seven days, with scores ranging from 0 (never implemented) to 7 (implemented daily). Severity weights were assigned based on each strategy's relative impact on food security and livelihoods in Polewali Mandar. The individual strategies listed were grouped into four categories, with 1 indicating the least severe category; 4 indicating the most severe category; and 2 and 3 being intermediate. This means that the least severe strategies are all assigned a weight of 1, the next group is assigned a weight of 2, and so on.

$$\text{CSI Score} = \text{Frequent (0-7)} \times \text{Severity (1-4)} \quad (2)$$

The total CSI is calculated by multiplying the frequency of each strategy by its severity weight, then summing the results. Higher scores indicate greater levels of food stress or insecurity. Using this CSI, it can obtain a quantitative picture of household food security and identify patterns of community coping strategy to the impacts of climate change in the study area.

3. Results and Discussion

3.1. Food Consumption Levels

Consumption is closely related to the activities of all living creatures, especially humans, to meet their basic needs, such as clothing, food, and shelter. Food is the most basic of all needs. In this regard, community welfare can be assessed in various ways, one of which is by measuring household food consumption expenditure [12].

Food consumption refers to the amount of food and beverages consumed or consumed daily to meet physical needs [13,14]. Food is a fundamental human need [15], so the availability of food for the community must always be guaranteed, both in terms of quality and quantity. Further details regarding community food consumption can be found in the following discussion.

3.1.1. Total Food Consumption Score

The food consumption level local community is based on the FCS approach, which reflects the diversity, frequency, and nutritional content of food consumed by the household in the past seven days. This score is then used to identify the level of household food security, with general categories: poor (0–21), moderate (21.5–35), and good (>35). These categories serve as a benchmark for assessing the extent to which the community is able to meet its nutritional and diverse food needs [16]. For

a more detailed overview of the community's food consumption level based on the food consumption score for each household, see in the Table 3.

Table 3. Total FCS

Food Consumption Score	Households	Percentage (%)
0-21 (Bad)	0	0
21.5-35 (Moderate)	0	0
>35 (Good)	81	100,0
Total	81	100,0

All households' food consumption scores were in the good category, but these high scores did not fully reflect the ideal diversity of food consumption. Interview results and detailed data indicated that these high scores were largely influenced by the high frequency of consumption of cereals, particularly rice in which this staple food is the most popular cereals containing the essential source such as fibre, energy, minerals, vitamins, and other biomolecules [17]. Furthermore, vegetables and fish were also consumed quite frequently, but contributions from other food groups such as meat other than fish, nuts, dairy products, and fruits were relatively low. Households with high incomes can meet their nutritional needs and even consume a more varied and higher-quality diet [18].

3.1.2. Food Consumption Frequency

Dietary diversity and meal frequency can be done by examining consumption from different perspectives, with varying strengths and weaknesses. Constructing a composite score that measures meal frequency is one widely explored and tested methodology [19]. Food frequency, in this case, is defined as the frequency at which a particular food or food group is consumed at the household level. To learn more about the frequency of food consumption in the community, can be seen in the following diagram chart.

The frequency of community consumption showed that the food group with the highest daily consumption was cereals, especially rice as the main staple food, which is consumed daily by 81 households. Daily consumption was also high in the meat categories, especially fish which provides sufficient nutrients for the community [20], with 72 households consuming it daily, followed by vegetables by 64 households, fat by 54 households, and sugar 51 households. In contrast, nuts are still low because only 4 households consume them daily, even the majority 49 households only 1-2 times per week, and 17 households did not consume them at all. For the public, nuts are not always available in the market and the price is quite high even though nuts contain nutrients for dietary enrichment. This nutrient can also find in roasted and dried consumption, also in cookies, cakes, and chocolate [21].

Fruits also showed a similar pattern, consumed more often 1-2 days per week for 38 households and 3 households never consumed them. Meanwhile, vegetables and milk and dairy products were consumed quite frequently, in the category of 3-4 times per week, by 10 and 8 households, respectively. Overall, the community's

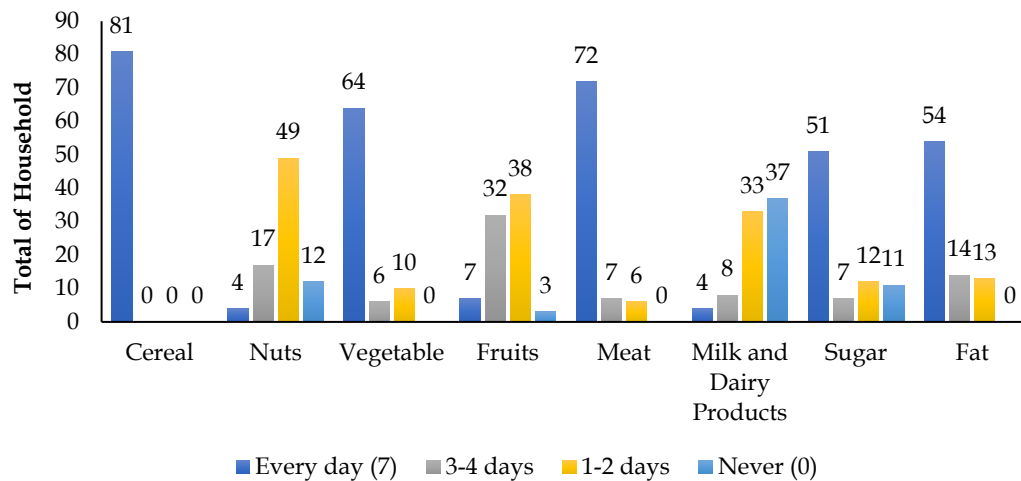


Figure 1. Food Consumption Frequency

consumption pattern is still dominated by staple foods such as rice, protein from fish, and energy sources such as sugar and fat, while consumption of foods rich in fibre, vitamins, and minerals such as fruits and nuts is still low and needs to be increased to achieve a more balanced and diverse diet to reduce the risk of obesity and related diseases [22].

3.2. Coping Strategy

3.2.1. Score of CSI

The CSI is an instrument used to measure a household's vulnerability to food security by identifying the coping strategies they employ when facing food shortages [11]. This index is calculated based on the frequency and severity of the strategies used. The higher the CSI score, the more frequent and extreme the coping strategies employed, reflecting a worsening household situation.

A low CSI indicates that the coping strategies used are relatively light and infrequent, but it is still an indicator of pressure on food security. Therefore, a low CSI score does not necessarily indicate complete food security, but rather indicates a lower level of difficulty than a high score. This study analysed CSI scores in rural community as part of an effort to understand the level of difficulty in meeting household food needs in the area.

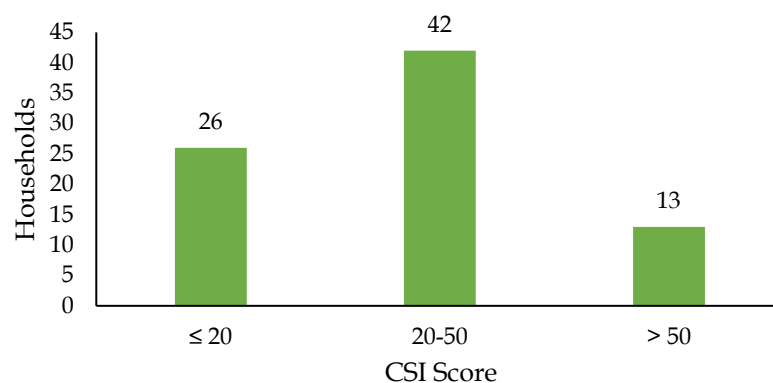


Figure 2. Score of CSI

Based on data processing, the majority of households or 42 households, had CSI scores in the 20–50 range. This range represented a moderate level of difficulty, meaning these households have implemented significant coping strategies, such as reducing meal portions, replacing high-quality foods with cheaper ones, or relying on assistance from relatives. According to Maxwell and Caldwell [23], the use of moderate strategies indicates ongoing pressure on food security, although it has not yet reached an acute crisis stage. This condition indicates that most people are starting to be forced to adjust their consumption due to economic pressures or limited resources. On the other hand, reduced food consumption is another solution for environmental solution due to decreasing waste creation [24].

A total of 26 households had a CSI score of ≤ 20 , which is categorized as a relatively low level of hardship. However, as stated by CARE/WFP [25], a low CSI still reflects the use of survival strategies, albeit at a low intensity, such as limiting consumption of certain foods or borrowing food from neighbour. The fact that all households had a CSI score above zero indicates that no household is completely food secure. This indicates that community, in general, remains vulnerable to disruptions in food supply and fluctuations in food prices.

Meanwhile, the group with a CSI score > 50 consisted of 13 households and was categorized as highly vulnerable. This high score indicates the implementation of extreme coping strategies that could potentially threaten long-term well-being, such as drastically sacrificing food consumption, selling productive assets, or incurring large debts to meet food needs. This condition aligns with the findings of Maxwell et al. [26], who stated that high CSI scores are usually correlated with acute food insecurity and the risk of declining household health conditions. Therefore, local people require immediate attention and intervention, both through direct assistance and economic empowerment programs to reduce reliance on detrimental coping strategies. Empowerment programs are essential to creating a just and inclusive society where every individual has the opportunity to thrive. Social justice and empowerment are not merely ideals, but rather necessary frameworks for developing a society (Parashar & Rawat, 2025). Moreover, Poverty remains a significant issue for society in Indonesia and other developing countries, characterized by material deprivation, low income, legal injustice, vulnerability to crime, health issues, limited education, and lack of authority [27].

3.2.2. *Adaptation Strategies Implemented by the Community*

Household adaptation strategies to food crises are important indicators for measuring a community's vulnerability and resilience. Susi Andriani (2015) stated that humans always strive to adapt to their surroundings, both biologically, genetically, and culturally. Frequently used adaptation strategies indicate low levels of economic stress and food security. The frequency of these strategies can be categorized as never, occasionally (1–2 days a week), frequently (3–4 days), and almost daily (5–6 days or every day).

Community adaptation strategies in facing food shortages are demonstrated through various adjustments, both in terms of consumption and livelihoods. The most common strategy is reducing the amount of food consumed at each meal, which is practiced by most households several days a week. This is an early indicator of food insecurity, with direct implications for reduced energy and nutrient intake (WFP,

2008). Furthermore, another fairly dominant strategy is replacing food ingredients with cheaper alternatives, such as switching from animal-based dishes to tofu and relatives, or local vegetables, which, although more affordable, have the potential to reduce nutritional quality. This shift in consumption reflects a compromise between affordability and meeting food needs, and is also an early sign of a decline in the quality of household food security [28].

In addition to adjusting consumption, other strategies used by communities include borrowing food from relatives, food stalls, or shops with deferred payments, reflecting the important role of social networks and informal credit in supporting food access. Some households even resort to extreme strategies, such as selling assets, which, while small in amount, still indicate a serious level of vulnerability to long-term economic conditions. Other strategies include reducing other essential needs, sacrificing adult portions for children, and even taking on additional work to supplement income. This variety of strategies demonstrates that communities are not solely relying on consumption savings but are also seeking new economic opportunities to maintain food security amidst the pressures of climate change [28,29].

Table 4. Strategies implemented by the community

Coping Strategy	Total Households				
	Never (0)	(1-2 days)	(3-4 days)	(5-6 days)	Every day (4)
Reduce the amount of food consumed at each meal	24	27	9	1	
Replacing food with cheaper ones	36	16	25	4	
Borrowing food from relatives	46	18	12	5	
Reduce food portions for adults so that children get appropriate food	55	15	10	1	
Selling owned assets	73	2	6		
Reducing other important needs	27	21	25	8	
Taking an extra work	38	20	8	15	

The most commonly used adaptation strategy was reducing the amount of food consumed at each meal, with 27 households doing this 1–2 days a week, 9 households doing it 3–4 days, and 1 household doing it 5–6 days per week. This indicates that portion restriction is a fairly common measure taken when food supplies are limited. According to CARE/WFP [25] this strategy is an early indicator of food insecurity because it directly affects energy and nutritional adequacy.

The second dominant strategy was substituting cheaper food options, practiced by 16 households for 1–2 days per week, 25 households for 3–4 days, and 4 households for 5–6 days. This consumption shift reflects a decline in the quality of food consumed, which in the long term has the potential to reduce household nutritional intake. noted that shifting to cheaper food is often one of the first steps before households enter a more severe stage of food crisis.

The strategy of borrowing food from relatives or food stalls was used by some households, with 18 households doing so for 1–2 days, 12 households for 3–4 days, and 5 households for 5–6 days per week. This reliance on social networks and informal credit indicates limited direct access to food. Meanwhile, extreme strategies such as selling assets were only used by a small number of households (2 households for 1–2 days, 6 households for 3–4 days), but this still indicates serious vulnerability, as it has implications for reduced economic capacity in the future.

Another, several community strategies for resource management were analysed over a 30-day period. This timeframe was chosen to provide a clearer picture of how frequently these strategies were implemented in people's daily lives. Thus, the emerging adaptation patterns not only reflect short-term responses to the pressures faced but also demonstrate household behavioural tendencies in maintaining food security and survival amidst dynamic conditions [28].

Table 5. Strategy for managing resources

Adaptation strategy	Households				
	Never (0)	(1–2 times)	(3–4 times)	(5–6 times)	Every week (4)
Selling productive assets (such as livestock, agricultural equipment)	72	6	3	0	0
Reduce spending on other important needs (such as education or health)	38	3	10	30	0
Encouraging family members to work outside the area	38	7	5	3	28

Based on table 3, it can be seen that the frequency of strategy implementation is measured in a one-month time span, so that the information 1–2 times, 3–4 times, 5–6 times, or every week refers to the intensity of strategy implementation by households within a 30-day period. The results show that most households (72) never sell productive assets, only a few do it 1–2 times (6 households) or 3–4 times (3 households). The strategy that is more frequently taken is reducing essential expenses, especially education and health, with 30 households doing it 5–6 times and 10 households doing it 3–4 times in a month.

Meanwhile, the strategy of assigning family members to work outside the area is quite dominant, with 28 households doing so weekly. This suggests that people are more inclined to reduce expenses and seek additional income sources rather than sell productive assets [30,31].

The adaptation strategies adopted by the community demonstrate a tendency to compromise between meeting short-term needs and long-term sustainability. Selling productive assets is a relatively rare option, as it impacts the household's future production capacity. Conversely, reducing spending on essential needs, such as education and health, is more frequently undertaken as it is seen as a quicker way to cover daily needs. Furthermore, assigning family members to work outside the area also emerged as an adaptation strategy that demonstrates income diversification,

while also reflecting the limited local employment opportunities that are unable to meet family needs. Thus, this resource management strategy reflects both the resilience and vulnerability of local people in the face of climate change and economic pressures [30].

Strategy is essentially planning and management to achieve a goal. However, to achieve that goal, strategy doesn't simply serve as a roadmap, but rather must demonstrate operational tactics. Similarly, the strategies used by communities to survive and ensure food security amidst extreme climate change are also used [29].

4. Conclusion

The results of the study indicate that although all households have a high FCS, food consumption is still dominated by cereals, especially rice, and animal protein sources such as fish. Other food groups, such as fruits, nuts, and dairy products, are consumed at low frequencies. This indicates that food security is quite good in terms of quantity, but the diversity and quality of nutritional intake are not optimal. The CSI results show that most households fall into the moderate hardship category (scores 20–50), with common adaptation strategies including reducing food intake, substituting cheaper food items, borrowing food, and taking on additional work. This indicates that even with food availability, some households still face economic pressures that force them to use survival strategies, and no household is completely food secure.

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