

## **Geographical Information Systems (GIS) Approach for Mapping the Aboriginal Children Malnutrition Growth: A Case in Kemar, Perak**

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### **Abstract**

Geographical Information System (GIS) has been widely used nowadays in health monitoring process throughout the whole nation. GIS also has been used to map population infectious diseases such as Dengue, Malaria and AIDS. This system has the ability to organize, manipulate, analyze and visually display spatial data and provide an efficient result thus can help the decision maker in solving the health problem. The use of GIS to map the aboriginal children malnutrition growth is thus appropriate. Children malnutrition is a multi current dimensional problem which involves with food security, education, and access to clean water, sanitation and health services. An aboriginal child is identify to be under the high risk of unhealthy growth nowadays. The factors that contribute to this issues is the living environment and sufficient of healthy food and clean water. GIS technologies have the potential to be used in mapping the children malnutrition growth and study the significance of the environment which relate to the cases. GIS has the ability to update information and visualize the result for further analysis to be taken by the bodies of interest. The objectives of this study is to identify the group of aboriginal children and their locations using global positioning systems (GPS) that need of assistance and help in health interventions, this study also provide up to date information for decision making and raise precaution awareness towards the Aboriginal Children malnutrition's problems. These malnutrition children growth results will be displayed by GIS to visualize the percentage growth. Once the result is obtained therefore further analysis can be done to monitor the aboriginal children growth with the support of healthy malnutrition program in future.

*Key words: Malnutrition, Aboriginal Children, Geographical Information System (GIS), Global Positioning System (GPS)*

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### **1.0 Introduction**

Geographical Information System (GIS) has been widely used nowadays in health monitoring process throughout the whole nation. GIS also has been used to map population infectious diseases such as Dengue, Malaria and AIDS. This system has the ability to organize, manipulate, analyze and visually display spatial data and can provide an efficient result thus can help the decision maker in solving the health problem. The use of GIS to map the aboriginal children malnutrition growth is thus appropriate. Childhood malnutrition is a multi dimensional problem face in the whole nation. The factors that contribute to this issue are lack of deprived of food security, education, access to clean water, sanitation and health services. Malnutrition remains a major burden to our population and is frequently a part of a cycle that includes poverty and disease. This is more pronounced in children as malnutrition in early periods of life originating from factors as poor food quality and insufficient food intake can lead to significant morbidity in future. (Murni S.U et. Al 2010). Pockets of malnutrition are often related to children living in underserved areas such as the resettlement villages, aboriginal population's squatters and fishing villages. This factor will lead to poor outcome measure such as lower IQ low rate.

The previous study on malaria has shown that the usefulness of GIS by providing the clues for further analysis of the disease. The display of the data pertaining to the study area provided an overview of the malaria incidence in relation to geographically and ecologically important entities. By using the same approach the outcome of malnutrition study would be a successful. It is apparent that GIS are being used for health by a number of researchers in varied areas of specialization. Their potential has been clearly demonstrated in a number or research projects. Thus make GIS is a useful tools in health monitoring process.

Nutrition in agro biodiversity is the one of the many areas of possible applications of GIS methodologies and Public Health Nutrition emergencies has only recently discovered the potential. Almost any nutrition survey aiming to define the nutritional status in a certain area (at district, town, province, region, state, nation or continent level) can be enhanced by a GIS presentation. No major changes are needed in conducting the nutrition survey or in identifying its best epidemiological design (Afolayan, 2009). GIS is not the magic bullet for any questions, the

use of GIS certainly contributes tools to provide better solutions or answers. More specifically, GIS helps in decision makings because its provide maps of the phenomenon of interest (Bhan, 1997). Applied to nutrition, GIS analysis is potentially an extremely powerful tool for monitoring, evaluation and targeting.

This study focus in GIS approach for mapping the aboriginal children malnutrition growth by showing the statistical percentage growth with the exact location of the aboriginal children populations. The aim of this study is to identify the group of aboriginal children and their locations using global positioning systems (GPS) that need of assistance and help in health interventions, this study also provide up to date information for decision making and raise precaution awareness towards the aboriginal nutrition problems.

### 1.1 Malnutrition

Malnutrition is implicated in more than half of all child deaths worldwide, resulting in lowered resistance to infection and death from common childhood ailments like diarrhea disease and respiratory infections. Those who survive however are further leading to faltering growth. Three quarters of these children who die from causes to malnutrition were and only mildly or moderately undernourished, showing no outward sign of their vulnerability. On the other hand, long term effects include higher risk of cardiovascular diseases, adult obesity, learning disabilities and poor social adaptations leading to other high risk factors for adverse outcomes for these children and their own families. These cycles of social deprivation would lead to other disadvantages in future. Malnutrition is found to be leading killer throughout the world, with under nutrition in the developing world the main nutrition problem (Gragnotati, et. al. 2005, Adhikari, 2009). For this research study the bench mark for the nutrition measurement are referred from the Health Department of Hulu Perak, categorized as poor, average and normal showed in table 1.1. Nutrition data include the height and weight and weight of age (WAZ) of every aboriginal children involved in this research are compiled, entered into the GIS software for the processing phase.

Table 1.1 : Nutrition Classification

Nutrition Category	Nutrition Level
Poor	< -3
Average	-2.99 to -2.0
Normal	>-1.99

### 1.2 Objective of research

The specific objectives of this study are listed below;

1. To identify the group of aboriginal children and their locations that need of assistance and help in health interventions and map the aboriginal children malnutrition growth using GIS approach.
2. To provide information for the aboriginal children malnutrition growth for better health monitoring process for Health Department.

### 1.3 Scope of the study

Scope of the study is to analyze the malnutrition growth for the aboriginal children using GIS approach. The study area is at Kemar, Perak and known as one of the aboriginal settlement of Perak State. The health data used for this project obtained from the Health Department of Grik, Perak. GIS approach used in this project can help the monitoring process for the public health especially for children.

### 1.4 Benefit of this Project

GIS is known as powerful technology that has the ability to manipulate, analyze, stored and visualize the geographic data in digital. So by using GIS approach, the health monitoring problem can be done with the support of appropriate data and expertise in the health area. This study focus in mapping the aboriginal children malnutrition health thus the information can be use by the decision makers in future planning for solving health problem among these children.

### 1.5 Study Area

The study area selected is aboriginal settlements in District of Kemar, Hulu Perak. (5°13'45"N 101°23'39"E). This study area has approximately 2127 populations of aboriginal people. The selection of the study area is based

on identification of healthy problem among aboriginal children in the settlement area. The number of aboriginal children involve with this study is approximately about 343 children living in 20 village in the settlement area Table 1.2 shows the sample of health data for the aboriginal children provided by Health Department, Hulu Perak.



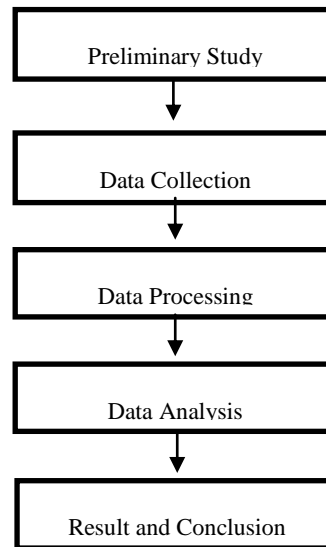
Figure 1.1 Study area, District of Kemar, Grik

Table 1.2 Sample of health data for the aboriginal children for February 2014

BIL	NAME	GENDER	AGE	VILLAGE	WEIGHT (KG)	HEIGHT (m)
1	ABBE HARRISMAN RAMAN	MALE	6	LERLAR	15.3	96.9
2	ABE HEMBOL MADOMI	MALE	3	RANTAU 2	10.6	77.1
3	ABOK LIYA AP ZAID	FEMALE	5	RANTAU 2	11.9	84.3
4	ADIAN AL RABUAN	MALE	4	RANTAU 2	9.4	77.3
5	ADIK ROZIN TEMPIAS	MALE	3	SEANGIT	9.9	78.2
6	ADRI SHAH ALDIMAZ B KULUP	MALE	4	RANTAU 1B	10.3	82.5
7	ADRIAN B RAMDAN	MALE	7	RANTAU 1B	15.7	101.3
8	AFIQ ZAFRIL AL AZMI	MALE	2	LERLAR	8.9	70.3
9	AGA ASMI AL ELLI	MALE	3	RANTAU 1B	7.2	74.3
10	AGA FENRES B EMRIE	MALE	3	RANTAU 1B	7.6	74.6
11	AGA HAZIQ AL ELLI	MALE	5	RANTAU 1B	12.2	86.5
12	AGA IRING AL JAMAL	MALE	3	LEDIAU	7.9	70
13	AGA JAZIRIE AL ELLI	MALE	7	RANTAU 1B	13.2	94
14	AGA JURIK AL JAMAL	MALE	6	LEDIAU	10.6	85.2
15	AGA MIRAR AL ROSLI	MALE	4	BAL STOL	11.5	80.9
16	AGA SUWOR AL SHARUDDIN	MALE	7	RANTAU 2	13.8	100.6
17	AGAR HERIMOL	MALE	3	RANTAU 1B	8.4	71.2
18	AGGA RISMAN	MALE	6	LERLAR	13.7	95.6
19	AGO HARIK AL KAHAR	MALE	6	LERLAR	16.7	100.5
20	AGO RUDIK MAN B JU	MALE	6	RANTAU 2	14.5	100.3

## 2.0 Material and Methods

### 2.1 General Workflow



### 2.2 Preliminary Study

Preliminary study includes the selection on study area, problem statements, aim and objectives, and review study cases. Selection of study area takes into consideration the issue of the malnutrition problems. The kemar village having about 343 aboriginal children that suffered for unhealthy growth. This malnutrition problems need to be solves to ensure all children having healthy bodies for normal IQ growth.

### 2.3 Data Collection

The types of data collection used in this study were obtained from secondary data. Secondary data was existing data that has been already collected and readily available from the relevant sources. Secondary data easily and quickly to be obtained compared to primary data. The secondary data collection for this study comes from several sources such as the topographic map from Department of Survey and Mapping Malaysia (JUPEM) and the personal details of aboriginal children information and health status from the Health Department of Grik, Perak. The data for location of aboriginal children in Kemar, will be collect using hand held Global Positioning System (GPS) during the field phase of the survey. Extra time is required for cleaning and analysis of the dataset to prepare for presentation in a GIS map.

### 2.4 Devices and Software

For this nutritional survey, a GPS device and GIS software are needed. The GPS allows users to collect data on both locations and tracks, while the GIS software allows the displays and analysis combined with data derived from a nutrition survey. A commercial GPS has a standard error of about 5 meters in positioning, which is normally is well below the precision that a nutrition survey requires. Some GPS can measure also the altitude, which can be useful in adjusting hemoglobin cut-offs to calculate the pre-balance of anemia in a survey. For this study the hand held GPS instrument is used with accuracy of 5m. Once the data have been collected by GPS, there are several possible method, solutions and software options for proceeding with the analysis. GIS software, ARCGIS version 10.2 is used for this study to process the geographical data.

### 2.5 Data Processing and Data Analysis

This section presents about the software used for data processing. Two types of software used to implement this study. The types of software used for this study includes GIS and Microsoft Excel 2010. The GIS software used were ArcGIS version 10.2, this software has the ability to stored, manipulate, analyze and visualize the spatial data for this study while the microsoft excel were used to create the tabular data for the malnutrition elements needed for this studies such as name, age, gender height and weight for all the aboriginals children's.

The data processing involve with development of database and preparation of digitalised map of study area. The process is conversion of data from Microsoft excel import into the ArcGIS software then start to create the attribute table and the base map. Base map basically created manually referring to the topographic map of the study area. After completing the database the analysis part will be done using several tools in spatial analysis in order to achieve the research objective.

Data analysis helped to produce the output or results of this study. There are several types of analysis method were carried out for this case study. The analysis used for this study is point density analysis, kernel density estimation, and buffering analysis. After finish the analysis part, the result will be display visually and we can determine the statistical malnutrition growth for the aboriginal children for six month period of time. The result will be discussed in the next chapter.

### 3.0 Result and discussion

The results and analysis achieved are based on objectives of this project. Analysis is a work process that could explain, distinguish and choose data to produce information based on specific criteria needed. This study focus on the malnutrition growth of aboriginal children in District of Kemar, Perak. Data obtained from the health department are entered, manipulate and analyzed to produce the result showing the percentage of malnutrition growth for the children from February to June 2014. The analyses for this study are base on comparing the nutrition level for each of the aboriginal children for 6 month period of time. The nutrition level obtained from the Health Department of Hulu Perak. Number of children involve for this study is about 343 children from 20 villages in the settlement area. Figure 4.1 shows the based map of study area, Kemar. Table 4.1 shows the reading of nutrition level by category required in the implementation of this research study.

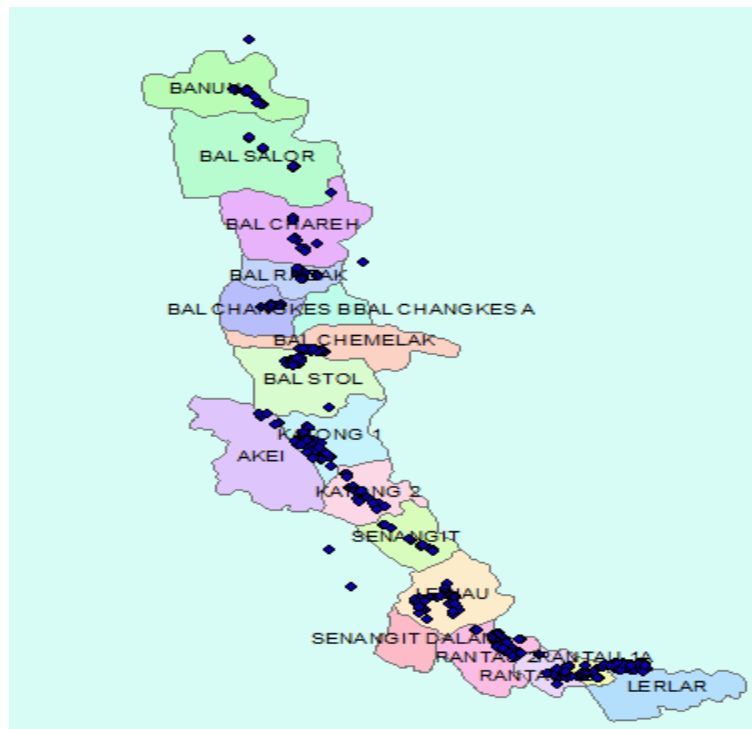


Figure 4.1: Based Map of Kemar, Perak

Table 4.1: Nutrition classification

Nutrition Category	Nutrition Level
Poor	<-3
Average	-2.99 To -2.0
Normal	>-1.99

#### 3.1 Nutrition Level Analysis base on Month

This analysis for this research study are for 343 aboriginal children of age 1 to 6 years old, take into consideration their nutrition level referred from their weight and height and weight of age (WAZ) for the month of February to

June 2014.

### 3.1.1 Analysis for Nutrition Level for the month of February 2014

For the month of February total percentage under poor, average and normal category is 12%, 34% and 54% respectively. Figure 3.1 shows the number of aboriginal children for poor category of nutrition level for the month of February 2014. The number of male and female under this category is 21 and 20 respectively. It can conclude that for category poor and average, male child have high number for these category rather than female child.

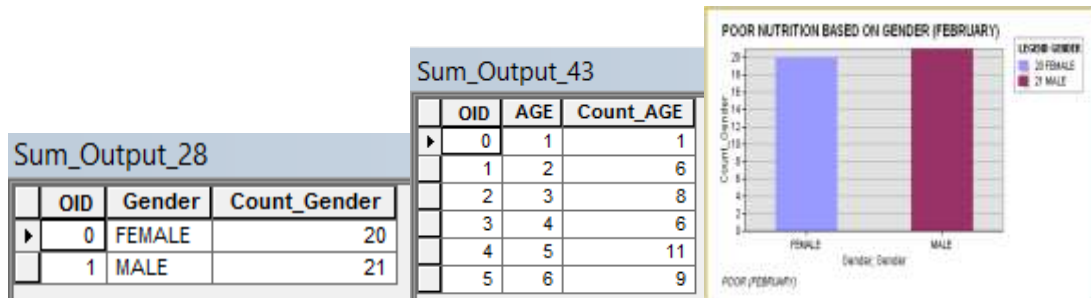


Figure 3.1: Poor nutrition level for the month of February 2014

Figure 3.2 shows the total number of aboriginal children under average category, which can clearly seen that male children again having the highest number than female children under this category. Both male and female children involved in this category are 65 and 50 respectively. For average, male children increase by 15 person than female children.

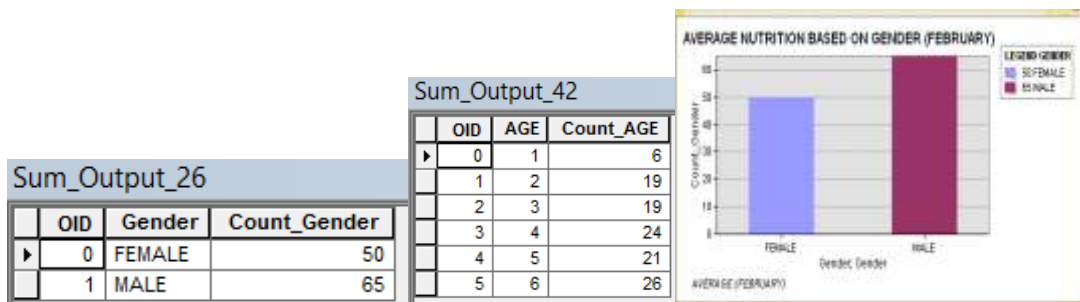


Figure 3.2 : Average nutrition level for the month of February 2014

While figure 3.3 shows the number of aboriginal children under normal category, male children slightly decrease by 5 person having total 91 children and female is 96 children. For this category female child is healthier than male children.

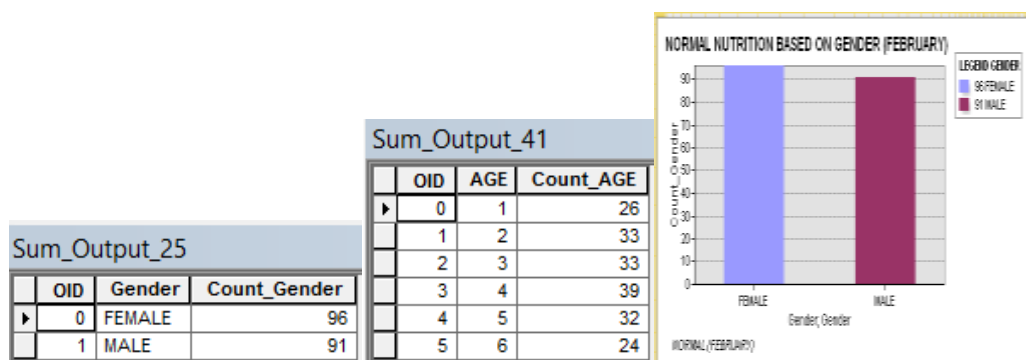


Figure 3.3: Normal nutrition level for the month of February 2014

### 3.1.2 Analysis for Nutrition Level for the month of April 2014

For the month of April 2014, total percentage under poor, average and normal category is 16%, 30% and 54% respectively. This shows that for April 2014, poor level of nutrition increase by 4%, Average decrease by 4% and

normal category remain. Figure 3.4 shows the number of aboriginal children for poor category of nutrition level for the month of April 2014. From the table, the number male children is 28 and female children is 25 which can be conclude that male children having highest number of poor nutrition level than female children.

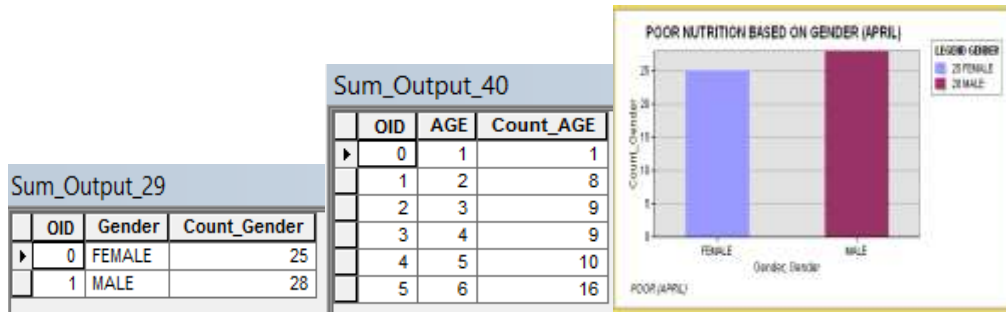


Figure 3.4: Poor nutrition level for the month of April 2014

Figure 3.5 shows the total number of aboriginal children under average category, which can clearly seen that male children again having the highest number than female children under this category. Both male and female children involved in this category are 56 and 46 respectively. For average, male children increase by 10 person than female children.

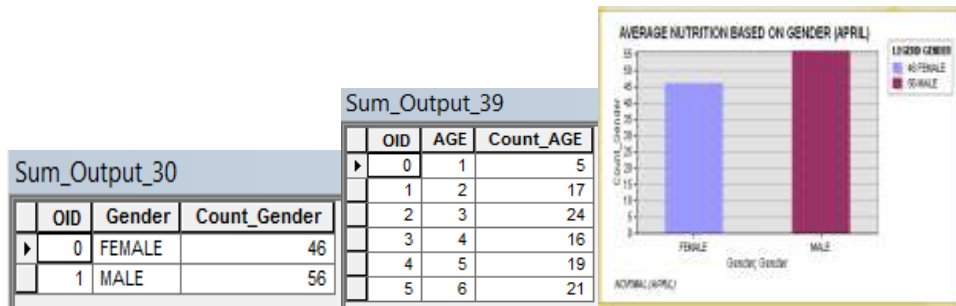


Figure 3.5: Average nutrition level for the month of February 2014

While Figure 3.6 shows the number of aboriginal children under normal category, male children slightly decrease by 9 person having total 86 children and female is 95 children. For this category the number of female child is increase than male children.

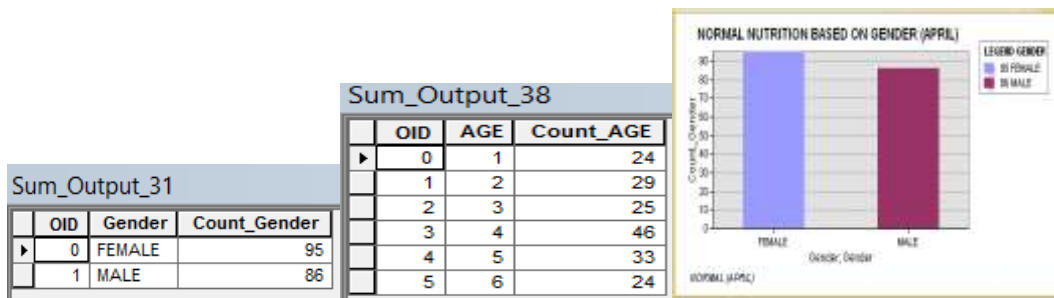


Figure 3.6: Normal nutrition level for the month of February 2014

### 3.1.3 Analysis for Nutrition Lever for the month of June 2014

For the month of June 2014, total percentage under poor, average and normal category is 12%, 32% and 56% respectively. This shows that for June 2014, poor level of nutrition decrease by 4%, Average increase by 2% and normal category increase by 2%. Figure 3.7 shows the number of aboriginal children for poor category of nutrition level for the month of June 2014. From the table, the number male children is 22 and female children is 19 which can be conclude that male children having highest number of poor nutrition level than female children.

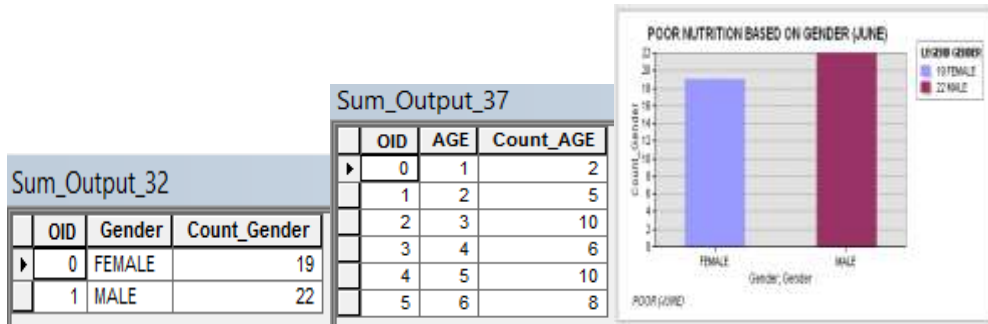


Figure 3.7: Poor nutrition level for the month of April 2014

Figure 3.8 shows the total number of aboriginal children under average category, which can clearly seen that male children again having the highest number than female children under this category. Both male and female children involved in this category are 58 and 48 respectively. For average, male children increase by 10 person than female children.

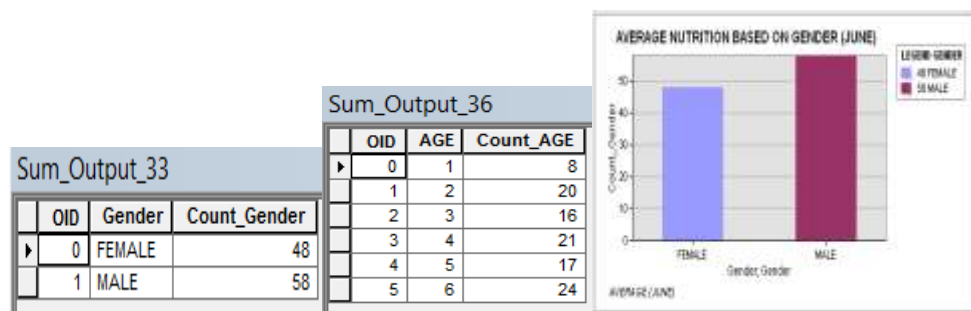


Figure 3.8: Average nutrition level for the month of February 2014

While Figure 3.9 shows the number of aboriginal children under normal category, male children slightly decrease by 7 person having total 92 children and female is 95 children. For this category the number of female child is increase than male children.

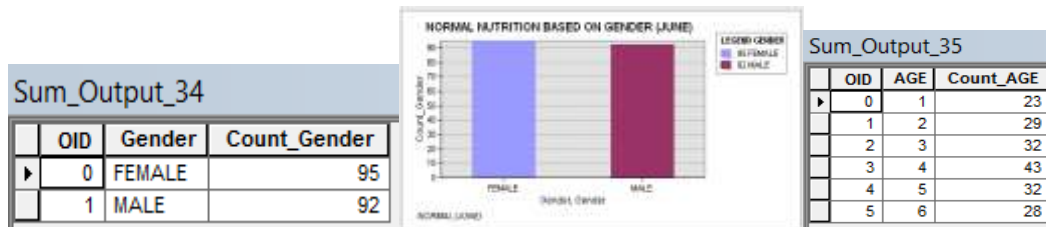


Figure 3.9: Normal nutrition level for the month of February 2014

### 3.2 Analysis base on percentage for the month of February, April and June 2014

For the month of February 2014, total percentage under poor, average and normal category is 12%, 34% and 54% respectively. Figure 3.10 show that there is a small number aboriginal child under poor category followed by average and normal. The total number of children under poor, average and normal nutrition level is 41, 115 and 187 respectively.



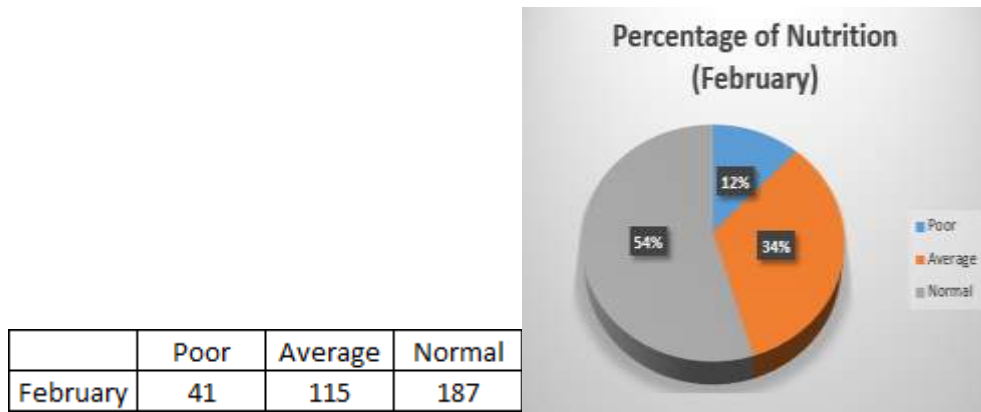


Figure 3.10: Pie chart for nutrition level for February 2014

For the month of April 2014, total percentage under poor, average and normal category is 16%, 30% and 54% respectively. Figure 3.11 show the percentage of nutrition level for aboriginal child under poor category followed by average and normal. The total number of children under poor, average and normal nutrition level is 53, 102 and 181 respectively. Comparison of nutrition level is made with the month of February, its show that for April 2014, poor level of nutrition increase by 4%, Average decrease by 4% and normal category remain.

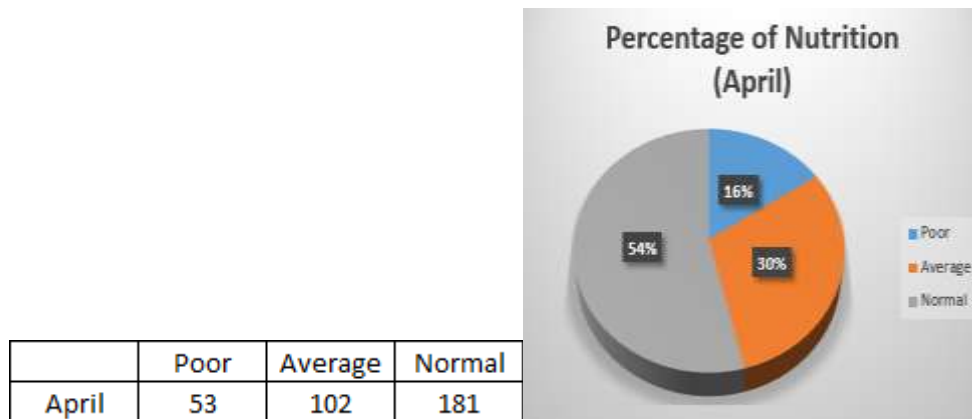


Figure 3.11: Pie chart for nutrition level for April 2014

For the month of June 2014, total percentage under poor, average and normal category is 12%, 32% and 56% respectively. Figure 3.12 show the percentage of nutrition level for aboriginal child under poor category followed by average and normal. The total number of children under poor, average and normal nutrition level is 41, 106 and 187 respectively. It is shows that for month of June 2014, poor level of nutrition decrease by 4%, Average increase by 2% and normal category increase by 2%.

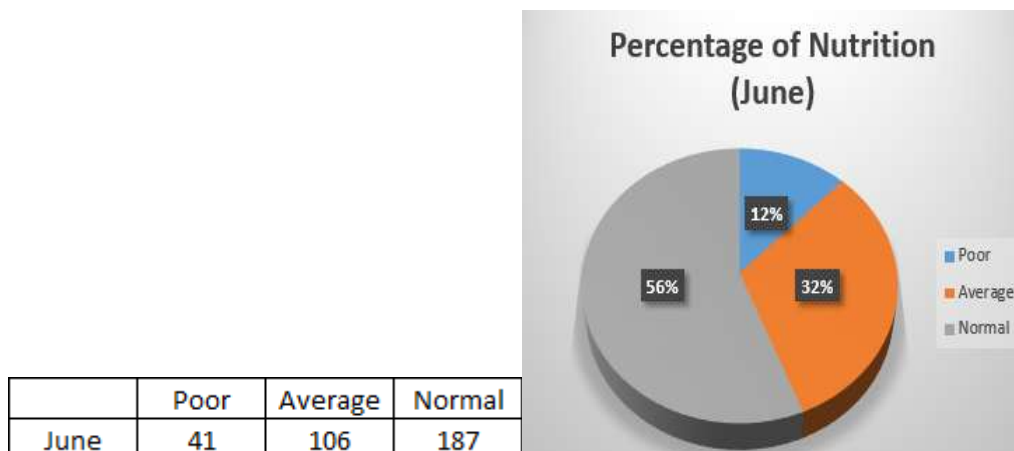


Figure 3.12: Pie chart for nutrition level for June 2014

### 3.3 Conclusion

As for the conclusion, from the map and analysis using GIS, the total number of increasing and decreasing under of the poor, average and normal category of malnutrition growth can be identified efficiently. GIS has the ability to show and mapped the exact location of all aboriginal children involved in this study and from the map the malnutrition growth of the children can be analyzed. There is a high and low number of increase and decrease between the three categories for male and female aboriginal children from the age of one to six years old. From the result, the aboriginal children malnutrition growth can be mapped in details showing the level of healthiness among them in the study area. The mapping process analyzed the height and weight of every aboriginal child from February, April and June 2014. The map shows the exact location of the aboriginal settlements and their malnutrition status. There is a numbers of decrease and increase in the aboriginal children malnutrition growth and the statistical result also can describe the health status of these children. The GIS approach for malnutrition growth able to provide accurate information on the health status for the aboriginal children in district of Kemar, Perak. The information can be use for Ministry of Health to monitor the nutritional status and solve the health problem faced by these children. This action not only helps the children growth but giving the chance for the children to have a healthy living of life in their settlements. This shows that geospatial technologies helps to resolve with its spatial analysis tools as health department can use maps produced by GIS as a monitoring tools in solving health problem.

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