The Role of Healthy Social Life, Food Security, and Nutrition in Shaping a Healthy Island: An Analysis Using Structural Equation Modeling

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ARTICLE INFO

ABSTRACT

Several important factors are associated with establishing a healthy island including a healthy social life, food security, and nutrition but in-depth information related to these dimensions is limited. The relationship dimensions include addressing poverty, managing natural and social disasters, handling disabilities, food availability, and food security. Therefore, this study aimed to identify the best model for establishing a healthy island in South Sulawesi. The experiment was carried out on five islands located in three municipalities/regencies in South Sulawesi, namely Tanakeke Island in Takalar Regency, Barrang Caddi Island and Lummu-Lumu Island in Makassar Municipality, as well as Saugi Island and Sapuli Island in Pangkep Regency. The sample consisted of 196 households, while data were analyzed using multivariate analysis through structural equation model tests. The results showed that addressing poverty (t value = 13.77; R2 = 0.75), managing natural and social disasters (t value = 12.15; R2 = 0.61), as well as handling disabilities (t value = 12,53; R2 = 0.64) significantly affected healthy social life. Additionally, food availability (t value = 6.25; R2 = 0.66), and security (t value = 2.72; R2 = 0.85) played key roles in the relationship between food security and nutrition affecting a healthy island. The best indicator of a healthy social life variable was addressing poverty (t value = 13.77; R2 = 0.75). Meanwhile, the best indicator of food security and nutrition variables was food availability (t value = 6.25; R2 = 0.66).

INTRODUCTION

A healthy island is one that is clean, safe, comfortable, and healthy for its inhabitants to live on because of environmental integrity, which includes community participation and cross-sector collaboration in relation to and in accordance with existing legislation. A healthy island is defined by community participation/ involvement in decision-making processes and cross-sector collaboration for social good.[1] The healthy island concept is a solution to the health problems faced by Pacific Island Countries.[2]

World Health Organization noted that Healthy Islands, as a brand, is subject to a wide range of interpretations and dynamics; countries use it however it best fits, and the concept evolves over time. It is not surprising then, that the vision is expressed in a plethora of ways, from mobilising people in a single village to clean up waste and remove pools of water to improve sanitation and control malaria, to using media to encourage awareness of a netball program to promote physical activity and reduce the burden of Non-Communicable Diseases (NCDs).[3] The group of countries that are developing healthy islands are Fiji, Samoa, Papua New Guinea, Kiribati, Vanuatu, Solomon Island and Tuvalu. Generally, these countries are included in the group of countries that have small populations. Apart from the Western Pacific Region, healthy islands are also being developed in many countries in South East Asia.[4,5]

The Healthy Island Initiative in several Pacific Island nations and the Maldives focuses on a variety of issues, such as focusing on eradicating specific illnesses or health issues, such as malaria control in the Solomon Islands, environmental health and health promotion initiatives in Fiji, or community development-based water supply and sanitation initiatives in Tonga, as well as community-based health promotion projects in the Cook Islands, Kiribati, Niue, Tuvalu, and Samoa.[6] The ongoing dietary transition in the Solomon Islands has resulted in an over-reliance on commercial food sources, leading to food insecurity, and subsequently an increase in various forms of malnutrition.[7] Food insecurity occurs when the food system experiences stress so that food is not accessible, available and/or of adequate quality. Food security in Pacific Island Countries (PICs) varies based on island geography and culture, ranging from inland and coastal communities on large islands with considerable natural assets to communities occupying small, low-lying islands with little or no limited land and clean water resources.[8] Climate change is one of the causes of food vulnerability in island countries. Kiribati, the country with the lowest GDP per capita in the Pacific, has inherent climate vulnerability with limited land area, low island population density and water shortages exacerbating public health problems. To ensure food security, the Kiribati government purchased land in Fiji and also used it as a migration site when sea levels rise.[9] The focus of this study is to look at the relationship between a healthy social life, food security, and nutrition towards a healthy island.

MATERIAL AND METHOD

This investigation was carried out using a quantitative approach. Permission to carry out the research was obtained from the local authorities and the Hasanuddin University Health Research Ethics Committee with protocol number 207220930010 on July 26 2022. The research was conducted from September 2022 to December 2022. Five islands in South Sulawesi were the subjects of this research: Tanakeke Island is in Takalar Regency; Barrang Caddi Island, Lummu-Lumu Island is in Makassar Municipality; Saugi Island, Sapuli Island are in Pangkep Regency. The total population on these 5 islands is 2,600 families. The sample calculation in this study uses the recommended sample size in SEM (Structural Equation Modeling) research, namely between 100 - 200. The guideline for determining the SEM sample size according to is.[10-13] Lastly, the final sample in this study was 196 families.

Univariate analysis was used in this study to get a general picture of the distribution of participants or variations of the variables under investigation, and complicated multivariate analysis was used to test a model based on the Structural Equation Modeling (SEM) strategy of the Lisrell program.

RESULTS

Healthy Social Life

Figure 1 is the result of confirmatory factor analysis testing for healthy social life variables with estimated values. The estimated value shows the size of the loading factor. Figure 2 is the result of confirmatory factor analysis testing for healthy social life variables with t values. The t value shows the indicator values that are considered significant for the main variable.

The results of the construct test for the healthy social life variable were evaluated based on the goodness of fit criteria in the following Table 1 with the results of the model and its criticality (cut-off value) presented.

From the evaluation of the proposed model, it shows that the evaluation of the construct as a whole produces a value above critical indicating that the model is in accordance with the data, so further model suitability tests can be carried out. Table 1 shows that the measurement model for a healthy social life has shown a fit model or suitability between the data and the model. This is evidenced from the existing fit criteria, there are already two that have met the criteria. Thus, referring to the principle of parsimony theory, the model above shows a good level of acceptance, so it can be concluded that the model is acceptable.
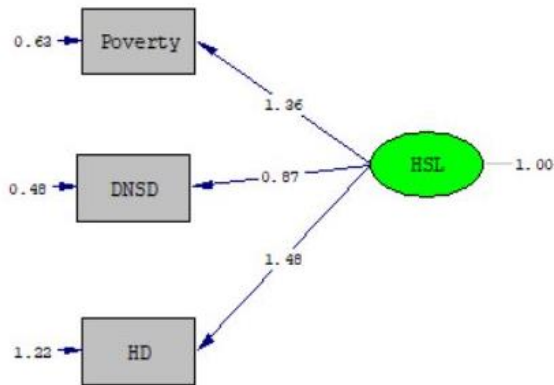
Source: Primary Data, 2022
Figure 1. Testing Confirmatory Factor Analysis of the Healthy Social Life Variable with Estimated Values
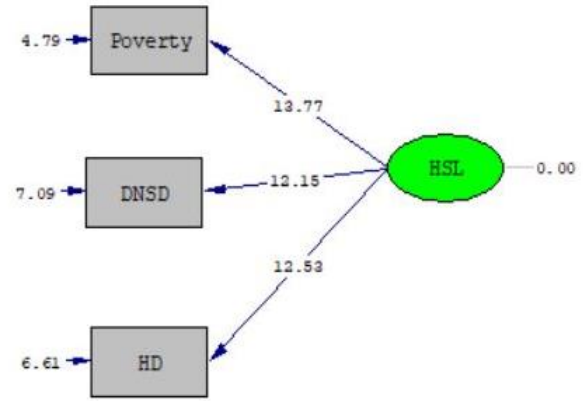
Source: Primary Data, 2022
Figure 2. Testing Confirmatory Factor Analysis of the Healthy Social Life Variable with t Values

Furthermore, to find out the indicators that contribute significantly to the healthy social life variable can be observed from the factor loading or lambda coefficient (λ) and its level of significance reflecting the contribution of each indicator to the healthy social life variable as shown in the following Table 2.

Table 2 shows that the indicators of handling poverty, dealing with natural and social disasters (BA), and handling disabilities have a t value of > 1.96, meaning that all of these indicators are statistically significant. Of the three indicators of the healthy social life variable, handling poverty is the best (most significant) indicator because it has the greatest R^2 value of 0.75, meaning that the contribution of handling poverty is 75.0% (compared to dealing with natural and social disasters (BA) = 0.61 and handling disabilities = 0.64).

Table 1. Evaluation of the Goodness of Fit Index Criteria for a Healthy Social Life

The Goodness of Fit Index	Cut of Value	Results	Model Evaluation
Chi-Square		0.000	
Probability	≥ 0.05	1.00	Good
RMSEA	≤ 0.08	0.000	Good
The Model is Saturated, and the Fit is Perfect!			

Source: Primary Data, 2022

Table 2. Factor Loading, t and R² Values of the Healthy Social Life Variable Measurements

| Variable Indicator	Factor Loading	t value	R²	Information
Handling poverty	1.36	13.77	0.75	Significant
Dealing with natural and social disasters	0.67	12.15	0.61	Significant
Handling disabilities	1.48	12.53	0.64	Significant

Source: Primary Data, 2022

Meanwhile, the factor loading value shows the correlation between the indicators and their latent constructs. Indicators with greater factor loading values have a higher correlation to explain their latent constructs. The results show that of the three indicators of the healthy social life variable, handling disabilities is the indicator with the greatest factor loading value, namely 1.48 (compared to handling poverty = 1.36 and dealing with natural and social disasters = 0.67).
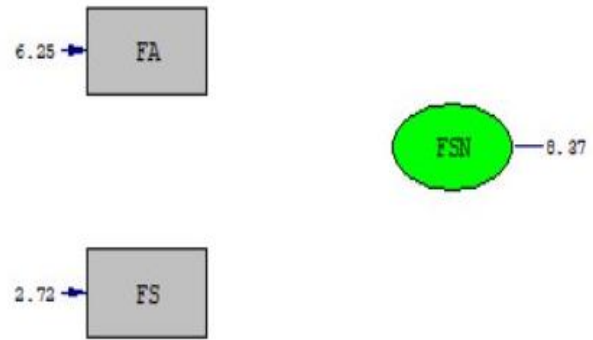
Food Security and Nutrition

Figure 3 is the result of confirmatory factor analysis testing for food security and nutrition with estimated values. The estimated value shows the size of the loading factor. Figure 4 is the result of confirmatory factor analysis testing for food security and nutrition with t values. The t value shows the indicator values that are considered significant with the main variable.

The results of the construct test for the food security and nutrition variables were evaluated based on the goodness of fit criteria in the following Table 3 with the results of the model and its criticality (cut-off value) presented.
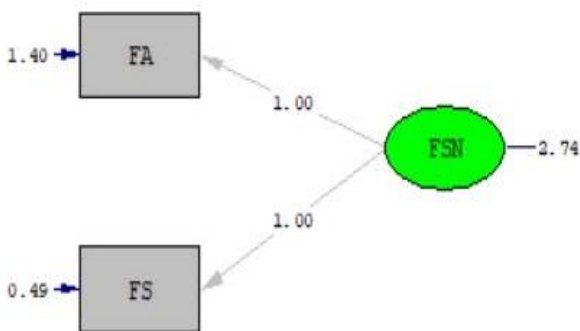
Source: Primary Data, 2022

Figure 3. Testing Confirmatory Factor Analysis of the Food Security and Nutrition Variables with Estimated Values

Source: Primary Data, 2022

Figure 4. Testing Confirmatory Factor Analysis of the Food Security and Nutrition Variables with t Values

Table 3. Evaluation of the Goodness of Fit Index Criteria for Food Security and Nutrition

The Goodness of Fit Index	Cut of Value	Results	Model Evaluation
Chi-Square		0.000	
Probability	≥ 0.05	1.00	Good
RMSEA	≤ 0.08	0.000	Good
The Model is Saturated, and the Fit is Perfect!			

Source: Primary Data, 2022

From the evaluation of the proposed model, it shows that the evaluation of the construct as a whole produces a value above critical indicating that the model is in accordance with the data, so further model suitability tests can be carried out. Table 3 shows that the food security and nutrition measurement model has shown a fit model or suitability between the data and the model. This is evidenced by the existing fixed criteria, two of which have met the criteria. Thus referring to the principle of parsimony theory, the model above shows a good level of acceptance, so it can be concluded that the model is acceptable.

Furthermore, to find out the indicators that contribute significantly to the food security and nutrition variables can be observed from the factor loading or lambda coefficient (λ) and its level of significance reflecting the contribution of each indicator to the food security and nutrition variables as shown in the following Table 4.

Table 4 shows that the indicators of food availability and food security have a t value of > 1.96 meaning that all of these indicators are statistically significant. Of the two indicators of the food security and nutrition variables, food security is the best (most significant) indicator because it has the greatest R^2 value of 0.85,

meaning that the contribution of food security is 85.0% (compared to food availability = 0.66).

Meanwhile, the factor loading value shows the correlation between the indicators and their latent constructs. Indicators with greater factor loading values have a higher correlation to explain their latent constructs. The results of the study show that the two indicators of the food security and nutrition variables are similar (food availability and food security have the same factor loading value of 1.00).

DISCUSSION

An island is a setting whose quality needs to be maintained based on several aspects, one of which is the social environment.[14] The findings of this study demonstrate that addressing poverty is the greatest metric for gathering data on the variable of a healthy social life on an island. This is so that those who are experiencing poverty can receive social help when appropriate measures are taken to combat it. This social support might take the form of cash aid, basic service access, and empowerment initiatives. With this support, those who are struggling with poverty might feel more safe and protected, which improves their quality of life and interactions with other people.[15] Addressing poverty must also include reducing stigma and discrimination against individuals who experience poverty. Social stigma related to poverty can limit their access to jobs, education, and health services and affect their social relationships. By reducing stigma and discrimination, individuals who experience poverty can feel more accepted in society and have better opportunities to participate in a healthy social life.[16]

The research conducted included two social health policy approaches: prevention and treatment.[17] Prevention is sometimes referred to as a social welfare policy that aims to improve public health conditions. Another definition of prevention is social work, which has a broader meaning that social life does not only refer to health. While healing is generally understood as a "social health care system," as noted by Johnson and Schwartz it is defined as a system that is generally responsible for disease and disability.

Table 4. Factor loading, t and R2 Values of the Food Security and Nutrition Variables Measurements

Variable Indicator	Factor loading	t value	R^2	Information
Food availability	1.00	6.25	0.66	Significant
Food security	1.00	2.72	0.85	Significant

Source: Primary Data, 2022

Food selection is a complex process as it is also influenced by taste, smell and texture. Non-food factors such as geography, seasonality, economics, food technology, shopping locations, and food availability.[18] The findings of this study also demonstrate that the greatest indicator for assembling indicators of food security and nutrition variables for a healthy island is food availability. This is due to the fact that ensuring food security and adequate nutrition depends in large part on the availability of food. When food availability is guaranteed, various aspects of food security and nutrition can be achieved,[19,20] including: Accessibility: availability of adequate food allows individuals and families to obtain food physically and financially. This includes factors such as market availability, equitable distribution of food, and access to adequate resources and income to buy food; Availability: availability of adequate food is an important aspect of food security. Stable and sustainable food production is very important to be able to meet food needs in a sustainable manner.

Factors such as climate change, natural disasters, and conflict can affect food availability; Adequacy of nutrition: availability of adequate food means that the food available must provide adequate and balanced nutrition for the individual. This includes aspects of micronutrients (vitamins and minerals) as well as macronutrients (carbohydrates, protein, and fat). Malnutrition can cause health problems such as undernourishment, vitamin deficiency, or malnutrition; Sustainability: sustainability of food means the management of natural resources, agriculture, and food systems that are economically, socially, and environmentally sustainable. This sustainability is important to ensure that future generations can also enjoy adequate food availability.

Small islands generally depend on subsystems and plants for survival and econom-

ic development. Local food production is very important for small islands, even with very limited land. Island communities are highly dependent on the sea and biological resources for their survival. Because land-based development is limited, the sea and fisheries sectors play an important role in the lives and economies of island communities. The ecological dependence of small island economies and their communities is also an issue.[21,22] Small island communities at the research location are very dependent on fishing activities and inter-island trade transportation. most of their basic needs, especially for food, are supplied from large islands, especially small islands, far from large islands and limited land for agriculture. Bad weather conditions, such as strong winds and high waves, disrupt fishing and trade activities on small islands. Fishermen stopped fishing and supplies from other islands also stopped.

Food insecurity has a detrimental impact on human health, meaning food and nutritional security are critical to improving public health outcomes.[23] In public health, food and nutrition have a very important impact both at the community and individual levels on the quality of life related to health and also socio-economic aspects.[24] Research carried out the physical formation of fishermen due to the risk of hard work activities carried out so that they consider fulfilling primary food needs such as rice and tubers not as a main priority but rather fulfilling the secondary needs of fishermen's households.[25] Apart from that, the existence of actors providing socio-economic guarantees in the fishing environment on Barrang Caddi Island adds to the worry factor of fishermen regarding the issue of fulfilling food for the households of capture fisheries fishermen, especially anglers.

Sensitive and specific interventions are needed as well as cross-sector collaboration that is focused and has a common target to improve food and nutrition security.[26]

CONCLUSION AND RECOMMENDATION

Handling poverty is the best indicator of a healthy social life. This is because poverty can affect various aspects of social life, such as access to education, adequate housing, decent work, access to health services, and social support. Effective efforts of handling poverty can help create a more just, inclusive, and supportive social environment, thereby promoting a healthy social life and improving the quality of life of people affected by poverty. Food security and availability have a close relationship with food security and nutrition. Food security and availability is the best indicator of food security and nutrition because it relates to availability, accessibility, and adequate food quality to meet the nutritional and health needs of the community. Besides, food security also reflects the ability of a region or population to face, cope with, and adapt to environmental changes, natural disasters, and food crises. Good nutrition is also closely related to food security because safe and quality food is a prerequisite for adequate nutritional intake.

Special policies are needed relating to handling poverty, food security, and food availability in the archipelago. So, island communities can have the same access as urban communities, especially in the fields of education, adequate housing, decent work, access to health services, security in food consumption, and food availability, especially when the rainy season arrives.

ACKNOWLEDGMENTS

AUTHOR CONTRIBUTIONS

SP and NSS contributed to the conceptualization of the writing of the section "Healthy islands based on the vision of healthy islands, conducting investigations or tracing results related to healthy social life in archipelagic areas, food security and nutrition in archipelagic areas." ABB and HH contributed to the "data analysis methods" section. TJ and SSR contributed to preparing tables and figures. SR, WH, and JAM contributed to editing and language. All authors read the manuscript and approved the final manuscript.

CONFLICTS OF INTEREST

There was no conflict of interest in this study.

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