Mapping the Factors Affecting Household Food Security of Tuberculosis Patients in Coastal Region of Surabaya

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Abstract. Food security is a condition of a person who has access to adequate, safe, and nutritious food to meet the needs of a healthy life. Affordability of food is determined by the aggregate purchasing power. It is also can be measured by the amount of poverty in Indonesia which reached 28,07 million in 2014. According to data from the health department, the largest TB cases in Indonesia were in East Java Province and Surabaya accounted for the largest number, there are 48379 cases in 2015. This study mapping the factors that affect household food security of TB patients in the coastal areas of Surabaya. This study used secondary data sources from 11 clinics i.e. TB patient's address and primary data source to survey patients about food security. Variables used in this study are variables related to socioeconomic factors and sanitary factors. Those variables will be analyzed descriptively and mapping using biplot analysis. Biplot generated based on socio-economic factors, sanitary factors, and status of households in 11 districts Surabaya that near the beach geographically. The result shows that 64% of TB patient households are food insecure than the left are food secure. More than 50% of TB patient households have a good house physically. From the result of mapping between sub-districts and factors, formed five groups consisting of: 1) Benowo and Mulyorejo; 2) Asemrowo, Gunung Anyar, Sukolilo and Pabean Cantikan; 3) Semampir, Krembangan and Bulak; 4) Kenjeran; and 5) Rungkut.

1. Introduction
Food Security is the condition when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life [1]. A good food security of the households gives a better way to ward off the disease, on the other hand the more fragile food security of a family the more vulnerable to diseases, like Tuberculosis (TB).

Tuberculosis is the type of the disease that spreads directly. The disease caused by bacteria that spreads through the air and has become the third highest cause of death in the world. According to data from the Health Department, the largest TB cases in Indonesia were in East Java Province and Surabaya accounted for the largest number, there are 48379 cases in 2015.

The earliest research had done by the researcher gave a conclusion that in the household with food secure for TB patient depend on the history of the disease, the mass of the house, and smoking habit. Furthermore, food insecure households also depend on the ventilation condition, nutritional status, and population status. This research aims to mapping the sub-districts between the percentage number of household in food security condition and the factors affecting the household of TB patients.
2. Material and Methods

2.1. Food Security

Food Security is the condition when all people, at all times, have physical, social, and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life [1]. Also, there are four food security indicators used to classify each household [2], those are:

- Food Availability
- Food Stability
- Food Access
- Utilization Food

where, the categories of household food security can be assigned by combining two aspects, between continuity of food availability and quality of food [2], which is presented in Table 1.

| Continuity of Food Availability | Quality of Food          |
|---------------------------------|--------------------------|
| Good                            | Food-secure              |
| Not Good (Bad)                  | Food-insecure            |

2.2. Tuberculosis

Tuberculosis is an infectious disease caused by Mycobacterium tuberculosis. This rod-shaped bacterium is firstly discovered by Robert Koch in Berlin, in Germany on 24 March 1882. This kind of bacteria is also an Acid-Fast Bacilli (AFB) smear. The TB bacteria can infect almost all human organs, such as the lungs, brain, kidney, digestive system, bones, lymph nodes, spleen, joints, skin, intestine, urinary tract, and other organs [4].

Based on the organ which is affected, tuberculosis is divided into two groups, those are Pulmonary tuberculosis and Extra-pulmonary tuberculosis. Moreover, in regard to the Acid-Fast Bacilli (AFB), tuberculosis is classified into two [5], those are:

- Tuberculosis with (+) AFB:
- Tuberculosis with (-) AFB:

Tuberculosis is one of serious diseases that can cause the high rate mortality in the world. There is around 8.6 million cases of tuberculosis in the world where 1.3 million people (about 15%) of the total cases are died. Factors which affecting the occurrence of tuberculosis [6], such as demography factors, environment and sanitation system, the behavior of patient, economy factors, nutritional status, hospital sheet of each patient, and the treatment period of patient.

2.3. Source of Data and Research Variables

In this research, researchers use primary data which is collected by conducting survey using a random sampling technique [7] to 162 respondents taken from 1.338 TB patients in eleven sub-districts – Mulyorejo, Pabea Cantikan, Semampir, Krembangan, Bulak, Kenjeran, Sukolilo, Gunung Anyar, Rungkut, Benowo and Asemworo – in Surabaya.

The variables used are:
Table 2. The Variables of Food Security

| X1: | Respondent status | X10: | Access of getting food |
|-----|-------------------|------|------------------------|
| X2: | Education background | X11: | Protein consumed |
| X3: | Long suffered from TB/month | X12: | Kind of TB suffered |
| X4: | Gender | X13: | Kind of primary food |
| X5: | Number of people suffering TBC in family | X14: | Number of people suffering TBC in family |
| X6: | Source of medical expense | X15: | Eating frequency per day |
| X7: | Kind of TB suffered | X16: | The ownership status of paddy/fishing grounds/ship |
| X8: | Long suffered from TB/month |

Table 3. Continuous

| X13: | House ownership status | X20: | Place to defecate (frequently) |
|------|-------------------------|------|-------------------------------|
| X14: | Type of roof | X21: | Septic tank distance to the toilet (m) |
| X15: | Type of wall |
| X16: | Type of floor |
| X17: | Building area |
| X18: | Ventilation width |
| X19: | Toilet ownership status |
| X22: | Source of water consumed |
| X23: | Electrical source |
| X24: | Landfills |
| X25: | Sewerage system |

Table 4. The Factors that Affecting Households Food Security of Tuberculosis Patient

| X26: | Percent number of household educated |
|------|-------------------------------------|
| X27: | Percent number of household with the head of the household have regular work |
| X28: | Percent number of household with school-age children |
| X29: | Percent number of household with toddlers |
| X30: | Percent number of households with quite good ventilation |
| X31: | Percent number of households with the density of household members sufficient |
| X32: | Percent number of households have a toilet |
| X33: | Percent number of household with an electrical source from PLN |
| X34: | Percent number of households have Landfills |
| X35: | Percent number of households with food secure |
| X36: | Percent number of households with food insecure |

2.4. Biplot analysis

Biplot analysis is a method that describing the vector rows and columns simultaneously, manifested in the graphic formats two dimension. The variables /attributes and the objects are shown in the same graph. This analysis was first introduced by Gabriel in 1971.

Suppose a matrix \( Y_p \) is a matrix data and \( X_p \) is A matrix of data that has been corrected with their average scores, \( X = Y - (JY)n \), Wich \( J \) as a matrix with the elements of one. With Singular Value the composition [8]:

\[
\hat{Y} = UDV^T
\]

where \( U \) dan \( V \) are matrix with orthonormal colon (\( U^T U = V^T V = I \)) and \( D \) is a diagonal matrix with the diagonal element are eigen values.

The information that can be reach by Biplot analysis are:

- Vector long shown the variations of a variable.
- The angle between vectors show a correlation between both, The smaller angles give more highly correlation of both.
3. Result and Discussion

3.1. The characteristic of the Households TB Patient

The characteristic of the households covering the status of food security, the percentage of the households food insecurity every sub-districts, the physical condition of buildings ownership of the toilet.

The status of food Security shown in Figure 1, Indicate that there has been 64 percent of the households are insecure and only 36% of the households in food secure.

![Figure 1. The Status of Food Security](image1)

The percentage of total households food insecure in each subdistricts reveals in Figure 2. Subdistrict with the highest of total number households food insecurity is Gunung Anyar (12 %) compared to others, while the lowest is Benowo (3%) and also Mulyorejo about 6 percent of households food insecure.

![Figure 2. The Percentage of Total Households Food Insecure in Each Subdistricts](image2)

The Physical Condition of the Houses shown through the type of floor, a roof and walls. As shown in Figure 3. There are still had an asbestos roof, dirt floor and woods as a wall, although the percentage were the small ones.
Figure 3. The Physical Condition of the Houses

Figure 4. shown of the ownership of the toilet, Eighty seven percents of the house have the privy and only thirteen percents of them use a public property as their toilet.

Figure 4. Ownership of the Toilet

The condition of household food security and the factors that affect describe along with subdistricts in a single picture as shown in Figure 5. The subdistricts mapped near by the factor of, means they correlated by each others.

Figure 5. The Mapping of The Factors That Affecting Tuberculosis Patient Households food security Among Subdistricts
Comparing Figure 5 and Table 5, there are several groups can be made depend on the factors that close to subdistrict.

**Table 5. The Angle Between Factor And Location**

| Location        | $X_{26}$ | $X_{27}$ | $X_{28}$ | $X_{29}$ | $X_{30}$ | $X_{31}$ | $X_{32}$ | $X_{33}$ | $X_{34}$ | $X_{35}$ | $X_{36}$ |
|-----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| ASEMROWO        | 57.79°   | 164.02°  | 2.89°    | 11.31°   | 99.67°   | 22.52°   | 53.77°   | 57.52°   | 58.33°   | 95.81°   | 10.75°   |
| BENOWO          | 39.34°   | 66.70°   | 100.22°  | 86.02°   | 2.34°    | 74.80°   | 43.55°   | 39.81°   | 38.99°   | 1.52°    | 108.08°  |
| PABEAN CANT     | 68.05°   | 150.96°  | 7.37°    | 21.58°   | 109.94°  | 32.78°   | 64.04°   | 67.79°   | 68.60°   | 106.08°  | 0.49°    |
| SEMAMPIR        | 164.10°  | 23.11°   | 135.22°  | 144.91°  | 122.22°  | 160.64°  | 168.11°  | 168.88°  | 166.07°  | 126.07°  | 127.36°  |
| KREMBANGAN      | 145.07°  | 4.08°    | 154.25°  | 144.91°  | 103.19°  | 179.66°  | 149.09°  | 145.34°  | 145.43°  | 107.06°  | 146.39°  |
| BULAK           | 166.04°  | 25.05°   | 133.28°  | 144.91°  | 124.16°  | 158.70°  | 149.09°  | 145.34°  | 144.53°  | 128.01°  | 125.42°  |
| RUNGKUT         | 136.75°  | 117.01°  | 76.07°   | 90.28°   | 178.63°  | 66.12°   | 97.37°   | 101.12°  | 101.93°  | 139.41°  | 68.21°   |
| KENJERAN        | 11.97°   | 207.04°  | 48.71°   | 34.51°   | 53.85°   | 23.29°   | 7.96°    | 11.71°   | 12.52°   | 49.99°   | 56.57°   |
| GUNUNG ANYAR    | 45.24°   | 186.23°  | 15.44°   | 1.24°    | 87.12°   | 9.97°    | 41.22°   | 44.97°   | 45.78°   | 83.26°   | 23.30°   |
| SUKOLILO        | 36.69°   | 177.68°  | 23.99°   | 9.78°    | 78.57°   | 1.43°    | 32.67°   | 36.43°   | 87.23°   | 74.71°   | 31.85°   |
| MULYOEROJO      | 33.06°   | 107.93°  | 93.74°   | 79.54°   | 8.82°    | 68.32°   | 37.08°   | 33.33°   | 32.52°   | 4.96°    | 101.60°  |

The subdistricts : Asemrowo, Pabean Cantikan, Gunung Anyar and Sukolilo become a group that close to the household food insecure and the factors household with schoool age children and toddlers, the density of household members sufficient, especially for Sukolilo also close to the factors of the household have a toilet, and electricity source from PLN.

Benowo and Mulyorejo are the subdistricts close to the food secure household and the factor household with quite good ventilation, Mulyorejo also closed to the factors that the households have a toilet, electricity source from PLN and Landfill. Semampir, Krembangan and Bulak as a group close to the factor that the head of household have a regular work. Kenjeran is close to the factors household educated, an enough population density, have toilet, an electrical source from PLN, and have Landfill, and the last is Rungkut as a subdistrict with no factors close to. The results above can be described on a map throughout Surabaya’s map as given in Figure 6.

![Figure 6. Map of Coastal Subdistricts of Surabaya with](Image 112x487 to 487x403)
4. Conclusion

There are still households Food Insecure, with Asbestos roof, cement plaster floor and wood wall in the coastal region of Surabaya. The coastal subdistricts divide into 5 (five) groups those are:

- Asemrowo, Gunung Anyar, Sukolilo and Pabean Cantikan
- Benowo and Mulyorejo
- Semampir, Krembangan and Bulak
- Kenjeran and Rungkut each stands alone

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