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# Assessing Pruning Knowledge towards Effective Tree Maintenance: A case study of four Local Authorities in Malaysia

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## Abstract

Pruning is one of the most crucial tree maintenance activities which give an impact on the tree's health and structure. Besides, improper pruning will contribute to the risk of injury to property and the public. This study aims to assess pruning knowledge among four Local authorities in Malaysia. Results found that 69.3 percent of tree pruning workers have a Good pruning knowledge level. However, Topping, pruning types and pruning cut dimension shows the lowest mean percentage of the correct answer. The findings also show that there is a significant positive relationship between pruning knowledge and education level and frequency attending pruning courses.

Keywords: Tree pruning; knowledge; sustainable practices; urban trees

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## 1.0 Introduction

Among tree maintenance practices, tree pruning reported as an essential element of urban tree maintenance activities, and it is one of the most important cultural practices for maintaining woody plants. If pruning ignored, it will give a significant impact on the tree's health and structure (Murad, 2000; Clark and Matheny, 2010). Not only that, but it will also contribute to the risk of injury to property and the public. For example, damage by the dead, hanging, and detached twigs/branches not prune would easily fracture, especially during strong wind. It might fall off and cause injury to people or property damage (Ow et al., 2013). However, if pruning is done, then it should not be done trivially. It is because improper pruning practices will also affect the tree's condition (Clark and Matheny, 2010). Topping will damage the original structure of the tree (Zakaria, 2012), which may shorten the life of a tree by making it susceptible to be attacked by insects and disease from the dead branch stub in the canopy (Gilman et al., 2015). Flush cut (Ow et al., 2013) and stub left (Clark and Matheny, 2010) can result in fungal infections on the wounds that will adversely affect tree health in the future. Besides, pruning equipment also affects the quality of pruning. Blunt cutting tools will result in rough and unclean pruning cuts (Zhang et al., 2018). The use of pruning equipment that not disinfected can also be a source of disease infections to the trees (Vanik, 2016).

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Therefore, Individuals that engaged in pruning work play a vital role because proper tree pruning will depend on pruning practices done by them, and it is essential for workers to equipped themselves with the knowledge (Ainuddin, 2014). This research aims to investigate the knowledge status of tree pruning workers in Klang Valley city, Malaysia. It is crucial to investigate the level of pruning knowledge among tree pruning workers to enhance the level of expertise and efforts to improve the quality of pruning practices in urban areas (Zakaria, 2012).

## **2.0 Literature Review**

Urban trees pruned to improve tree health, reduced risk of the branch and stem breakage for safety purposes, or modify tree form (aesthetics) (Hoyle et al., 2017). Shigo (1989) described pruning as “the best thing an individual can do for a tree but at the same time, one of the worse things; much depends on how pruning is carried out.” This demonstrates the importance of good pruning practices influenced by factors of human behaviour such as knowledge and attitude. Knowledge is the basis of the conduct or behaviour of an individual. Without knowledge, one cannot act upon any information or issues that arose. Exposure to new information can enhance knowledge. According to Schwartz (2012), behavioural changes occur when it increases one's knowledge.

There are several previous studies of knowledge and practice in the urban forestry field. Zhang and Zheng (2011) research on public attitudes toward the urban tree and supporting urban tree programs in Alabama U.S found that public with more information and knowledge about the benefit of urban tree programs and forestry services had a positive attitude and more likely to donate money for urban tree programs especially public with higher education level. While Gurung et al. (2012), who study peoples' perceptions towards urban forestry and institutional involvement in Metropolitan Cities of Lalitpur City in Nepal, found that respondents with higher education have more knowledge about the ecosystem and they perceived urban forest as an important element for sustainable landscapes. A study by Almas and Conway (2017) among municipalities in Carolinian Canada found that the more knowledge gained from native species increased their positive actions to sustainable native tree species management while a study by Kobbail (2012) on 100 local people in Kosti Province-Central Sudan found that people who are knowledgeable more aware of the benefits of trees and community forestry practice.

While there is not much research on knowledge and practice in pruning. Some of them by Kuhns and Reiter (2007) whose study about knowledge and attitudes of households towards utility pruning in six cities in the western United States. The results from the research found that individuals who are exposed to knowledge will have a positive attitude toward the acceptance of utility pruning. Besides, another study also carried out by Kuhns and Reiter (2009) on knowledge and practices of topping in the interior western United States city found that the majority of them who had not topped trees were significantly more knowledgeable about topping. A study by Fickri and Siregar (2018) found that 93.91% of trees in a campus area in Dramaga, Bogor with improper pruning cuts indicated that the workers were still lack of pruning knowledge and skills. Whereas Close et al. (2001) who conducts a study about homeowners in south-central Illinois to find out the extent of their motivations and knowledge towards topping. The study found that less-educated homeowners tend to do topplings.

## **3.0 Methodology**

### **3.1 Description of the study site**

This study was conducted in selected cities in Klang Valley, Malaysia. Based on the research undertaken by Akmar et al. (2011), there are six cities in the Klang Valley with high urbanization levels, namely Kuala Lumpur, Putrajaya, and four districts in Selangor, namely Shah Alam, Petaling Jaya, Subang Jaya, and Klang. In this research, only four cities involved, which are Shah Alam, Petaling Jaya, Subang Jaya, and Kuala Lumpur. The selection of these sites was based on the following criteria. Firstly, most employees who carry out pruning work under the Local Authority involved who do not have a certified arborist certificate. The second criterion is because this area is the most urbanized in Klang Valley. Trees in this area need to be given attention in terms of care as they tend to be exposed to stress such as poor aeration from compacted soil, high environmental temperature, pest and disease problems, vandalism, and others (Cavender and Donnelly, 2019). The third criteria are this area is high in population density (Akmar et al., 2011). If tree pruning is neglected or not done correctly, it will cause harm to humans and properties.

### **3.2 Research methodology**

The method for obtaining data is to use quantitative approaches. The study was conducted using a questionnaire as an instrument to gather research data. The research instrument consists of a set of questionnaire which contains two sections which comprised; Section A (Worker's demographic information) and Section B (Knowledge on tree pruning). Section A consists of 9 respondent's background-related items. Basic demographic information such as age, gender, race, education level, status of employment, duration of service, certified arborist status and background information related to work; work done besides pruning, area of pruning work, frequency of pruning courses attended and course organizer. Section B covers 58 items of question-related to the knowledge of tree pruning. Multiple choice questions are often used in most studies to assess the level of knowledge but in this study technique used in the production of the questionnaire to evaluate respondent's knowledge using Likert scale based on the method performed by Fazio and Krumpke (1999) which avoids the feeling of taking

a test by the questions presented as seeking an "opinion." This method was also applied by Kuhs and Reiter (2009) in their study to find out the level of knowledge of households on tree topping. This method is very suitable to be used to prevent respondents from feeling panic and afraid to answer the questions raised because they are worried about giving the wrong answers. Items are in the form of 5-point Likert's rating scale statements that is 1 (strongly disagree), 2 (disagree), 3 (don't know) and 4 (agree) and 5 (strongly agree). However, when entering data into SPSS, the data will be coded either "1 = right" or "0 = wrong". There are 40 items with positive statements and 18 items with negative statements. For positive statements, respondents who answered 4 (agree), and 5 (strongly agree) will be considered as the correct answer and will be given one mark. While 0 marks for the wrong answer, respondents who answered 1 (strongly disagree), 2 (disagree), and 3 (don't know). While for negative statements, 1 (strongly disagree) or 2 (disagree) will consider as the correct answer (1 mark) and 0 marks for the wrong answer; respondent who is answering 4 (agree), 5 (strongly agree) and 3 (don't know). If the respondent has two choice answers or does not answer the question, then 0 marks will be given, assuming the respondent does not know the question/item presented.

Questions made referred to manual of Best Management Practices of Tree Pruning manual by International Society of Arboriculture (ISA), manual of Pruning Trees Landscape Amenity by the National Landscape Department (JLN). While questions about tree topping are modified through a questionnaire by Kuhns and Reiter (2009) and Fazio and Krume (1999). The dimensions of pruning knowledge questions are:

Dimension 1: The purpose of pruning landscape trees (10 items)

Dimension 2: Pruning methods (9 items)

Dimension 3: Pruning cuts (7 items)

Dimension 4: Pruning wound (6 items)

Dimension 5: Topping (7 items)

Dimension 6: Pruning types (10 items)

Dimension 7: Pruning tools (9 items)

The language used is the simple Malay language so that respondents will easy to understand each of the questionnaire contents. Knowledge score based on Almas and Conway (2017) which modified as in Table 1. Based on knowledge score by him, each category has the same class interval size. Still, in this study, only the category with high knowledge has different class interval sizes compared to the other four categories. It is because the researcher believes the respondent labelled as high knowledge should have less than 10% of the wrong answer. A maximum total score of 58 expected.

Table 1: Knowledge score category level

Knowledge category	Knowledge score
Very low	0-12
Low	13-25
Moderate	26-38
Good	39-51
Very good	52-58

(Source: modified from Almas and Conway (2017))

Respondents involved in this study consist of managers, site supervisors, and subordinates involved with pruning work. Selection of the sample respondents of tree pruning workers in Klang Valley cities, which are Kuala Lumpur City Hall (DBKL) and Selangor city; Shah Alam City Council (MBSA), Petaling Jaya City Council (MBPJ) and Subang Jaya City Council (MPSJ). There are 17 landscape contractors under Kuala Lumpur City Hall (DBKL), 46 landscape contractors under Shah Alam City Council (MBSA), 38 contractors under the Petaling Jaya City Council (MBPJ), and 23 contractors under the Subang Jaya City Council (MPSJ). The total of the known population is 298 people. Based on the sampling chart by Krejcie and Morgan (1970) and Cohen (1988), for a population of 298 or 300 people, the required sample was 169 people with a 5% margin error. Therefore, the number of samples in this study is sufficient. Illiterate workers and contractors who do not want to give cooperation are excluded from the study. From 298 questionnaires distributed, 205 of respondents gave feedback and returned all questionnaires, each of cities exceeded a 60% response rate, and the total response rate was 70%.

## 4.0 Findings

### 4.1 Respondents' demographics

Table 2 shows the demographic information of respondents of tree pruning workers involved in the study. The majority of respondents were subordinate positions, with 55.6 percent (114 respondents) followed by supervisor (70 respondents = 34.1 percent) and manager (21 respondents = 10.2 percent). The majority of the respondents were male (194 respondents = 94.6 percent) indicated that male workers mostly did the pruning work. Besides, most of the workers involved in the cutting work were Malay nationality (156 respondents = 76.1 percent). In terms of age, most of the workers (84 respondents = 41.0 percent) aged between 31 to 40 and 35.6 percent (73 respondents) aged between 21 to 40. While 70.7 percent (145 respondents) were permanent workers and the rest (60 respondents) are contract workers (29.3 percent).

The findings also found that most of the workers with low-level education in which more than 50 per cent of them had SPM and below with the highest percentage (86 respondents = 42 percent) of respondents with SPM education level). Over 50 percent of the respondents had five years, and less of working experience with 43.9 percent (90 respondents) of them had 1 to 5 years of working experience and 10.2 (21 respondents) with less than one year of work experience. While 47.4 percent of the respondents had more than five years of working experience with more than 30 years (3 respondents = 1.5 percent), 21 to 30 years (12 respondents = 5.9 percent), 11 to 20 years (41 respondents = 20 percent) and 6 to 10 years (38 respondents = 18.5 percent).

For the frequency of attending pruning course, the highest percentage of respondents were 43.9 percent (90 respondents) who attended 2 to 4 times pruning course followed by 21.0 percent (43 respondents) who attended more than five times pruning course. While 19.0 percent (39 respondents) never attended the pruning course and 16.1 percent (33 respondents) only attended one time of pruning course.

Table 2: Demographic data of tree pruning workers

Variables		Frequency	Percentage (%)
Job position	Manager	21	10.2
	Supervisor	70	34.1
	Subordinate	114	55.6
Gender	Male	194	94.6
	Female	11	5.4
Age (years)	< 20	7	3.4
	21-30	73	35.6
	31-40	84	41.0
	41-50	30	14.6
	> 51	11	5.4
Race	Malay	156	76.1
	Indian	14	6.8
	Chinese	0	0
	Others	35	17.1
Job status	Permanent	145	70.7
	Contract	60	29.3
Education level	Standard 6	16	7.8
	PMR/STP	16	7.8
	SPM	86	42.0
	STPM	5	2.4
	Certificate	20	9.8
	Diploma	29	14.1
	Bachelor Degree	3	1.5
Certified arborist?	Others	30	14.6
	Yes	11	5.4
Working experience (years)	No	194	94.6
	< 1	21	10.2
	1-5	90	43.9
	6-10	38	18.5
	11-20	41	20.0
	21-30	12	5.9
Frequency attending pruning course	> 31	3	1.5
	Never	39	19.0
	1 time	33	16.1
	2-3 times	90	43.9
	4 times and more	43	21.0

#### 4.2 Analysis of respondent's pruning knowledge

Fig.1 shows the mean percentage of correct answer pruning knowledge based on each dimension. It found that the Topping dimension showed the lowest percentage of 47.4 percent followed by the Pruning types (53.4 percent) and Pruning cut (69.7 percent) dimension. While the Pruning method and Purpose of tree pruning dimension showed the highest percentages of 85.5 percent and 85.1 percent, respectively. Based on items in the Topping dimension, majority of the respondents agree that that topping is the best way to avoid harm to the public and property. Also, they argue that toppings will not harm the health of the tree. While the lowest mean percentage of the correct answer is pruning types dimension. Based on the item with the lowest correct answer percentage, the majority of the respondents disagree with the appropriate way of utility pruning. Besides, they also feel that overthinning and over reduction is the correct way of pruning the landscape tree. Also, based on the pruning cut dimension, the item with the lowest correct answer percentage revealed that the majority of respondents agree that flush cut accepted in pruning.

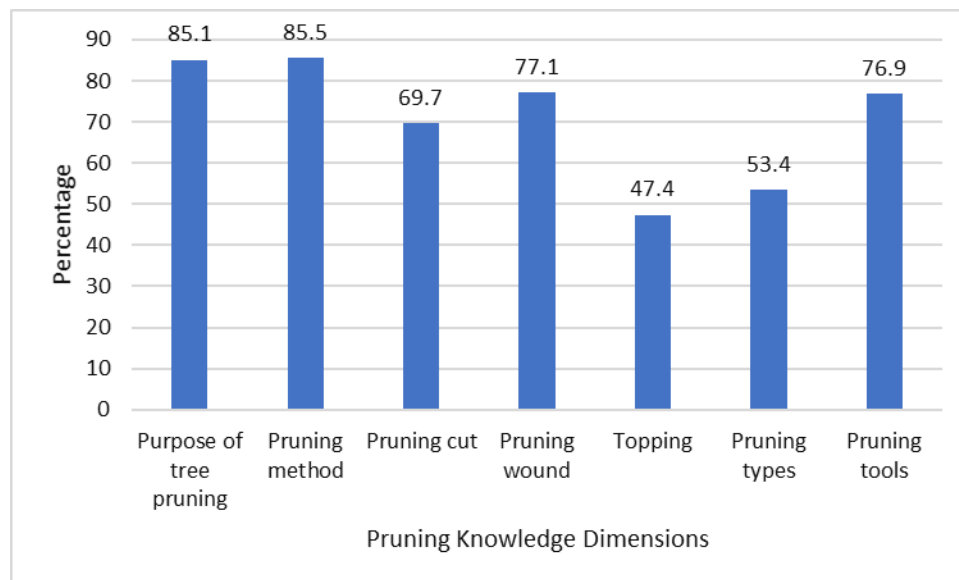


Fig.1: Mean percentage of correct answer based on each dimension

Fig. 2 shows the number and percentage of respondent's pruning knowledge level. Based on the knowledge score category (Table 1), respondents with very good knowledge are respondents who answer 52 to 58 correct answers from a total of 58 knowledge questions. Based on Fig.1, only 4.9 percent of the respondents are with very good knowledge level. While the majority of respondents (69.3 percent) are with good level of pruning knowledge followed by 23.9 percent with moderate level of pruning knowledge. Only 1.5 percent and 0.5 percent are with low and very low knowledge level. Good and very good knowledge level indicates that respondents have acquired appropriate knowledge.

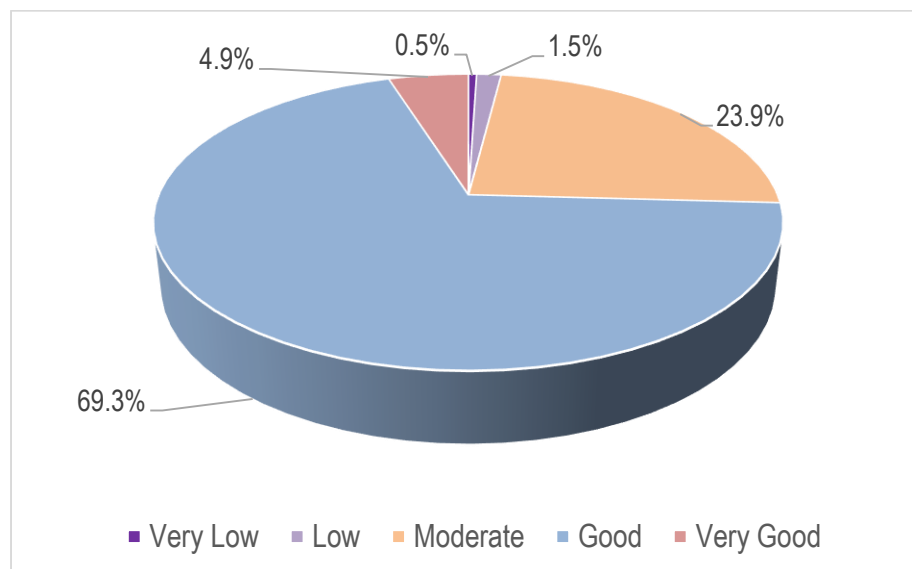


Fig.2 percentage of respondents pruning knowledge level

Correlation analysis carried out on the data obtained to determine the presence of the relationship between the variables. Table 3 shows Pearson's correlation results to determine the existence of relationships between pruning knowledge and demographic variables of age, education level, service period, and frequency attending pruning course. Findings show that there is a significant positive relationship between pruning knowledge and education level and Frequency attending pruning courses. The relationship between the two variables is very weak with a value of  $r = .249$ ;  $p = 0.000$  for the education level variable and the value of  $r = 0.155$ ;  $p = 0.000$  for the variable Frequency attending pruning course.

Table 3: Table: Correlation between variables	
Variables	Pruning knowledge (r,p)
Age	0.074
	0.292

Education level	0.249** 0.000
Service period	0.029 0.676
Frequency attending pruning course	0.155* 0.027

\*. Correlation is significant at the 0.05 level (2-tailed).

\*\*. Correlation is significant at the 0.01 level (2-tailed).

## 5.0 Discussions

Overall, the majority of workers have Good knowledge level on tree pruning. However, pruning workers have low knowledge of Tree topping, pruning types, and pruning cut dimension. Based on the questions of these three items, most of the workers believed that topping would not affect the appearance of the tree (item B38), did not harm the tree (item B36) and give good health to the tree (item B35). While pruning types knowledge is a worker's understanding of different methods on pruning based on specific cutting objectives. According to the questionnaire, three items with the lowest percentage of correct answers were items B47, B45 and B43, indicating that respondents had low knowledge of crown thinning (item B47), crown reduction (item B45), and crown raising (item B43). Also, pruning workers have low knowledge of tree pruning cut. Three items with the lowest percentage of correct answers were items B20, B25 and B21. Based on the questionnaire, respondents agreed that the ragged edges (item B20) and flush cut (item B25) were proper pruning cut. Apart from that, workers also cannot sure of the correct pruning cut (item B25).

According to Sreetheran et al. (2011), some of the tree maintenance workers who do topping because they think that it is the best way to reduce the height of an overgrown tree. Understanding the type of pruning will determine the best method of pruning based on pruning needs (Zhang et al., 2018). too much crown raising and crown thinning will reduce the photosynthesis process in trees (Norainiratna and Noriah, 2017). While pruning cut plays an important role because every cut that has done will affect the health of the trees while poor pruning can cause damage that lasts for the life of the tree. Even the traditional method of pruning branches was to make a flush cut, but this method in recent times has avoided as it encourages the invasion of decay into the main trunk (Haavik et al., 2015).

## 6.0 Conclusion

Based on Fig. 2, it was found that the majority (69.3 percent) of the pruning workers had Good knowledge level on tree pruning. However, they have low knowledge of Topping, Pruning type and Pruning cut (Fig.1). Education level and Frequency of attending pruning course also influence the pruning knowledge (Table 3). The knowledge of the tree pruning workers is still needed to be improved. It is recommended that the Local authority will take steps to more regularly expose pruning courses to landscape workers and focus more on the topping, pruning type, and pruning cut syllabus. The pruning course method also needs to take into account the appropriateness of learning based on education level as most of the pruning workers are low-level education. It is hoped that future studies on pruning and tree care related to human behaviour will be conducted regularly.

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