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The Knowledge, Attitude and Practice of Research Misconduct Among Health Sciences Undergraduates: How Do They Associate?

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ABSTRACT

Research misconduct is an act of fabrication, falsification, and plagiarism. This unethical act affects the quality of research publications in the private and public sectors and threatens public trust. Studies have shown that many factors contribute to the act of committing this behaviour, such as environment, pressure, and time constrain. Therefore, this study aims to determine the association between knowledge, attitude, and practice of research misconduct among undergraduate students of the Faculty of Health Sciences (FSK), Universiti Kebangsaan Malaysia Kuala Lumpur Campus (UKM KL). A questionnaire was adapted and modified for this study from the 'Reporting of Suspected Research Misconduct in Biomedical and Behavioural Research' by the U.S. Department of Health and Human Services, Office of Research Integrity. The universal sampling method was applied, and the participants were 3rd-year and 4th-year students. For this study, a quantitative cross-sectional study was employed. In conclusion, there is a weak association between knowledge and attitude towards the practice of research misconduct among undergraduate researchers of FSK, UKM KL, which is not statistically significant.

Keywords: *Fabrication, Falsification, KAP, Plagiarism, Research Misconduct*

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INTRODUCTION

Over the past few decades, the scientific community and the public have been shocked by research frauds conducted among researchers. The U.S. Office of Research Integrity defines research misconduct as "fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results" (The Office of Research Integrity, n.d.). Other types of wrongdoings include intentional research protocol violations, falsification of a resume, inappropriate assigning of authorship, and not declaring a conflict of interest (Broome et al., 2005; Buzzelli, 1993). Research misconduct is commonly reported in the scientific literature (Fanelli, 2009; Gardner et al., 2005; Smith, 2006) and is more frequently reported in pharmacological, clinical and medical research than in other fields. The reasons for this are still unknown (Fanelli, 2009; Luther, 2010). However, Smith (2006) states that misconduct may easily occur among scientists because the system is operated on trust. Besides that, based on the response of one of the participants in the study by Olesen et al. (2018), research misconduct can easily happen in data collection and analysis because researchers usually work alone and have complete control of the research. Another representative factor that could explain research misconduct is the pressure faced by researchers to 'publish or perish' (Felaefel et al., 2018).

A study on all the retractions of scientific publications from PubMed between 2000 and 2010 provides data from different countries (Steen, 2011). A retraction ratio of frauds to total papers published by the U.S. and all Asian countries is reported to be between 0.60 and 0.67, meaning that the ratios between these countries are mostly similar. However, the actual frequency of increased misconduct is unknown (Fanelli, 2013; Steen et al., 2013) because it probably is an insignificant fraction of all retracted fraudulent papers. However, despite the insignificant fraction, research misconduct is a global problem with worldwide occurrences. A retraction of a research article can be done based on the authors' honesty. Honest retractions often result from scientific errors represented by the literature (Casadevall et al., 2014). Dishonest retractions are triggered by the discovery of data fabrication falsification or any other types of misconduct (Stern et al., 2014). A recent study on the causes for retraction of scientific articles found that most of these stemmed from scientific misconduct, which may be related to bench science and clinical research. Retracted articles were classified according to the cause of retraction, including documented fraud (data fabrication or falsification), duplicated publication, suspected fraud and other unknown errors and reasons such as authorship dispute and journal error (Fang et al., 2012).

This study focused on the undergraduates of the Faculty of Health Sciences, Universiti Kebangsaan Malaysia Kuala Lumpur Campus (UKM KL), who were involved in their Honours research project. These include all 4th-year students regardless of their study programme and 3rd-year students from the faculty's Environmental Health & Industrial Safety, Nutrition Science and Dietetics study programmes. In 2016, the headline "How serious is academic fraud in top universities in Malaysia?" was featured in Astro AWANI (Ong, 2016). The story described alleged research misconduct by some faculty members of the Faculty of Medicine, Universiti Malaya. The researchers were manipulating figures (images and graphs) within the original Scientific Report paper and across three other publications. This indicates that research fraud is still rampant even in prestigious academic institutions in Malaysia. Such research misconduct incidents can jeopardise the affected institution's name and fame (Panigrahi et al., 2017).

Plagiarism is a well-known misconduct issue and a significant problem in research in the academic community (Helgesson & Eriksson, 2015). A weak basic understanding of plagiarism in students (Yusof & Masrom, 2011) leads to unending cases of plagiarism in Malaysian higher learning institutions. Smith et al. (2007) highlighted several factors contributing to plagiarism: lack of understanding, awareness, personal attitudes, and competence. Plagiarism, fabrication, and falsification can be comparable to lying, cheating, and stealing. This behaviour should not be tolerated in any research university. Based on a study by Olesen et al. (2018), research misconduct still occurs in the research community in Malaysia's institutions of higher education despite the actions taken by the institutions to monitor research misconduct. Although studies on research misconduct have been carried out in various countries due to an apparent outbreak of research fraud, especially in low-middle income countries (e.g., India), such

studies are limited in Malaysia. The Malaysian perspectives mainly were focused on the association between knowledge, attitude, and practice regarding the research misconduct among postgraduate researchers in Malaysian higher learning institutions. Therefore, this research aims to highlight the association between knowledge, attitude, and practice regarding research misconduct among undergraduate researchers of the Faculty of Health Sciences, UKM KL.

METHODOLOGY

Research Design and Sampling

This cross-sectional study was conducted at Universiti Kebangsaan Malaysia, Kuala Lumpur Campus. Universal sampling was employed for study subjects' recruitment. We used the name list of the undergraduate researchers obtained from the academic office as the sampling frame. We recruited those in their 3rd year and 4th year as these two groups of students had been exposed to research work. The sample size calculation was based on the known population of undergraduate researchers (337 students). The significance level was set at 0.05 and the degree of accuracy at 10%. After the 30% of non-response rate was factored in, a total of 98 participants were required. We recruited 4th-year students (n = 49) and 3rd-year students (n = 27) from the Faculty of Health Sciences (FSK), UKM KL. The sample size calculated was 75 students. The inclusion criteria for the subjects were the undergraduate researchers and being registered at the time of enrolment.

Research Instrument

A structured questionnaire was used to obtain information on knowledge, attitude, and practice of research misconduct. For this research, we have adopted the 'Reporting of Suspected Research Misconduct in Biomedical and Behavioural Research' questionnaire by the U.S. Department of Health and Human Services, Office of Research Integrity.

Statistical Analysis

Data were analysed using SPSS statistical software. The level of significance was set as $p < 0.05$. Shapiro-Wilk test was employed to determine the normality of the data. Study subjects' knowledge, attitude, and practice of research misconduct were analysed using descriptive analysis. The knowledge, attitude, and practice of research misconduct were compared between gender and study programmes using an independent sample t-test and one-way ANOVA. The correlations between variables were analysed using Pearson correlation. The association between knowledge and attitude towards the practice of research misconduct among study subjects was analysed using a multiple linear regression test. Results are presented in mean ± standard deviation.

RESULTS AND DISCUSSIONS

The knowledge is categorised and quantified from numerical inputs, where the score of 3 – 4 is low (bad), 5 – 6 is medium, and 7 – 8 is high (good). For attitude, the score of 2 – 3 is low (bad), 4 is medium, and 5 – 6 is high (good). In the category of practices, the score of 2 is low (good), 3 is medium, and 4 – 5 is high (bad). The descriptive statistics (Table 1) showed the mean scores of knowledge, attitude and practice of research misconduct. Both male and female students were categorised as having medium knowledge, a medium score for attitude, and a low score for practice.

Table 1: The mean scores of knowledge, attitude, and practice of research misconduct

Criteria	Male (n = 22)	Female (n = 54)	Overall (N = 76)
Knowledge	6.00 ± 1.85	5.57 ± 1.53	5.70 ± 1.63
Attitude	4.27 ± 0.94	4.13 ± 0.80	4.17 ± 0.84
Practice	2.86 ± 0.77	2.96 ± 0.97	2.93 ± 0.89

Next, an independent t-test was used to compare the knowledge, attitude, and practice of research misconduct between genders. The values are as follows; knowledge ($t(74) = 1.037$, $p = 0.303$), attitude ($t(74) = 0.672$, $p = 0.504$) and practice ($t(74) = -0.458$, $p = 0.649$). Therefore, there were no significant differences in the mean for knowledge, attitude and practice of research misconduct between males and females.

Then, a one-way ANOVA was used to compare the knowledge, attitude, and practice of research misconduct between programs (Table 2). All assumptions of normality on skewness, kurtosis and Shapiro-Wilk statistics were supported. From the analysis, we did not find any significant difference for knowledge [$F(9, 66) = 1.143$, $p = 0.346$], attitude [$F(9, 66) = 1.431$, $p = 0.193$] as well as practice [$F(9, 66) = 0.629$, $p = 0.768$] of research misconduct across the study programmes.

Table 2: The mean scores of knowledge, attitude, and practice according to study programmes

Programme	Knowledge	Attitude	Practice
Biomedical Science	5.93 ± 1.66	3.47 ± 0.94	4.13 ± 0.94
Environmental Health & Industrial Safety	6.00 ± 1.85	3.50 ± 1.20	4.63 ± 0.92
Diagnostic Imaging & Radiotherapy	5.00 ± 2.83	3.00 ± 1.41	4.00 ± 1.41
Dietetics	5.10 ± 1.52	3.00 ± 1.05	3.90 ± 0.74
Nutrition Science	6.10 ± 1.20	3.50 ± 0.70	4.50 ± 0.53
Physiotherapy	4.33 ± 1.53	2.67 ± 1.16	3.33 ± 0.58
Audiology	5.00 ± 2.00	3.33 ± 1.53	3.33 ± 0.58
Speech Science	4.50 ± 0.58	3.75 ± 0.50	4.25 ± 0.50
Optometry	7.00 ± 1.73	3.00 ± 1.00	4.33 ± 0.58
Occupational Therapy	6.00 ± 1.73	4.00 ± 1.73	4.67 ± 0.58

Furthermore, we performed a Pearson correlation analysis to explain the correlation between the knowledge, attitude, and practice of research misconduct. The results (Table 3) showed that knowledge and attitude have a strong and positive correlation ($r(74) = 0.508$, $p < 0.001$), knowledge and practice have a weak negative correlation ($r(74) = -0.139$, $p = 0.23$), while attitude and practice have a medium negative correlation ($r(74) = -0.263$, $p = 0.02$).

Table 3: Correlation between knowledge, attitude, and practice of research misconduct

Variables	Pearson correlation	P (Sig.)
Knowledge and Attitude	0.508	<0.001
Knowledge and Practice	-0.139	0.23
Attitude and Practice	-0.263	0.02

Finally, to determine the association between knowledge and attitude towards the practice of research misconduct among study subjects, a standard multiple regression analysis was performed. Before interpreting the results of the multiple linear regression, several assumptions were evaluated. Normality, linearity and homoscedasticity assumptions of residuals were met. Besides that, according to the Mahalanobis distance, the maximum value shown in Table 4 did not exceed the critical χ^2 of 13.82 at df

= 2 ($\alpha = 0.001$); hence there were no outliers. In addition, there was no multicollinearity, indicated by values of tolerance (< 0.1) and VIF (> 10), as shown in Table 5.

Table 4: Residual statistics (for Mahalanobis distance) of knowledge and attitude accounted for the variability in practice of research misconduct

	Minimum	Maximum	Mean	Std. Deviation	N
Mahal. Distance	0.155	6.859	1.974	1.340	76
Dependent variable: Practice					

With the aid of table 5 also, the equation developed using the coefficients of the regression model would be Practice = 4.059 – 0.004 (Knowledge) – 0.264 (Attitude). This means that after controlling knowledge, a 1 unit increase in attitude will decrease 0.264 units of practice.

Table 5: Coefficients of multiple linear regression of knowledge and attitude accounted for the variability in practice of research misconduct

Model		Unstandardised Coefficients		Collinearity Statistics	
		B	Std. Error	Tolerance	VIF
1	(Constant)	4.059	0.501		
	Knowledge	-0.004	0.069	0.742	1.348
	Attitude	-0.264	0.133	0.742	1.348
Dependent variable: Practice					

Besides, in combination of tables 6 and 7, knowledge and attitude accounted for a non-significant 6.9% of the variation in practice of research misconduct, $R^2 = 0.069$, $F(2,73) = 2.721$, $p = 0.072$. The p-value for knowledge and attitude were also not significant.

Table 6: Multiple linear regression of knowledge and attitude accounted for the variability in practice of research misconduct

	Practices			
	R square	Adjusted R square	Standardised coefficients	Sig.
Knowledge	0.069	0.044	-0.008	0.953
Attitude			-0.259	0.052

Table 7: ANOVA of multiple linear regression of knowledge and attitude accounted for the variability in practice of research misconduct

Model		df	F	Sig.
1	Regression	2	2.721	0.072
	Residual	73		
	Total	75		
Dependent variable: Practices Predictors: (constant), attitude, knowledge				

DISCUSSION

The mean score of the study subjects' knowledge of research misconduct is in the medium category. This means that undergraduate researchers of FSK, UKM KL have a fair amount of knowledge regarding research misconduct. The knowledge encompasses the understanding and ability to identify research misconduct, fabrication, falsification and plagiarism. This is an improvement compared to a study by Yusof & Masrom (2011), which showed that students in Malaysian higher learning institutions have a relatively weak grasp of the basics of plagiarism. Despite that, students still have a long way to go in enhancing their understanding of research misconduct, including how to reduce the instances of research misconduct and ways to increase the reporting of research misconduct should they encounter any.

Next, the mean score for study subjects' attitudes towards research misconduct is also in the medium category. This shows that the undergraduate researchers in FSK, UKM KL have a decent attitude that views research misconduct as an unethical act. This includes reporting research misconduct, finding and reading the university's policy on responding to research misconduct allegations, and implementing good behaviours such as honesty and integrity to reduce the instances of research misconduct. According to Olesen et al. (2018), higher learning institutions should proactively address the availability of their respective research misconduct regulations and policies. When students are continuously reminded of this, they adopt good behaviour and refrain from research misconduct.

Then, the mean score for the practice of research misconduct among study subjects' is in a low category. This is good as it implies that the practice of research misconduct is low among undergraduate researchers of FSK, UKM KL. One way to reduce the practice of research misconduct in Malaysian higher learning institutions is by conducting classes or courses on research ethics, which could elevate students' knowledge and awareness, as reported by the participants of a study by Olesen et al. (2018). Therefore, even if research misconduct were to occur, the issue would have probably been addressed due to reporting research misconduct.

Statistically, there were no significant differences between the mean scores for knowledge, attitude, and practice of research misconduct between all programs under FSK, UKM KL. All programs had almost similar levels of knowledge, attitude, and practice of research misconduct. This implies that all undergraduate researchers of FSK, UKM KL had practically the same approach or exposure by their lecturers when they were taught about research misconduct and its repercussions. Regardless, researchers in all areas of study should avoid research misconduct at all costs (Olesen et al., 2018). A study by Fanelli (2013) reported that male researchers are more likely to engage in research misconduct when compared to female researchers. This was based on data compiled by the U.S. Office of Research Integrity (ORI). However, our study found that both males and females have similar levels of knowledge, attitude, and practice of research misconduct because there was no significant difference between both genders.

Furthermore, in our study, the Pearson correlation showed a positive and strong ($r = 0.508$, $p = 0.001$) correlation between knowledge and attitude, meaning that respondents with higher knowledge will significantly portray a good attitude. These results were supported by a previous study in the Middle East by (Felaefel et al., 2018), which found that a lack of 'prior ethics training' proved to be a significant factor for misconduct of 'circumventing research ethics' and 'fabrication and falsification'. The same study also showed that ethics training significantly influenced attitude through admitting self-reported research misbehaviours. Therefore, ethics training might enhance the knowledge, awareness, and attitude towards research integrity.

In addition, the only negative and weak correlation found in our study was between knowledge and practice ($r = -0.139$, $p = 0.23$). Similar results were also found in a study by Okonta & Rossouw (2013), whereby there was no correlation between scientific misconduct and education in ethics. However, in another study by Adeleye & Adebamowo (2012), it was found that 'one's knowledge of research ethic'

was associated with at least one type of research misconduct. Hence, more studies are needed to clarify further the link between knowledge of research misconduct and its practice.

Besides that, there was a negative and medium correlation between attitude and practice of research misconduct ($r = -0.263$, $p = 0.022$), meaning that participants with a good attitude would significantly avoid intentional research misconduct. A contrasting perspective was shown in a study by Okonta & Rossouw (2013), which proposed that individuals who perceived a high prevalence of misconduct in the workplace might lower their moral threshold for committing an offence because they perceived that everybody else was committing similar offences.

Finally, a multivariate analysis by multiple linear regression was used to determine the association between both independent variables (knowledge and attitude) and the dependent variable (practice). Table 6 showed that only 6.9% of the variance in the practice of research misconduct are affected by knowledge and attitude ($R^2 = 0.069$). Hence, this exhibits a weak association between both factors. In contrast, a previous study in Nigeria demonstrated a stronger association whereby 22.0% of the participants admitted to at least one of the fabrication, falsification, and plagiarism practices due to knowledge gaps in research ethics and the pressure to publish their papers to get promoted (Adeleye & Adebamowo, 2012).

Overall, there were several limitations in our findings. These include: (i) the reporting of research misconduct practice may be biased because the participants may not answer the questions honestly due to specific expectations; (ii) the generalisation of samples due to universal sampling may not be as accurate when compared to stratified random sampling; (iii) the correlation and regression analysis conducted may not be able to accurately determine the causal factors among the variables; (iv) the comparison of our findings with different studies may not be as comprehensive because of the different methodologies and questionnaires employed; (v) this study only involved the undergraduate researchers of FSK, UKM KL which cannot be generalised to the whole population of undergraduate researchers in Malaysian higher learning institutions, due to the differences in learning environments; (vi) the questionnaire adapted and modified in this study, which was the ‘Reporting of Suspected Research Misconduct in Biomedical and Behavioural Research’ by the U.S. Department of Health and Human Services, Office of Research Integrity, mainly consisted of open-ended questions. The students’ responses were then categorised into similar themes or meanings. Thus, there may be a generalisation of responses from students to make it a quantitative study and perform the necessary analysis.

CONCLUSION

This study examined the knowledge, attitude, and practice (KAP) of research misconduct among undergraduate researchers of the Faculty of Health Sciences (FSK), UKM KL. It can be concluded that: (i) the study subjects’ had medium levels of knowledge and attitude, with low levels of practice in research misconduct; (ii) there were no statistically significant differences between the mean scores of knowledge, attitude, and practice of research misconduct in study subjects’ regardless of gender and study programmes; (iii) knowledge and attitude showed a positive and strong correlation; (iv) knowledge and practice showed a negative and weak correlation; (v) attitude and practice showed a negative and medium correlation; (vi) 6.9% of the variance in the practice of research misconduct are affected by knowledge and attitude, making this a weak association.

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