

Knowledge and Awareness of Diabetes Mellitus as a Risk Factor of Colorectal Cancer among Health and Medical Sciences Students in Kuantan, Pahang

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Abstract

Studies have shown that there is a strong association between diabetes mellitus and colorectal cancer. The risk of colorectal cancer is reported to be increased by 19% for people with diabetes mellitus. However, the knowledge and awareness regarding diabetes mellitus as a risk factor for colorectal cancer in the local community in Pahang was yet to be determined. Therefore, to start with, this study aimed to evaluate the level of knowledge and awareness of diabetes mellitus as a risk factor for colorectal cancer among IIUM Kuantan students, the sociodemographic characteristics contributing to the levels and the correlation of the level of knowledge and awareness. A total of 127 IIUM Kuantan students participated in this cross-sectional study by responding to a self-administered questionnaire that has been developed using the available literature on the association of diabetes mellitus and colorectal cancer. The questionnaire was first validated (I-CVI=1.00), and pilot study was also conducted to evaluate the reliability of the knowledge ($\alpha=0.788$) and awareness ($\alpha=0.795$) items using Cronbach's alpha value. Then, data was collected throughout April 2022 by distributing the questionnaire through an online platform among the targeted participants. The results are analyzed with non-parametric tests: Mann-Whitney U and Kruskal Wallis test using the SPSS. Statistical significance was set at $p<0.05$ at a 95% confidence level. This study revealed a poor level of knowledge ($n=82$, 64.6%) and awareness ($n=72$, 56.7%) of diabetes mellitus as a risk factor of colorectal cancer among the IIUM Kuantan students. There was a moderate positive correlation between the level of knowledge and awareness of IIUM Kuantan students on diabetes mellitus as a risk factor of colorectal cancer ($r=0.608$, $p<0.001$). These levels of knowledge and awareness, however, were not significantly associated with any sociodemographic variables. Therefore, this study proves that there is a need to improve the knowledge and awareness of the IIUM Kuantan students. Hence, the university could take action by organizing programs to spread the knowledge on this issue to the students, in order to enhance their awareness of the risk of colorectal cancer by diabetes mellitus.

Keywords

Diabetes mellitus, colorectal cancer, risk factor of colorectal cancer, diabetes mellitus complications

Introduction

Diabetes mellitus and colorectal cancer are two non-communicable and heterogenic diseases that are the major public health concern in Malaysia. Diabetes mellitus is characterized by a significant elevated plasma glucose level that occurs either due to the destruction of pancreatic beta-cells or insulin insensitivity. Globally, the International Diabetes Federation estimated an increase of 51% in the prevalence of diabetes mellitus from 2017 to 2045^[1]. The prevalence of diabetes mellitus in Malaysia has shown an increasing pattern from 13.4% in 2015 to 18.3% in 2019.^[2] On the other hand, colorectal cancer is defined as the abnormal growth of cells in any region from the colon to the rectum. This cancer can either be sporadic, inherited or even familial.^[3] In 2012, the Global Cancer Observatory (GLOBOCAN) ^[4], estimated that this type of cancer is Malaysia's third-highest cancer in men, and second in women. However, in 2020, GLOBOCAN recorded colorectal cancer as the second most frequent cancer in Malaysia, for both sexes, with incidence of 15.4% for males and 11.9% for females. ^[5] This shows an increasing trend of this cancer in men by less than 10 years time.

Concerningly, diabetes mellitus is believed to have a strong association with colorectal cancer because both diseases seem to share some metabolic linkage such as the condition of hyperglycemia and hyperinsulinemia and common risk factors like obesity and ageing.^{[6][7]} Moreover, a large prospective cohort study ^[8] also supports the strong association between diabetes mellitus and colorectal cancer whereby the risk of colorectal cancer increased by 19% for diabetic patient as compared to non-diabetic patient. Antidiabetic medications like insulin and sulfonylurea are also found to possibly increase the risk of colorectal cancer.^[9] In fact, a meta-analysis ^[10] suggested that diabetes mellitus is an independent risk factor for colorectal cancer. Hence, the identified strong associations could depict a pattern where an increase in the incidence of diabetes mellitus may eventually increase incidence of colorectal cancer.

The increased risk of colorectal cancer by diabetes mellitus is worrying because, the prevalence of both diseases is already at a high percentage in the country and globally. If close attention is not given to the association of these diseases, they will result in a serious burden to the world. Sadly, the community seems to have a low level of knowledge and awareness of the risk of colorectal cancer by diabetes mellitus. A study in Klang Valley on colorectal cancer ^[11] shows only a minority of respondents know diabetes as the risk factor of colorectal cancer. Similarly, when conducting a study on colorectal cancer ^[12], Aga et al found that majority of the sciences students at the university of Jeddah do not know and were not aware that diabetes mellitus is a risk factor of colorectal cancer. But, to date, no direct study on the knowledge and awareness has been done specifically towards the increased risk factor of colorectal cancer by diabetes mellitus. Instead, many studies only include this issue as one of the items in their questionnaire on other areas of study. Therefore, this study was conducted to evaluate the knowledge and awareness regarding diabetes mellitus as a risk factor of colorectal cancer. To start with, this study involved only students of IIUM Kuantan who have a science and medical background. This will serve as an important benchmark to what extent the awareness and educational campaign should be initiated by the local authority to reduce the prevalence of diseases.

Methodology

Ethical Approval

The ethical approval was requested from the Kulliyah Postgraduate and Research Committee (KPGRC) of Kulliyah Allied Health Sciences approval from IIUM Research Ethical Committee (IREC) [IREC 2022-KAHS/DBMS/11] before the research was conducted. Respondents' information was kept private and confidential throughout the research.

Study Design and Subject Recruitment

The cross-sectional study was conducted by distributing a self-administered digital questionnaire within the International Islamic University Malaysia, Kuantan Campus (IIUMK). This research targeted the population of undergraduate students from the six faculties in IIUMK, applicable to male and female

undergraduates' students from year 1 to year 4 using convenience sampling. The sample size for this research was calculated using the single proportion formula taking into consideration the expected population proportion from a previous study by National Health and Morbidity Survey [2] and the significant value from most previous studies. Substituting the values into the formula:

$$n = \frac{Z_{1-\alpha/2}^2 p(1-p)}{d^2}$$

n = Sample size

$Z_{1-\alpha/2}$ = In majority studies, significant value of p , $p < 0.05$, hence 1.96 is used in this

formula

p = Expected proportion in population from previous study 0.257 as the prevalence of diabetes in Kuantan state, 0.257 is used in this formula

d = precision is decided as 0.08

hence, yielding $n = 115$

However, 10% of participants were initially expected to drop out of the studies, which is approximately 12 participants. Therefore, the total number of participants for this study was 127.

Questionnaire Development

A questionnaire has been developed by referring to the literature review made for this study using the domains included in the review of 'metabolic links of diabetes mellitus and colorectal cancer'. The questionnaire was designed in English language. Overall, there are 27 items in the questionnaire. Section A consisted of 7 items regarding the socio-demographic information of the respondents. Meanwhile, section B contains 10 items on the knowledge of diabetes mellitus as a risk factor of colorectal cancer and the answer options provided for this part are 'True', 'False', and 'Not sure'. Lastly, the 10 items in Section C identified the awareness of respondents on this issue. Likert scales are used for this part, consisting of 1 to 5 scale, ranging from 'strongly disagree' to 'strongly agree' options. The items for Section A and B under their respective domains are presented in Table 1.

Table 1: Questionnaire Domains and Items.

No.	Items
Knowledge Items	
Common Risk Factors	
1.	Diabetes mellitus and colorectal cancer have several common risk factors such as unhealthy lifestyles, age, sex and race.
2.	Obesity increases risk factors of both diabetes mellitus and colorectal cancer.
3.	Older adults are generally more prone to develop diabetes mellitus and colorectal cancer.
Metabolic Associations	
4.	Diabetes mellitus may increase one's risk towards development of colorectal cancer through several metabolic pathways (such as insulin-like growth factor (IGF) pathway).
5.	High glucose level in the blood (hyperglycemia) inhibits death of cancer cells through apoptosis.
6.	High insulin level in blood (hyperinsulinemia) leads to cancer cells proliferation.
7.	The increase of insulin-like growth factor 1 in diabetes mellitus does not lead to cell proliferation. #
Medication Links	

8. Antidiabetic medication is one of the factors that lead to colorectal cancer.
9. Exogenous insulin and glibenclamide are antidiabetic medications that decreases risk of colorectal cancer. #
10. Metformin is antidiabetic medication that has no potential to cause colorectal cancer.

Awareness Items

General Awareness

11. I think many types of cancer can be linked to diabetes mellitus.
12. I realize that colorectal cancer has high prevalence in Malaysia.
13. I have heard about the increased risk of colorectal cancer by diabetes mellitus before.

Common Risk Factors

14. I believe that diabetes mellitus and colorectal cancer have some common risk factors.
15. I realize obesity is the risk factor of diabetes mellitus and colorectal cancer.

Metabolic Associations

16. I have read or learned about the metabolic pathways in diabetes mellitus.
17. I am aware that diabetes mellitus can be metabolically linked to colorectal cancer.
18. I do realize the effect that insulin-like growth factor 1 (IGF-1) has on colorectal cancer.

Medication Links

19. I believe that some antidiabetic medications may increase the risk of colorectal cancer.
20. I am aware that exogenous insulin may elevate the risk of colorectal cancer.

Note Negative items are identified with ‘#’

Questionnaire Validation and Pilot Study

The questionnaire was validated by experts involving five practicing medical officers. The validations were then analyzed using the content validity index (CVI).^[13] The score for the scale-level content validity index based on the universal agreement method were also used to calculate the content validation index.^[14] The item-level content validity index (I-CVI), scale-level content validity based on averaging method (S-CVI/Ave), scale-level content validity index based on universal agreement (S-CVI/UA) and average proportion of items judge as relevant by the experts were all 1.00. Hence, all items are retained in the questionnaire as all items achieved 100% universal agreement between the five experts.

Next, a pilot study was conducted to ensure the reliability of the self-administered questionnaire items. using Cronbach’s alpha in Statistical Package for Social Sciences (SPSS). The pilot study obtained acceptable Cronbach’s alpha value for both knowledge and awareness section of the questionnaire, 0.788 and 0.795 respectively.

Statistical Analyses

The data collected were analyzed using SPSS. Both descriptive and inferential statistics were performed on the data. The normality of data was first analyzed by observing the shape of the histogram, comparing means, and skewness before further interpretation could be done. Thereafter, the descriptive frequency was analyzed to determine the level of knowledge and awareness. For section B and C, correct answers were given 1 point while incorrect and uncertain answers were given 0 point. Based on the widely adopted Bloom’s cut-off points ^[15], the points in between 80-100% (8-10 points) were categorized into ‘high’, 60-79% (6-7 points) into ‘moderate’ and (≤ 5 points) into ‘poor’.

Meanwhile, to determine the sociodemographic characteristics that contribute to the level of knowledge and awareness, non-parametric: Mann-Whitney U and Kruskal-Wallis tests, were used. Finally, Spearman’s correlation was used to get a better interpretation of the linearity of the correlation analysis between knowledge and awareness of diabetes mellitus as a risk factor of colorectal cancer among IIUMK undergraduate students.

Results

Sociodemographic Characteristics of Respondents

The frequency and percentages for each of the sociodemographic characteristic's variables are presented in Table 2. A total of 127 respondents were able to be obtained. The mean of the respondents' age are 22 years old ($\bar{X}$ =22.00). Only one respondent (n=1, 0.8%) that were aged under 20 years old while majority of the respondents are of the age 23 (n=41, 32.35. Besides, the questionnaire was responded mostly by female (n=105, 82.7%), while only one out of five respondents are male (n= 22, 17.3%). Furthermore, the distributions of the respondents are highest for Kulliyyah of Pharmacy (n=27, 21.3%), and from the B40 category (n=51, 40.2%).

As for medical history, only one responded having a personal medical history of type 1 diabetes mellitus (n=1, 0.8%) while all other respondents have neither diabetes mellitus nor colorectal cancer (n=126, 99.2%). On the other hand, there were some respondents who have family member that has medical history of type 2 diabetes mellitus (n=42, 33.0%), and several respondents for type 1 diabetes mellitus (n=5, 3.9%) and colorectal cancer (n=2, 1.6%). However, majority of respondents do not have any family member with diabetes mellitus nor colorectal cancer (n=59 ,46.5%) and there are some that do not know the type of diabetes mellitus that their family member has (n=19, 15.0%).

Table 2 Distribution of Responds on Sociodemographic Characteristics (n=127)

Sociodemographic Characteristics	Frequency	Percentage (%)
Age		
19	1	0.8
20	23	18.1
21	14	11.0
22	37	29.1
23	41	32.3
24	11	8.7
Gender		
Male	22	17.3
Female	105	82.7
Kulliyyah of study		
Kulliyyah of Allied Health Sciences	23	18.1
Kulliyyah of Dentistry	24	18.9
Kulliyyah of Medicine	19	15.0
Kulliyyah of Nursing	17	13.4
Kulliyyah of Pharmacy	27	21.3
Kulliyyah of Sciences	17	13.4
Year of study		
Year 1	25	19.7
Year 2	21	16.5
Year 3	37	29.1
Year 4	44	34.6
Family financial background		
B40 (total household income less than RM 4,850)	51	40.2
M40 (total household income between RM 4,851 and RM10,970)	47	37.0
T20 (total household income more than RM 10,971)	29	22.8
Do you have personal medical history of the diseases below?		
Type 1 diabetes mellitus	1	0.8
Type 2 diabetes mellitus	0	0.0
Colorectal cancer	0	0.0
None of the above	126	99.2
Do any of your family member has medical history of the diseases below?		
Type 1 diabetes mellitus	5	3.9
Type 2 diabetes mellitus	42	33.0

Diabetes mellitus (but I do not know which type)	19	15.0
Colorectal cancer	2	1.6
None of the above	59	46.5

Note: The total of highest frequency for each item is highlighted in bold

Scores of Knowledge and Awareness on Diabetes Mellitus as A Risk Factor of Colorectal Cancer

The level of knowledge and awareness of the targeted respondents are identified as the first objective of the study. Table 3 shows the descriptive frequencies of the level of knowledge and awareness of diabetes mellitus as a risk factor of colorectal cancer among IIUM Kuantan students. It can be observed that the majority of the IIUM Kuantan students have poor level of knowledge (n=82, 64.6%) and awareness (n=72, 56.7%) on the issue.

Table 3 Scores of Responds on Knowledge and Awareness Sections.

Scoring Level	Frequency	Percentage (%)
Knowledge		
High	11	8.7
Moderate	34	26.8
Poor	82	64.6
Awareness		
High	32	25.2
Moderate	23	18.1
Poor	72	56.7

Note: The total of highest frequency for each section is highlighted in bold

Knowledge on Diabetes Mellitus as a Risk Factor of Colorectal Cancer

The knowledge section of the questionnaire consists of items that are divided according to three domains. The results for the distributions of respond and the trend of correct answers on the knowledge section are presented in Figure 1. It can be observed that majority of the respondents selected 'True' for the positive items in the first domain: common risk factors. As for the metabolic associations domain, most respondents selected 'Not sure' for the positive items. However, majority answered 'True' and there were none who selected 'False' for the item 'Diabetes mellitus may increase one's risk towards the development of colorectal cancer through several metabolic pathways (such as insulin-like growth factor (IGF) pathway). Meanwhile, for the negative item, selection of 'Not sure' were the highest (n=90, 70.9%).

On the other hand, the selection of 'True' for the negative item in the medication links domain is the second highest (n=22, 17.3%), while only few (n=7, 5.5%) responded 'False'. However, the number of respondents who selected 'Not Sure' (n=98, 77.2) is more significant. The distribution for positive items in the domain shows high selection of 'Not sure', followed by 'True' and 'False'. However, it can be noted that one of the positive items: 'Antidiabetic medication is one of the factors that lead to colorectal cancer' has the highest responds of 'False' (n=21, 16.5%) as compared to the other positive item.

Awareness on Diabetes Mellitus as a Risk Factor of Colorectal Cancer

Similarly, the items for awareness on diabetes mellitus as a risk a factor of colorectal cancer were constructed from few domains and the trend of correct answers are presented in Figure 1. Regarding the general awareness of the increased risk factor of many types of cancer by diabetes mellitus, majority of respondents selected 'Neutral' (n=45, 35.40), however a greater number of respondents selected 'Strongly agree' and 'Agree', if combined. As for the domain of metabolic associations, majority selected 'Strongly agree' and 'Agree' for the first two items which are general statements on the metabolic associations. However, most of the respondents selected 'Neutral' (n=58, 45.7) as compared to either 'Strongly agree' or 'Agree' for the item 'I do realize the effect that insulin-like growth factor 1 (IGF-1) has on colorectal cancer'. Lastly, both items on the medication links domain have highest responds of 'Neutral' as compared to other scales.

Association of Sociodemographic Characteristics on Knowledge

The second objective of the study is to identify the associations of the sociodemographic characteristics and the level of knowledge and awareness of the IIUM Kuantan students on the increased risk of colorectal cancer by diabetes mellitus. The normality test showed that the normality assumption was not met. Furthermore, there is no significant association between the knowledge of the respondents with any of the independent variable: age ($p=0.167$), gender ($p=0.682$), kulliyah of study ($p=0.558$), year of study ($p=0.621$), family financial background ($p=0.530$), personal medical history ($p=0.113$) and family member medical history ($p=0.366$). Most of the groups of the variables has mean of 4.00 to 5.00 except for those of age 24 ($\bar{X}=3.80$, $M=4.00$), Kulliyah of Nursing students ($\bar{X}=5.29$, $M=5.00$), and those who are not sure of the type of diabetes mellitus in their family member ($\bar{X}=5.82$, $M=6.00$). In addition, there are few groups of variables: age 19, personal medical history of type 1 diabetes mellitus, and family member medical history of colorectal cancer has no variation in the selection of responds.

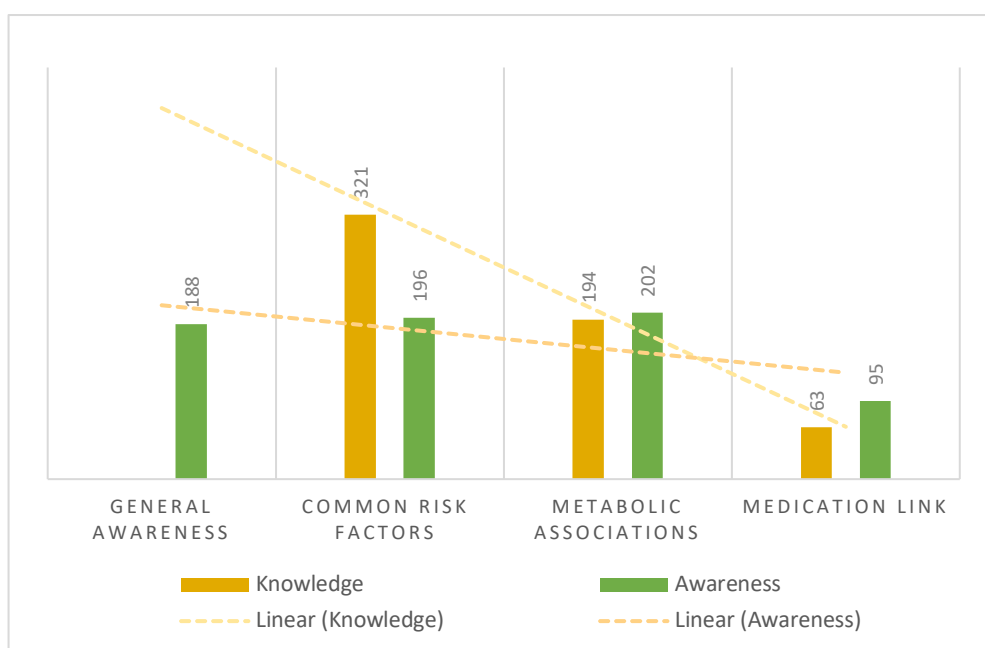


Figure 1: Trend of Correct Answers for Domains in Knowledge and Awareness Sections

Association of Sociodemographic Characteristics on Awareness

There is also no significant difference in between the level of awareness among the IIUM Kuantan students with their sociodemographic characteristics: age ($p=0.403$), gender ($p=0.536$), kulliyah of study ($p=0.914$), year of study ($p=0.272$), family financial background ($p=0.822$), personal medical history ($p=0.114$) and family member medical history ($p=0.263$). Majority of the groups of variables has mean in between 5.00 and 6.00 except for age 24 ($\bar{X}=4.40$, $M=4.00$), Kulliyah of Dentistry students ($\bar{X}=4.83$, $M=4.00$), fourth year students ($\bar{X}=4.83$, $M=4.50$) and those who have family member medical history of type 2 diabetes mellitus ($\bar{X}=4.78$, $M=4.00$).

Correlation Between Knowledge and Awareness on Diabetes Mellitus as a Risk Factor of Colorectal Cancer

The third objective of this study is to determine the correlation between knowledge and awareness on diabetes mellitus as a risk factor of colorectal cancer. The Spearman's test is used as the correlation analysis since the normality assumption is not met. The results are presented in Table 4. The analysis shows moderate positive correlation between the level of knowledge and awareness among the respondents. In addition, there is significant association between the knowledge and awareness of the IIUM Kuantan students on diabetes mellitus as a risk factor of colorectal cancer ($p<0.001$).

Table 4. Correlation between Knowledge and Awareness Scores (n=127)

Variables	Correlation coefficient, r	p-value
Knowledge and Awareness Scores	+0.608	<0.001

Discussion

The first objective of the study is to identify the level of knowledge and awareness of diabetes mellitus as a risk factor of colorectal cancer development. The overall knowledge (n=82, 64.6%) and awareness (n=72, 56.7%) of majority of the participants on diabetes mellitus as a risk factor of colorectal cancer is poor. This is consistent to a study that found out that ^[12], out of 271 participants of their study on knowledge of colorectal cancer and its associated risk factors, majority of them do not know that diabetes is a risk factor of colorectal cancer (n=189, 50.8%). Furthermore, another study on the knowledge and awareness of colorectal cancer among general public of Kuwait ^[16] also resulted in least out of 675 participants have the knowledge of diabetes as risk factor of colorectal cancer (n=124, 18.4%). In addition to that, a study in Klang Valley ^[11], Malaysia also showed that only 32.4% of participants responded that having diabetes is a risk factor of colorectal cancer.

However, it is notable the findings on the trend of correct and wrong answers in knowledge and awareness sections where majority respondents answered correctly for the domain common risk factors and for the items that are more general may suggest that the participants have the knowledge and awareness on each disease separately but lack of knowledge and awareness on the association of both diseases. The questionnaire may have also prompted items that require deeper knowledge on the pathophysiology and treatment of both diseases. Therefore, it is possible that the students were unable to answers the items correctly as they may have only learned the basic knowledge of this matter and were not exposed with the association between the diseases since they are undergraduate students. Hence, the outcome of this study enhances the need to disseminate the information and awareness on this issue in the university and public through social media.

The second objective of the study is to determine the sociodemographic characteristics that contribute to the knowledge and awareness of diabetes mellitus as a risk factor of colorectal cancer. It can be concluded that there is no significant difference in the level of knowledge and awareness between the groups of any of the sociodemographic characteristics. Hence, in this study, no sociodemographic characteristic contributed the level and knowledge and awareness on diabetes mellitus as a risk factor for colorectal cancer. Consistently, a study ^[12] found that the level of knowledge and awareness of the participants on having diabetes as an associated risk factor of colorectal cancer is also independent to gender and courses of study. This may be due to the fact that the participants who are students received the same exposure towards knowledge in the university regardless of their gender.

Furthermore, the students might learn the same basic knowledge even though they are from different study courses, as they are all undergraduate students, and all of the courses are medical and science related. It can be seen in a study on type 2 diabetes mellitus including its complication that ^[17] the level of knowledge and awareness among the students are significantly associated with courses of study. Students from Family and Consumer Science and Psychology had more knowledge and awareness of diabetes than Business Administration students, which according to the researcher, could be due to the different focus of the courses. The students of Family and Consumer Science and Psychology might learn about diseases, and healthy lifestyles while Business and Administration Students does not have exposure to health issue. Hence, in this study, the depth of their knowledge and awareness in this issue is generally the same, possibly, because all courses include subjects that are related to health and illness.

Meanwhile, a study ^[18] discussed that participants who have experience cancer or have family member that has cancer have more knowledge and awareness of the risk factors of colorectal cancer possibly due to having heard about the diseases from others. However, this study may not find any significant association

with the personal and medical history of diabetes mellitus or colorectal cancer because all except one participant does not have any history of diabetes mellitus nor colorectal cancer and majority of the respondents do not have family members that experience the diseases. Therefore, most of the participants might not be familiar of the diseases as they have not experienced or heard about the diseases from their relatives. Nevertheless, there are no other studies that reported the comparison of the sociodemographic characteristic and the level of knowledge and awareness of this matter directly as many studies only have one item in their questionnaire that address diabetes mellitus as one of the risk factors of colorectal cancer and their analysis of the significance value is as a total of all the items in the questionnaire. Hence, since it is noted that the level of knowledge and awareness of the participants are not dependent to their gender, age, level of study, courses of study, financial family background nor personal and family medical history of the disease, it is important that the spread of information and awareness of the increased risk factor of colorectal cancer through diabetes mellitus should be towards all walks of life.

Lastly, the study aimed to determine the correlation between the level of knowledge and awareness of diabetes mellitus as a risk factor of colorectal cancer among the IIUM Kuantan students. As expected, there was a moderate strong positive correlation between both variables. This shows that awareness increases as knowledge increases. Therefore, it is very important for the public to have proper knowledge of colorectal cancer and diabetes mellitus as its associated risk factor, for them to be aware of it and practice what it takes to prevent themselves from having both diseases.

Limitation of Study

Although the research purposes have been met, there are some limitations of this study that must be considered. The major limitation of this study is the sampling method. This study was unable to conduct random sampling as there were not enough time to approach the university authorities to collect the list name of the students applicable for the study in the university. Not only that, but stratified convenience sampling was also difficult to be achieved concerning the limited time between the pilot study of the questionnaire and the data collection. Although, effort was made to make sure that the participants of the study are distributed at its best among the six kulliyahs and the four level of study, the study cannot be generalized to the population as normality assumption was unable to be met. The results of the study are only representing the study samples. However, the findings of the study are still not less important as it may set a guideline for future research and for awareness campaign in the university on diabetes mellitus as a risk factor of colorectal cancer.

Next, the limitation of this study is that there is lack of study conducted on the knowledge and awareness of diabetes mellitus as a risk factor of colorectal cancer. Meanwhile, this issue is only included as part of the items when researching on the complications of diabetes mellitus or risk factors of colorectal cancer in general. Therefore, it was a challenge to compare the study to the available or existing results of other studies for a better understanding of the findings in this study. Furthermore, this limitation is also the reason that the questionnaire for this study need to be developed as there are no previous research tool to be adapted or integrated.

Conclusion

In conclusion, since the level of knowledge and awareness of diabetes mellitus and colorectal cancer among the study sample are poor, the findings of this study manifest that there is a need for campaigns to educate and make the public aware of the risk of colorectal cancer from diabetes mellitus. This is with hope that the campaign may increase the knowledge and awareness towards this issue and avoid themselves from the modifiable risk factors of diabetes mellitus, which at the same time can prevent the increased risk of colorectal cancer.

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