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FOREWORD

The primary aim of research endeavours is to unravel the mysteries of the unknown, uncovering insights that can revolutionise our understanding of the world, paving the way for innovation, progress, and the betterment of society. Thus, as we embark on the inaugural issue of the International Review of Interdisciplinary Sciences (IRIS), it is fitting that our cover story spotlights the profound work of Ts. Dr. Liew is exploring Luteolin's potential as an anti-cancer compound. Dr Liew's groundbreaking research is centred on developing an efficacious anti-cancer compound with minimal side effects, concentrating on Luteolin—a flavonoid found in various botanical sources. His innovative research manipulates polymers to augment the solubility and bioavailability of Luteolin, aiming for precise drug delivery to breast cancer cells, marking a significant advancement in combating multi-drug resistant cancer cells. Dr. Liew's extensive academic, industrial, and community service background has earned him national and international acclaim, underscoring his unwavering dedication to advancing cancer therapies for the betterment of society.

The Editorial Board's dedication shines through in their relentless pursuit to curate the second issue of IRIS, aiming to foster a journal that not only ignites the passion for exploration among emerging scholars but also constructs a vibrant platform for the interchange of ideas to benefit society. Embracing a diverse and interdisciplinary perspective.

In light of this, I invite readers to delve into this issue and explore the intriguing studies pursued by passionate young researchers across various institutions and regions. Featured in this issue are studies such as "Factors Associated with the Utilization of Visual Inspection with Acetic Acid in Nepal," "The Future of Metformin in Treating Lung Cancer," and "Bioprocess: Mapping the Road to Environmental Preservation."

Lastly, I encourage you to share a copy of IRIS with those who could benefit from it or contact us to explore potential contributions. IRIS has the potential to impact the field significantly, and we would be delighted to collaborate with individuals who share our vision. Your support is essential to our success, and we look forward to working together to achieve our shared goals. Thank you.

YBhg. Prof. Dr. Zabidi Azhar Mohd Hussin PSK
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Cancer cell

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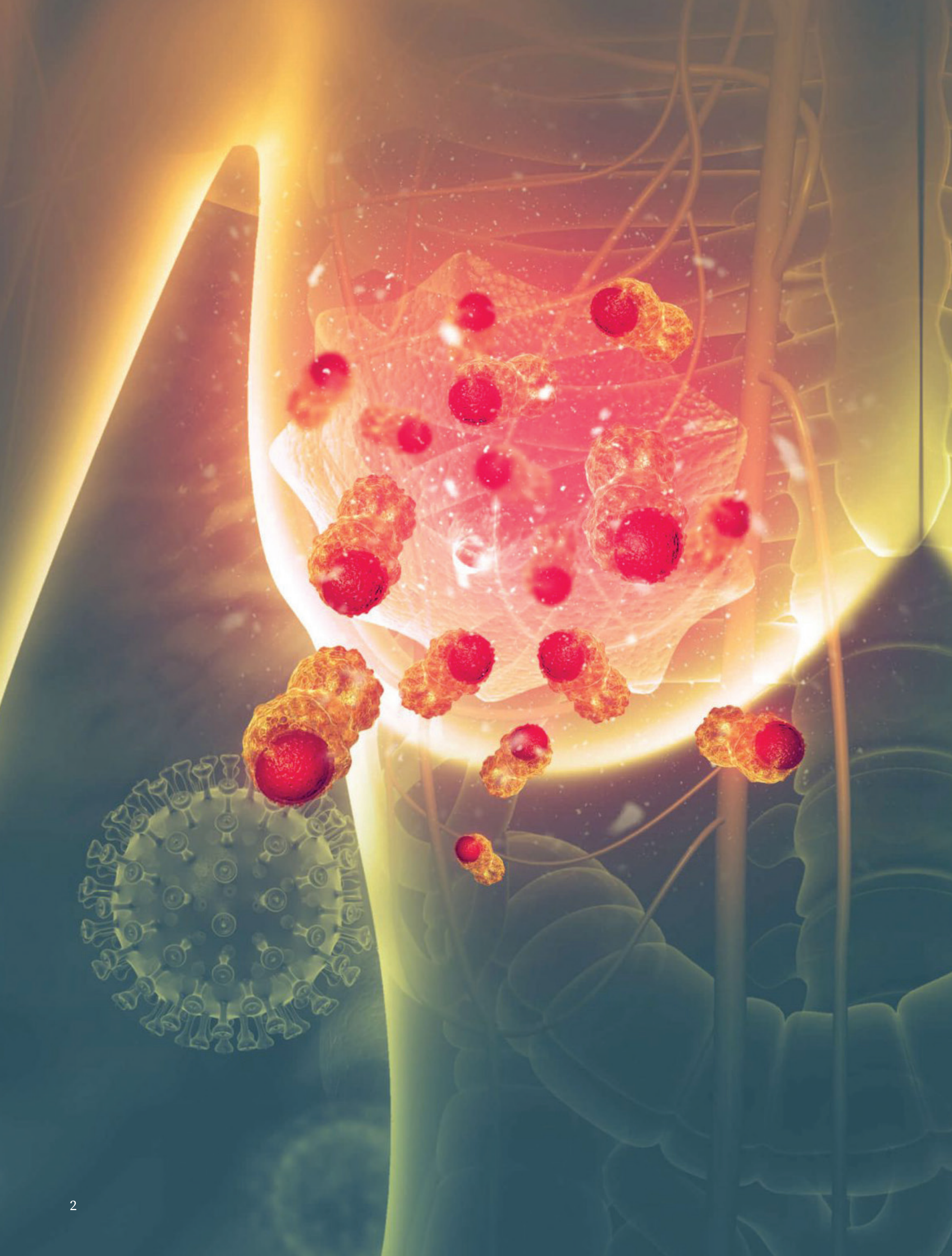


Looking at Luteolin:The Anticancer Compound

by Theresa Stephen

According to the Breast Cancer Foundation Malaysia, 1 in 19 women in Malaysia are at risk of breast cancer with Chinese women at the highest risk followed by Indian women and Malay women. Breast cancer is also the second leading cause of cancer deaths among women worldwide, right after lung cancer.

Cancer is a group of cells that have grown inexplicably, damaging healthy tissues surrounding it. This group of cancer cells would form a lump, which is called a tumour. A malignant tumour present in the breast is known as breast cancer.

In an effort to contribute to breast cancer research, University of Cyberjaya's Head of Pharmaceutical Technology and Industry Department, Associate Professor. Ts. Dr. Liew Kai Bin and his team work on discovering the anticancer property of Luteolin, originally found in plants such as the species Reseda luteola.

> "Luteolin is a plant extract that can be found in many plants such as fruits, vegetables, and medicinal herbs. It is a natural flavonoid with anti-cancer properties. However, its use is limited due to its solubility and bioavailability. It would be a waste if we do not explore the potential of the natural extracts by overcoming its limitations," he says.

He was also driven to conduct this research as many anti-cancer drugs used today in chemotherapy are either chemically synthesised or extracted from plants with high side effects. The high risk of serious side effects often time complicates the chemotherapy process. The goal is to develop a compound with high anti-cancer effects and low side effects.

His research titled, "Development of Luteolin Loaded Folate Decorated Vitamin E TPGS—Poloxamer Long Circulating Micelle for Multi-Drug Resistant Breast Cancer Smart Targeting", investigates the effects of different concentrations of Vitamin E TPGS (a synthetic water-soluble version of vitamin E) and other polymers in enhancing the solubility and absorption of Luteolin to better target highly resistant forms of breast cancer cells.

Luteolin is a yellow, crystalline polyphenolic flavonoid that is present in fruits and vegetables like apples, carrots, celery, cabbage, green peppers, and dandelion leaves. Aside from its use in modern medicine, herbal traditions around the globe also use luteolin-rich plants to strengthen the immune system, relieve inflammation, and combat cancer.

As luteolin has limited solubility and low bioavailability, its extract is not clinically appealing to become a practical product. As such, Dr. Liew's research tries to manipulate the extract using 2 polymers, Vitamin E TPGS and Poloxamer, to form nanomicelles. Nanomicelles are used in the process of targeted drug delivery in the body which allows a greater depth of tissue penetration and increases the bioavailability of the drugs. When the nanomicelles are encapsulated with luteolin, the extract's solubility and bioavailability become greatly enhanced.

"Breast cancer cells are full of folate receptors. By including folate in the nanomicelles, it would increase its ability to perform targeted drug delivery to breast cancer cells. As micelles are nano-sized, they are easily solubilised and absorbed into the body," says Dr. Liew.

Needless to say, the process is more complex than that. Cancer cells have their own defence mechanism to reject foreign particles such as anti-cancer drugs from their membrane to protect them from being dissolved. This makes the anti-cancer agents less effective in killing cancer cells.

This is where the effectiveness of polymers – Poloxamer and Vitamin E TPGS – come to play. Poloxamer is reported to accumulate in multi-drug resistance cancer cells which increases the targeting and success rate of cancer treatment. Vitamin E TPGS on the other hand has also been reported to increase the circulating time inside the body and can also overcome multi-drug resistance. With the encapsulation of Luteolin in Vitamin E-TPGS Poloxamer micelle, the solubility and bioavailability can be enhanced and the accumulation in multi-drug resistance cancer cells can be increased.

While it is important to produce a drug that can kill cancer cells, it is important to note the side effects it may cause. For a medicine to work, its molecules must bind to the right receptor to exert pharmacological action. For example, when a person who suffers a heart-related disease takes their prescribed medicine, it should be able to bind to the heart or the blood vessel controlling the dilation and constriction. However, when the molecules bind to other receptors in other organs, the person would then suffer side effects.

The anti-cancer medicines in the market work like non-specific missiles that hit both cancer cells as well as healthy cells, causing side effects. Therefore, there is a need for smart targeting drugs, a newer generation of medicine that is able to target cancer cells more specifically.

In 2021, Dr. Liew managed to secure a Fundamental Research Grant Scheme (FRGS) award of RM144,300 from the Ministry of Higher Education for his research. His co-researchers include Associate Professor Dr. Shairyzah Ahmad Hisham, Deputy Dean of Academic Affairs of the Faculty of Pharmacy, Professor Dr. Shamima Abdul Rahman, Postgraduate Coordinator of the Faculty of Pharmacy, Associate Professor Dr. Chan Siok Yee from Universiti Sains Malaysia, Dr. Masriana Hassan from Universiti Putra Malaysia and Dr. Riyanto Teguh Widodo from University Malaya.

> "Besides producing a scientific publication, I hope to produce a new practical natural-based anti-cancer product that can be used in the clinical setting. As cancer is still a major healthcare concern that takes the lives of many every year, I hope to be able to produce a highly effective, low-cost product with minimum side effects made accessible for patients," says Dr. Liew.

"We have completed the first phase of the research which is the formulation stage. The next phase would be to test the product in cell lines and animal models. We have partnered with the Malaysian Nuclear Agency to provide us with its facilities to conduct the animal study which will take 1 year to complete. If the second phase is completed with positive outcomes, there is a high possibility that this product can enter into the clinical phase for cancer prevention. We're confident that the product will make a great impact on anti-cancer therapy and look forward to completing the research for the greater good."

Side effects of cancer drugs
There are different kinds of side effects patients deal with when taking cancer drugs, and these side effects vary from person to person. Some of the side effects of breast cancer treatment include nausea or vomiting, diarrhoea, constipation, arm swelling, shortness of breath, and breast skin irritation.

Chemotherapy is the use of anti-cancer drugs to destroy cancer cells. Patients who undergo chemotherapy usually face side effects on a short-term basis, which would go once treatment has finished. However, some of these side effects are severe, like a drop in the number of platelets.

This can lead to bruising easily, nosebleeds, and bleeding gums. Chemotherapy patients also have an increased risk of getting an infection, which can be life-threatening if treatment is not done quickly.

Though most chemotherapy side effects are temporary, there are also patients who suffer late side effects such as early menopause, infertility, and heart and lung problems.

In fact, some chemo drugs may also increase the risk of developing a second cancer, especially if one receives higher doses of chemo over a longer period.

Breast cancer – the world's most prevalent cancer
The three main parts of the breast are the lobules, ducts, and connective tissue. The lobules are the glands that produce milk, and the ducts are tubes that carry milk to the nipple. The connective tissue surrounds and holds everything together.

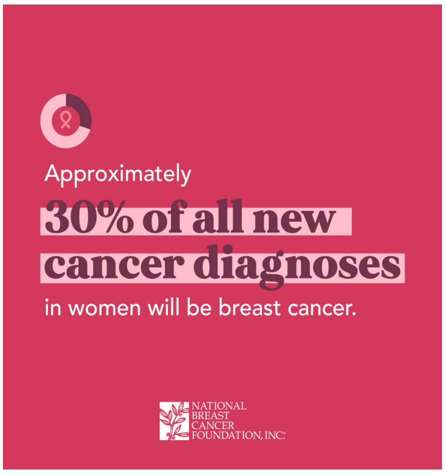
The most common types of breast cancer are known as:

1. Invasive ductal carcinoma. This is when the cancer cells begin in the ducts and then grow outside the ducts into other parts of the breast tissue.
2. Invasive lobular carcinoma. Cancer cells begin in the lobules and then spread from the lobules to the breast tissues that are close by.

In both types, invasive cancer cells can spread to other parts of the body, a term known as metastasize.

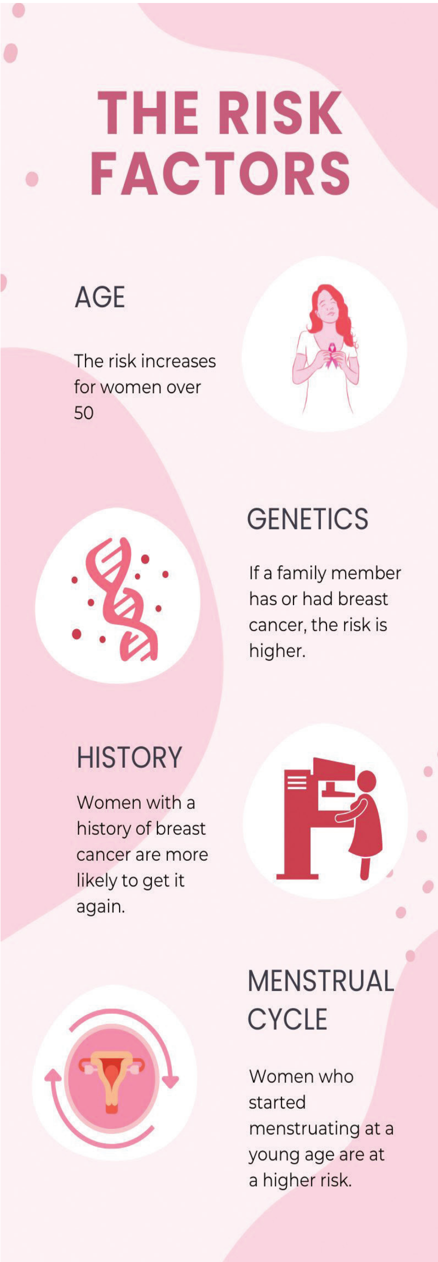
Breast cancer is one of the 5 most common cancers in Malaysia. According to Cancer Research Malaysia, 2.3 million women were diagnosed with breast cancer in 2020, resulting in 685,000 deaths globally. More Asian women succumbed to the disease compared to the rest of the world as breast cancer continues to rise rapidly in the region.

In countries with high-income economies and in some Malaysian private hospitals, 9 out of 10 breast cancer patients survive for as long as 10 years. However, the stats reduce to 5 out of 10 in some parts of Malaysia due to late detection and poor or delayed access to treatment.



Source: National Breast Cancer Foundation, Inc. (America)

Breast cancer prevention
The importance of breast cancer screening cannot be overstated. Cancers detected at an early stage have a higher chance of being cured. Doctors recommend that women get mammograms every 2 years if they are above the age of 50. However, each woman has different risk factors and may require to be screened at a younger age.



Source: MyHealth Portal

Women are also encouraged to perform regular breast self-examinations. The best chance of a long-term recovery from cancer is when the cancer has not yet spread.

In order to reduce the risk of breast cancer, it is also advised to avoid alcohol or drink in moderation. Alcohol increases the risk by damaging DNA in cells. In fact, compared to women who don't drink at all, women who have 3 alcoholic drinks weekly have a 15 percent higher risk of breast cancer.
It is also important to exercise at least 30 minutes on most days of the week. Research has found that women who exercise have an improved quality of life and fewer side effects during treatment.

Challenges faced by male breast cancer patients
Both men and women are born with a small amount of breast tissue. While women begin developing more breast tissue during puberty, men do not. Despite the differences in breast tissue size, the risk of developing breast cancer is still eminent.

Male breast cancer commonly occurs in older men, though it can happen to men at any age. Some of the symptoms include:

- A painless lump or thickening in the breast tissue
- Changes to the skin texture on the breast
- Changes to the nipple, such as redness or scaling, or a nipple that begins to turn inward
- Discharge from nipple

Aside from the gruelling process of surgery, chemotherapy, or radiotherapy, men also face stigmatisation due to this disease as it is a typical "women's disease". A study found that men diagnosed with breast cancer experienced social isolation as some do not know how to deal with a man having breast cancer. As it is a rare cancer, men would undergo therapy surrounded by other breast cancer patients who are female. An exchange of similar experiences to gain support is difficult to find, especially in these settings.

Associate Professor Ts. Dr. Liew Kai Bin, Head of Department, Pharmaceutical Technology and Industry

Upon obtaining his PhD at University Sains Malaysia, Dr. Liew served as a community and industrial pharmacist in various pharmaceutical-related fields, including product development, bioequivalence study, analytical chemistry, regulatory affairs and public health pharmacy before joining academia.

He has published over 80 publications in international journals and book chapters and has been awarded national and international grants that are worth more than RM500,000. Dr. Liew has been repeatedly invited as a speaker to deliver speeches in various countries such as Japan, India, and Indonesia. He has also supervised research projects for both undergraduate and postgraduate pharmacy students. Dr. Liew's research product has won several awards, including Best Innovation, Gold and Silver Awards in international exhibitions, including the Malaysia Technology Expo and International Innovation and Technology Expo.

Apart from teaching and doing research, he is also actively involved in community service and professional development programmes. He has also counselled public health campaigns organised by pharmacy students. Dr. Liew was the organising chairman for a few international workshops and seminars during his tenure at UCSI University. He was also awarded the Best New Lecturer by UCSI University in 2015.

Visual Inspection with Acetic Acid: A Promising Solution for Cervical Cancer Screening

Title: Factors associated with utilisation of visual inspection with acetic acid in Nepal

Student: Tara Ramtel
Supervisor: Prof. Dr. Krishna Gopal Rampal

Cervical cancer remains a significant public health concern, particularly in low-income regions, where access to screening and early detection is limited. In Nepal, despite the promotion of Visual Inspection with Acetic Acid (VIA) as a cervical cancer screening method, the overall utilisation rate has remained alarmingly low. This article summarises the findings of a cross-sectional study conducted in Bagmati Province, Nepal, aiming to identify the factors associated with the underutilisation of VIA screening.

VIA is an accessible and cost-effective method for cervical cancer screening in low-resource settings. It involves visually examining the cervix after applying acetic acid. One of its key advantages is the ability to provide immediate treatment if abnormal lesions are detected during screening. Early detection through VIA significantly increases the chances of successful treatment, preventing up to 80% of cervical cancer cases.

This study, conducted in Nepal, found several factors that contribute to the underutilisation of this screening. They include a lack of awareness; many women in Nepal remain unaware of cervical cancer and the availability of screening services. Many women, especially in rural areas, remain uninformed about the risks of cervical cancer and the importance of early detection. This lack of awareness means that women do not proactively seek out screening services, even when they are available.

Socioeconomic status also plays a crucial role in determining a woman's ability to access healthcare services, including cervical cancer screening. In Nepal, where poverty is widespread, the cost associated with VIA screening, albeit relatively low compared to other screening methods, can still be a significant deterrent. Women from low-income households may prioritise other essential needs over preventive healthcare.

In addition, societal and cultural beliefs about cervical cancer and screening can influence women's decisions regarding VIA. Misconceptions, stigma, and fear surrounding the disease can deter women from seeking screening. Some may believe that cervical cancer only affects promiscuous women or that it is a disease best left undiscussed. These misconceptions contribute to low screening rates.

Encouragingly, women who had previously undergone VIA screening were more likely to accept and undergo the procedure again, highlighting the importance of familiarity and positive experiences. Remarkably, women who had never had a cervical cancer screening before were also more likely to do so when offered orientation and free VIA screening services, highlighting the importance of awareness.

The study suggests several recommendations to enhance VIA screening accessibility and utilisation, including launching community awareness campaigns, increasing female service providers, providing free services, and expanding VIA screening services to grass-root level healthcare facilities.

Future of Metformin in Treating Lung Cancer

Title: Metformin HCl Oral Preparation Exhibits Anticancer Activity In-vitro in a Human Non-small Cell Lung Tumour Cell Line

Researchers: Chowdhury Forhadul Karim, Mohammod Jahidul Islam, Shamima Abdul Rahman
Summarised by: Asyraf Shipurizan

S 19.3 million new cases of cancer are diagnosed worldwide according to GLOBOCAN 2020, a cancer database. Among them, lung cancer is the leading cause of death and is responsible for around 18% of cancer-related deaths. The prevalence of respiratory cancer increases with the number of smokers due to its strong association with lung cancer in both men and women.

Non-small cell lung cancer or NSCLC, a type of cancer that affects the lungs, is the most common type of lung cancer and accounts for about 85% of all lung cancer cases. NSCLC can develop when cells in the lungs grow abnormally and form a tumour. Common symptoms of NSCLC include a persistent cough, chest pain, shortness of breath, and coughing up blood. NSCLC is usually treated with surgery, chemotherapy, or radiation.

Recently, a drug called Metformin has been shown to have the ability to stop or slow the growth of cancer cells in the lab, and it may be a possible option for treating lung cancer in the future. This drug could potentially be used alongside existing treatments to improve their effectiveness.

Metformin is an oral medication commonly used to treat type 2 diabetes by reducing the amount of glucose produced by the liver and increasing insulin sensitivity to the body cells. In recent years, there has been growing evidence suggesting that Metformin may have anti-cancer effects, including in the treatment of NSCLC.

Researchers (Karim et.al) wanted to investigate if a medicine called Metformin HCl could stop the growth of lung cancer cells (known as A549 cells) in a study. They tested if the medication could prevent cancer cells from growing, killing them, or dividing. They examined how cancer cells responded to various medication doses and compared the results to untreated cancer cells.

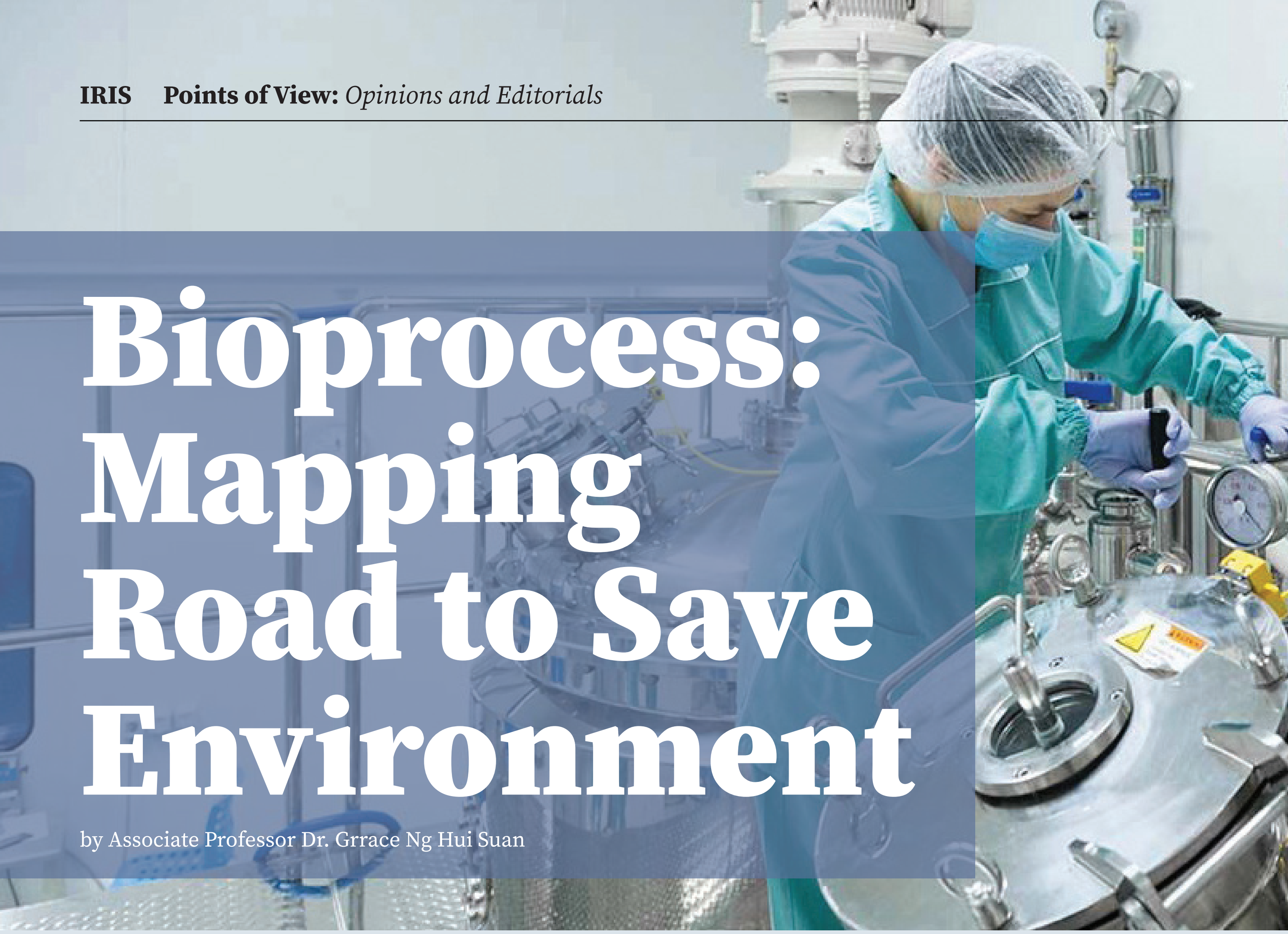
Researchers used Metformin HCl 500mg oral tablet purchased from a regular pharmacy in Bartam, Penang, Malaysia. The tablet was crushed and mixed with distilled water, filtered, sterilised, and stored in a freezer. The drug was then diluted for each experiment. The culture media and chemicals related to the experiment were obtained from different companies in the United States of America including reagent kits for analysing apoptosis and cell cycle.

Apoptosis is a natural process of programmed cell death that occurs in the body as a way to remove damaged, old, or unnecessary cells. This process is important for the body to maintain normal tissue function, development, and growth. When cells undergo apoptosis, they shrink from blebs and break into fragments, which are then cleared up by specialised cells without causing inflammation or damage to surrounding tissues. Apoptosis plays a crucial role in various physiological and pathological processes, such as embryonic development, immune system regulation, cancer, and neurodegenerative diseases.

According to the study, Metformin HCl tablets have the potential to be applied as a treatment for NSCLC, because they were able to induce apoptosis with cell cycle arrest after 8 days without entirely stopping cell growth. Metformin also had no adverse effects on normal cells. The research also reveals that Metformin HCl oral tablets could be used to treat lung cancer. The medicine has demonstrated encouraging results in reducing cancer cell development and killing cancer cells while causing no harm to normal cells. However, more research is needed before it can be used as a standard treatment. The research has yet to rule out when it will be available for patients, but ongoing research and clinical trials will help determine how safe and effective it is. If the research is successful, it could become a new and improved treatment option for people with lung cancer in the future.

"Although the recent study on using Metformin as a potential treatment for lung cancer is promising, there are important factors that need further clarification," stated

Associate Professor Dr. Hairel Anuar Selamat, an Assistant Professor from the University of Cyberjaya. Dr. Hairel highlighted the study's lack of details regarding the source and quality of the Metformin used, the process of determining dosages, and how these dosages were standardised for testing. Despite recognising Metformin's potential for lung cancer treatment, he underscored the challenges ahead and stressed the need for more research. Dr. Hairel identified a significant obstacle in conducting research involving actual patients, which requires approval from the Ethical Committee. Such studies, he explained, could yield crucial insights into appropriate dosages, treatment duration, and potential side effects for lung cancer patients. He also pointed out the potential cost-effectiveness of Metformin, which could alleviate the financial burden of lung cancer treatment and redirect healthcare budgets towards preventive care. He cautioned, however, that the current research is in its early stages and cannot yet replace established mainstream treatments for lung cancer. eam treatments for lung cancer. Dr. Hairel remains hopeful about Metformin's future role in treating lung cancer, emphasising the necessity for more comprehensive research, particularly involving real-life patients. In his evaluation, the study marks a positive initial stride towards exploring Metformin's potential in lung cancer treatment.



Bioprocess: Mapping Road to Save Environment

by Associate Professor Dr. Grrace Ng Hui Suan

Looking at the global issues faced by Mother Earth today, have you ever thought of doing something that matters? Do you have the urge to join the science community in developing solutions to combat the global crisis?

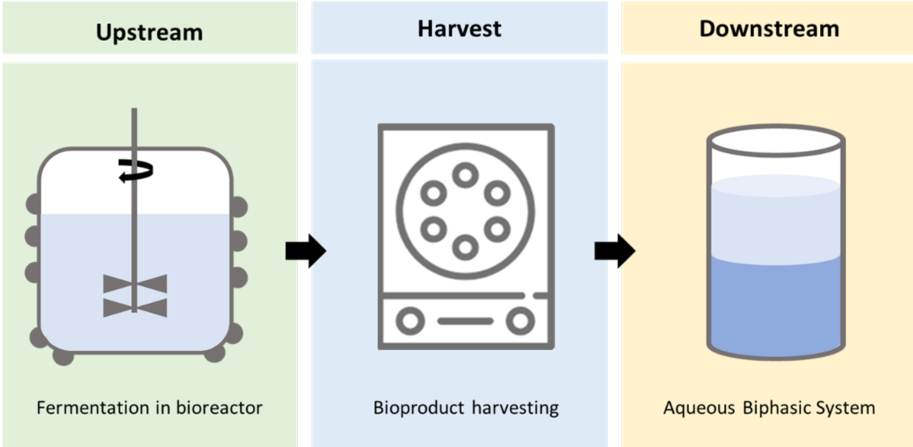
Interested in both the biotechnology and engineering fields? Wondering how waste products could be valorised into valuable bioproducts? How will we convert waste to wealth?

> "The environmental crisis is a global problem, and only global action will resolve it". - Barry Commoner.

Bioprocess engineering offers both the knowledge in biotechnology and engineering disciplines, dealing with the development of novel technologies for the production of high-value bioproducts. Bioproducts are bio-based materials such as industrial enzymes, biofuel and bioactive compounds derived from biological resources, which could serve as sustainable alternatives to unrenewable products.

Bioprocesses are mainly classified into upstream and downstream processes. Upstream processing focuses on the production of desired bioproducts via fermentation, whereas downstream processing focuses on the extraction, separation and purification of desired bioproducts using novel and promising approaches.

For upstream processing, microbial fermentation provides advanced technologies for the effective production of bioproducts to meet the growing market demands. Our research team here at University of Cyberjaya studies the optimization of fermentation media formulation and growth condition of microorganism and microalgae for the production of desired bioproducts. Considering the increasing amounts of industrial wastes, nutrient-rich



industrial wastes are usually applied as substrates in the fermentation media for the bioconversion of valuable bioproducts in order to achieve the goals of circular bioeconomy.

The multi-step operation of conventional downstream approaches has been viewed as a hurdle for industrial-scale practices due to long processing time and high processing cost. To circumvent the demands for an effective downstream processing approach, our research team has been studying the feasibility of a novel strategy, called aqueous biphasic system (ABS) for the recovery of various desired bioproducts from fermentation broth. This promising approach is favourable for the industrial implementation of downstream processing in one-step operation with high yields and productivity. In view of the attractive properties of ABS, it has also been widely employed for the extraction of functional compounds from food wastes due to the great content of antioxidative and bioactive compounds which could reduce environmental concern.

To-date, one of the environmental problems worldwide is the accumulation of feather waste from the poultry industry resulting from improper waste management. Keratinase enzyme is regarded as an efficient tool for the hydrolysis of keratin in feather waste to generate valuable end-products such as animal feed and fertilizer. Our research team is currently working on the production of keratinase from microbial fermentation broth due to the continuous rising market demands from various industries. Using feather waste as substrate, keratinase is produced via the microbial fermentation in the fermentation broth, followed by the separation and purification of keratinase using ABS. To enhance the efficiency of the downstream processing approach, we also study the feasibility of unconventional ABS for the recovery of keratinase from fermentation broth by integrating electric field into the ABS for the formation of aqueous biphasic electrophoresis system (ABES).

The close research collaboration between University of Cyberjaya and several universities in Taiwan provides our students with attachment opportunities to conduct their research in Taiwan and in turn expose them to a different work and research culture from another country. Students are given a great platform to acquire research knowledge within the biotechnology, biorefinery and bioprocess engineering field.

The research team at University of Cyberjaya under the leadership of the Director of Centre for Research and Graduate Studies and Bioprocessing expert, Associate Professor Dr. Grrace Ng Hui Suan is eager to meet new and eager talent interested in this field, especially if they are passionate in converting waste to wealth. Ultimately, the goal towards adopting sustainable bioprocesses in the pursuant of fulfilling one of the UN Sustainable Development Goals are in the hands of our current generation.

For more details about our research, kindly refer to our publications available online at ***https://www.researchgate.net/profile/Hui_Suan_Ng, https://scholar.google.com/***

Using Fe_3O_4 to Modify the Mechanical Properties of Epoxy Resin: Predictive Modelling using Computational Simulation

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ABSTRACT

Introduction: Adding fillers is a common strategy used to enhance mechanical properties of epoxy. Nanoparticles, natural and synthetic fibers, and rubbers are some of the common fillers used for this purpose. Despite numerous works have been done on reinforcing epoxy resin using nanomaterials, there is less information on the uses of Fe_3O_4. In particular, the Fe_3O_4 loading amount and its' Poisson's ratio on the mechanical properties of epoxy composite remain unknown.

Objective(s): It is the aim of this project to evaluate the mechanical properties of 0.5 wt. % - 50 wt. % Fe_3O_4-loaded epoxy composite through computational simulation.

Methodologies: This study began with defining of pre-modelling engineering data (i.e., material properties) in the ANSYS software, followed with the development of 2D dumbbell-shaped geometry which extruded into a 3D geometry in accordance to ASTM D638. Then, the mechanical properties of the epoxy composite were obtained through simulation.

Results: Simulation results showed that both the maximum total deformation and the equivalent total strain reduced with the addition of Fe_3O_4 filler. In specific, the maximum total deformation of composite was largely decreased by ~89 % when added with 50 wt. % of Fe_3O_4; with the same amount of Fe_3O_4 filler, ~85 % reduction in equivalent total strain was resulted. The same trend was observed regardless to Poisson's ratio of Fe_3O_4.

Conclusion: The outcomes of this study serve as a guideline for future selection of suitable filler to achieve the desired mechanical properties of epoxy composite.

Keywords: Iron oxide; epoxy composite; mechanical properties; Poisson's ratio; filler amount

INTRODUCTION

Epoxy resin, a high-performance thermosetting polymer, has been extensively used in various industrial applications (Sukanto et al., 2021, Tee et al., 2022). Nevertheless, epoxy resins generally suffer from brittleness issue which limits their usage in high loading and strong impact application (Barbosa et al., 2017, Shundo et al., 2022). To cope with such limitation, epoxy resin is normally incorporated with different types of soft particle fillers (Shundo et al., 2022). Nanoparticles, natural and synthetic fibers, and rubbers are some of the common fillers used to toughen an epoxy resin (Ramasamy et al., 2021, Tee et al., 2022).

Reinforcing the epoxy resin with metal oxide (especially in nano-scale form) have been proven to improve the tensile strength, stiffness, impact strength, flexural strength, and other mechanical properties of an epoxy resin. Nevertheless, overloading of the filler was also found leading to detrimental effect owing to particle agglomeration. The particle agglomeration leads to poor dispersion of the nano-metal oxide in the polymer matrix (Tian et al., 2021). For instance, Goyat et al. reported that the tensile strength of a TiO_2-reinforced epoxy resin was improved by ~ 26 % when the amount of TiO_2 was increased from 0 wt. % to 10 wt. %; however, a reduction in tensile strength was observed when the amount of TiO2 was further increased to 20 wt. % due to particle agglomeration (Goyat et al., 2018). Despite that, it is noteworthy that different types of metal oxides enhance the mechanical properties of an epoxy resin at different extent. Apparently, the original properties of the metal oxide play a significant role in determine quality of the reinforcement.

In this study, Fe_3O_4 was evaluated for its potential to reinforce epoxy resin. Worth to highlight that Fe_3O_4 particles tend to agglomerate due to van der Waals and magnetic dipole-dipole attractions; hence, selecting a proper loading amount is necessary to avoid the aforementioned detrimental effect. Here, mechanical properties of an epoxy resin (upon incorporated with Fe_3O_4) was predicted via computational simulation (ANSYS Static Structural Analysis). The total deformation and equivalent total strain were predicted by adding different weight percent of Fe_3O_4. In addition, this study also aimed to evaluate the effects of Poisson's ratio of Fe_3O_4 on the mechanical properties of the epoxy composite. It is envisaged that the present work will provide a guideline for future selection of suitable metal oxide filler for toughening of epoxy resin.

METHODOLOGIES

The mechanical properties simulation was performed by utilizing ANSYS computational fluid dynamic software. ANSYS Workbench is a simulation software that provides the tools necessary for finite element analysis (FEA) of a self-designed composite structure (Mathapati, 2014). In this study, ANSYS Static Structural 2020 R1 was used to develop a 3D simulation model of Fe_3O_4 epoxy composite as the specimen. Here, the design Modeler in ANSYS was used to develop the dumbbell-shaped specimen; the design began with the sketching of a 2D dumbbell-shaped geometry and extrudes to become a 3D structure. Then, the meshing of the geometry was carried out to break up the domain into cells (elements). Such refinement of elements was to further improve the accuracy of the simulation results. The boundary conditions consist of the fixed support as the constraint and a load as the force applied on the specimen. The flow chart of the simulation work is illustrated in Figure 1.

Several important input parameters for the creation of metal oxide epoxy composite include the density, Young's modulus, the Poisson's ratio, the shear modulus, the bulk modulus, and the tensile yield strength for both the resin matrix and the Fe_3O_4 filler. These pre-modelling data are tabulated in Table 1. Note that the Poisson's ratio of Fe_3O_4 was found to range from 0.262 to 0.37 (Chicot et al., 2011); while the one for epoxy resin is 0.35. The minimum Poisson's ratio of Fe_3O_4 (0.262) was estimated by using the values of adiabatic bulk modulus and shear modulus for equivalent isotropic polycrystalline aggregate, whereas the maximum Poisson's ratio of Fe_3O_4 (0.37) was obtained by using molecular dynamic analysis and depth-sensing micro-indentation (Chicot et al., 2011, Gercek, 2007). Hence, to realize the role of Poisson's ratio on the resultant mechanical properties, the simulation was performed at two different settings of Poisson's ratio of Fe_3O_4, namely 0.262 and 0.37. These two values represent a condition where the filler has Poisson's ratio lower or higher than the resin's Poisson's ratio, respectively.

Table 1: The properties of epoxy resin and Fe_3O_4 that defined in this work.

Properties	Epoxy Resin*	Fe_3O_4	References for Fe_3O_4
Density (kg/m^3)	1160	5100	(Chicot et al., 2011)
Young's Modulus (Pa)	3.78×10^9	175×10^9	(Chicot et al., 2011)
Poisson's Ratio	0.35	0.262 to 0.37	(Chicot et al., 2011)
Bulk Modulus (Pa)	4.20×10^9	-	-
Shear Modulus (Pa)	1.40×10^9	-	-
Tensile Yield Strength (Pa)	5.36×10^7	4.00×10^7	(Yang et al.,2017)

*Data was adapted from the ANSYS database

Different amounts of Fe_3O_4 (0.50 wt.% up to 50.00 wt.%) were pre-defined as the filler. The selection of these concentration ranges has covered both the low range (0-5.00 wt.%) and high range (10.00-50.00 wt.%) filler content commonly employed in literature. The mechanical properties of the Fe_3O_4 epoxy composite specimens were then simulated and compared with the pure epoxy resin (0.00 wt.%) (i.e. without addition of Fe_3O_4).

RESULTS AND DISCUSSION

Mechanical properties evaluation: Total deformation

Figure 2 provides the total deformation distribution of the dumbbell-shaped specimen under different simulation conditions. As shown in this figure, the maximum value of total deformation occurred at the side of the specimen where the force was applied (red color region); on the other hand, the fixed side experienced zero total deformation (blue color region). The same observation was seen for the specimen without Fe_3O_4 filler (Figure 2a), with 50.00 wt.% Fe3O4 filler at Poisson's ratio 0.262 (Figure 2b), and with 50.00 wt.% Fe_3O_4 filler at Poisson's ratio 0.37 (Figure 2c).

Table 2 lists the maximum total deformation attained by the epoxy composite upon added with different amounts of Fe_3O_4 filler. Result implied that the value of maximum

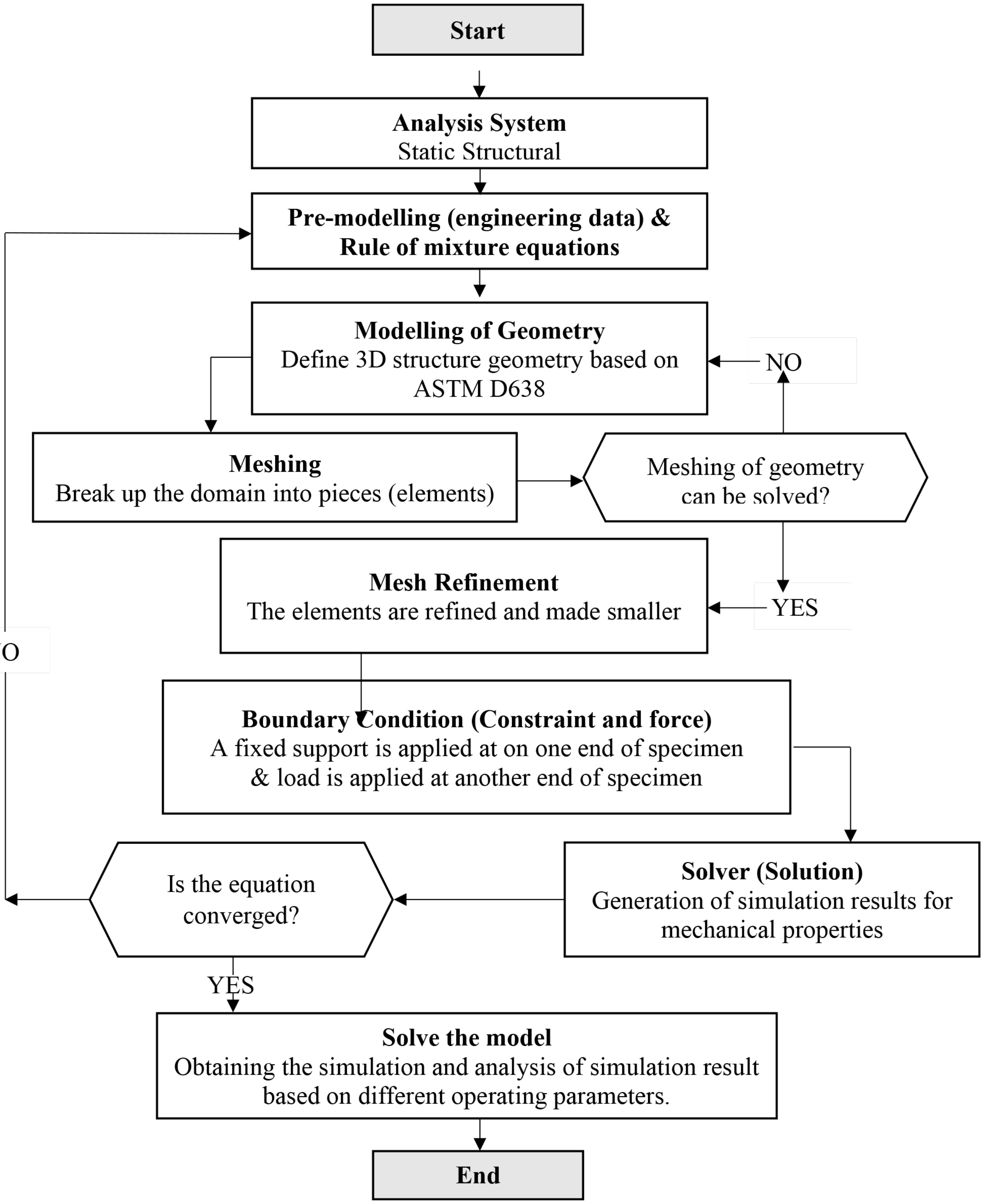

Figure 1: S Flow chart of the present study

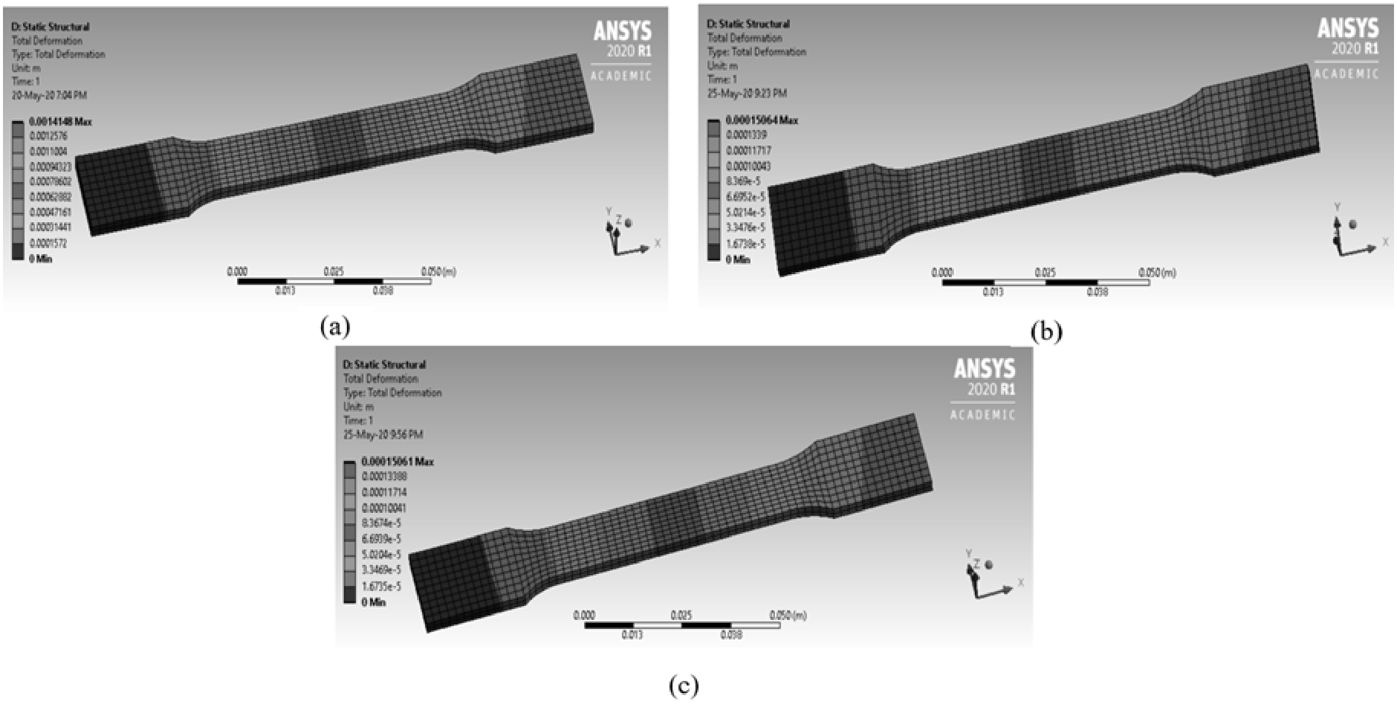

Figure 2: Contour plot showing the total deformation distribution on (a) the pure epoxy resin, (b) the epoxy composite containing 50.00 wt.% of Fe_3O_4 by setting 0.262 as the Poisson's ratio of Fe_3O_4, and (c) the epoxy composite containing 50.00 wt.% of Fe_3O_4 by setting 0.37 as the Poisson's ratio of Fe_3O_4.

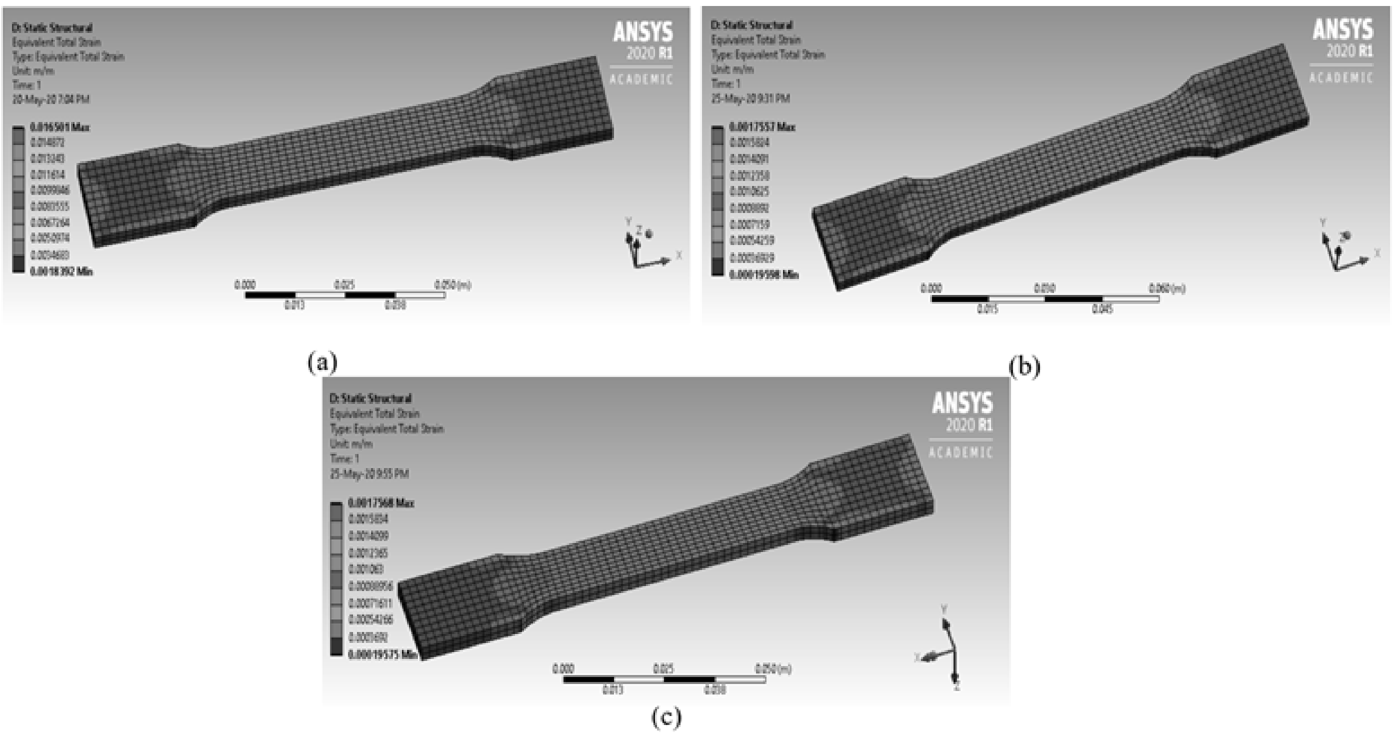

Figure 3: Contour plot showing equivalent strain distribution on the specimen geometry. (a) pure epoxy resin, (b) incorporating 50 wt.% of Fe_3O_4 into pure epoxy by setting 0.262 as the Poisson's ratio of Fe_3O_4, and (c) incorporating 50 wt.% of Fe_3O_4 into pure epoxy by setting 0.37 as the Poisson's ratio of Fe_3O_4.

total deformation gradually decreased with the increase in weight percent of Fe_3O_4 added into the epoxy resin. The same trend was observed regardless of the value of Poisson's ratio of pure Fe_3O_4. In fact, it was found that the maximum total deformation of the epoxy composite has reduced by ~ 89 % when the Fe_3O_4 filler amount was increased to 50.00 wt.%. Such reduction in total deformation depicted that the Fe_3O_4 could provide great material stiffness to restrict deformation (Jumahat et al., 2012, Rajak et al., 2019). Despite that, result also implies that the different setting for Poisson's ratio of Fe_3O_4 has only mild effect (< 0.02 % differences) on the composite's total deformation.

Table 2: The properties of epoxy resin and Fe_3O_4 that defined in this work.

Weight Percent of Fe_3O_4 (wt. %)	Maximum Value of Total Deformation (m)		Percentage Difference (%)
	v = 0.262	v = 0.37	
0.00 (Pure Epoxy Resin)	0.00141480	0.00141480	0.0000
0.50	0.00134530	0.00134530	0.0000
1.00	0.00128180	0.00128180	0.0000
1.50	0.00122350	0.00122350	0.0000
2.00	0.00117000	0.00117000	0.0000
2.50	0.00112050	0.00112050	0.0000
3.00	0.00107480	0.00107480	0.0000
3.50	0.00103230	0.00103230	0.0000
4.00	0.00099271	0.00099270	0.0010
4.50	0.00095578	0.00095577	0.0011
5.00	0.00092123	0.00092122	0.0011
10.00	0.00066849	0.00066847	0.0030
20.00	0.00041166	0.00041163	0.0073
30.00	0.00028168	0.00028165	0.0107
40.00	0.00020319	0.00020316	0.0148
50.00	0.00015064	0.00015061	0.0199

Mechanical properties evaluation: Equivalent total strain

The equivalent total strain in analysis was defined as the sum of the elastic, plastic, creep and thermal strain. Figure 3 provides the equivalent total strain distribution on the dumbbell-shaped specimen under different simulation conditions. The highest equivalent total strain was found to be located at the curved transition region (neck) of the geometry, which is also the location where maximum stress was normally observed (Mansour et al., 2011, Nigrovič et al., 2018).

Table 3 lists the maximum values of equivalent total strain attained by the epoxy composite upon added with different amounts of Fe_3O_4 filler. Results clearly shown that the maximum value of equivalent total strain decreased with the increase in Fe_3O_4 loading amount. Despite that, the percentage of difference between the equivalent strain by setting 0.262 and 0.37 as Poisson's ratio was less than 0.0626 %. Thus, these data also indicated that different Poisson's ratio of pure Fe_3O_4 has no significant effect on the maximum equivalent total strain.

Table 3: The maximum values of equivalent total strain (by setting 0.262 and 0.37 as the Poisson's ratio of pure Fe_3O_4)

Weight Percent of Fe_3O_4 (wt. %)	Maximum Value of Equivalent Total Strain (m/m)		Percentage Difference (%)
	0.262	0.37	
0.00 (Pure Epoxy Resin)	0.016501	0.016501	0.0000
0.50	0.015690	0.015690	0.0000
1.00	0.014949	0.014949	0.0000
1.50	0.014270	0.014270	0.0000
2.00	0.013645	0.013645	0.0000
2.50	0.013068	0.013069	0.0077
3.00	0.012535	0.012535	0.0000
3.50	0.012039	0.012039	0.0000
4.00	0.011577	0.011578	0.0086
4.50	0.011147	0.011147	0.0000
5.00	0.010744	0.010744	0.0000
10.00	0.007795	0.007796	0.0090
20.00	0.004800	0.004801	0.0187
30.00	0.003284	0.003285	0.0304
40.00	0.002368	0.002369	0.0422
50.00	0.001755	0.001756	0.0626

CONCLUSION

This study evaluated the change in total deformation and equivalent total strain of epoxy resin upon incorporated with different amounts of Fe_3O_4 filler. The objective was achieved by developing a 3D simulation model of Fe_3O_4 epoxy composite according to ASTM D638 for predicting the mechanical properties in ANSYS. Results showed that the incorporation of Fe_3O_4 can enhance the mechanical properties of epoxy resin by reducing both the total deformation and equivalent total strain. In addition, it was found that the Poisson's ratio of Fe_3O_4, either at 0.262 (i.e lower than Poisson's ratio of epoxy resin) or 0.37 (i.e higher than Poisson's ratio of epoxy resin), has negligible effect on the magnitude of both total deformation and equivalent total strain. In contrast to numerous published experimental works which found that overloading of metal oxide filler may lead to detrimental effect on the mechanical properties, such observation was not seen in the present work. This discrepancy could be ascribed to the exclusion particle agglomeration effect from the simulation. The colloidal stability of metal oxide particles which directly affect their interfacial interaction with epoxy resin was not taken into account in the current stage of simulation.

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Exploring Telepharmacy Use Among Community Pharmacists: A Qualitative Document Analysis of Services Provided and Barriers Faced

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ABSTRACT

Introduction: Telepharmacy is the delivery of pharmaceutical service over a distance by using information and communications technology (ICT), which enables pharmacists to provide patients with pharmaceutical care over the phone, video conferencing, or other means of communication tools. Despite existing for decades, its adoption among community pharmacists is rather slow.

Objective(s): This study aimed to identify telepharmacy services provided by community pharmacists and barriers preventing the provision of telepharmacy services.

Methodologies: Research design was qualitative document analysis and search of literature in e-databases using MeSH keywords.

Results: Out of the 84 documents from the search result, 43 documents were included in the study. Subtheme generated of telepharmacy services provided by community pharmacists included patient and medication aspects. The four themes that emerged relating to barriers impeding telepharmacy services were technological, governance, humanistic and economic.

Conclusion: Telepharmacy service delivered by community pharmacist shows great potential to increase medication adherence. Barriers can be overcome by establishing a regulatory framework, training community pharmacists to adopt technology and educating the public on the potential benefits of telepharmacy.

Keywords: Telepharmacy; telemedicine; community pharmacist; pharmaceutical care services

INTRODUCTION

Telepharmacy is the delivery of pharmaceutical service over a distance by using information and communications technology (ICT), has been quickly adopted to overcome many healthcare challenges that emerged (Unni et al., 2021). Originally, telepharmacy was used to extend healthcare to rural areas. The medical chest program was introduced by the Australian Royal Flying Doctor Service (RFDS) in 1942, where medications were dispensed remotely (Cherry et al., 2018). Later, The North Dakota Telepharmacy Project in 2001 became the earliest recorded telepharmacy implementation in community pharmacies (History Telepharmacy |NDSU, n.d.). Established telepharmacy services include medication selection, order review and dispensing, patient counselling and monitoring, and provision of clinical service (Le et al., 2020),

Community pharmacists play a significant role in the provision of pharmaceutical care during the pandemic as they have been described as first line of contact among health professionals due to their accessibility to the public (Agomo, 2011). They provided telepharmacy services through various modes such as video call, voice call or chat (Crilly & Kayyali, 2020). During this period, telepharmacy has shown great promise as a tool to increase healthcare access.This study aimed to identify telepharmacy services provided by community pharmacists and barriers preventing the provision of telepharmacy services.

METHODOLOGIES

The research design was qualitative document analysis incorporating search of literature in e-databases using MeSH keywords related to the topic. The inclusion criteria included analysing articles of published research, documents from reference lists, databases, hand searching, grey literature and websites and documents ranging from the recent 5 years for key relevancy between 2018-2023. Keywords of "community pharmacist", "telepharmacy,", "e-pharmacy", and "barriers in telepharmacy" were entered into electronic database search engines such as Google Scholar, PubMed and Research Gate. They were read thoroughly to generate inputs on the study. Advanced search option and Boolean terms such as "AND", "OR", and "NOT" were used to optimize search results. Extraction of data was performed by trained researcher to digitally collect and file in Microsoft Document and Microsoft Excel by using data collection sheet and data collection form. Data was analysed carefully by focused re-reading and review of data to recognize common codes that repeatedly appeared to strengthen the reliability process. Two experts in qualitative research comprising of academicians with over 15 years were involved in the validation process. Discussion by argumentative validation method was carried out.

RESULTS AND DISCUSSION

A total of 43 out of 84 documents from multiple sources were analyzed for the purpose of this study. For telepharmacy services provided by community pharmacists, patient and medication subthemes emerged. The codes and categories were classified one main theme as tabulated in Table 1.

Table 1: Telepharmacy Services Provided by Community Pharmacists

CODES / SUBTHEMES	THEMES
Patient aspects	
a. Patient counselling	
b. Medication review	
c. Patient monitoring	
Medication aspects	**Pharmaceutical Services**
a. Medication adherence	
b. Pharmacovigilance	
c. Medication sales	
d. Home drug delivery (HDD) supply	
e. Electronic prescription	

Telepharmacy Services Provided by Community Pharmacists

Subthemes were patient aspects and medication aspects. Traditional tasks performed by pharmacists can be delivered online to patients to provide greater pharmaceutical care convenience from the comfort of their home, cutting cost and time taken. Villanueva-Bueno et al. (2022) found significant role of telepharmacy in the pharmaceutical care process in which out of 7,758 telepharmacy consultations, pharmacotherapeutic monitoring successfully prevented 1,043 adverse drug reactions (10.4%) and a high adherence rate among patients (95.2%). Patients receiving telepharmacy services are more likely to follow pharmacists' recommendations such as taking medications. (Ibrahim et al., 2021). During the Covid-19 lockdown, patients had difficulty to access medication, leading to medication non-adherence (Akour et al., 2021). Telepharmacy prevented disruption of medication availability among patients in emergency situations. Online medicine purchase from verified e-pharmacy websites were accepted among the public, especially in the developed countries. Home Drug Delivery (HDD) provides medication refills for patients through home delivery, where patients have the option of ordering their medication via e-mail, application, website portal and others. Remote home drug delivery may provide a convenient option and increase accessibility of medication for patients. Although pharmacists are under-utilised in the healthcare system, the Covid-19 pandemic has brought so many opportunities for role expansion. Smoking cessation programmes has been successfully delivered via telepharmacy (Buford et al. in 2013, Crilly & Kayyali, 2020) E-prescribing eased medication dispensing process employing the electronic medication record (EMR) system for use by physicians and pharmacists alike and improved inter-consultation and improved patient's progress.

For telepharmacy barriers preventing the provision of telepharmacy services, four themes emerged. The codes and subthemes were classified and tabulated in Table 2.

Table 2: Barriers Preventing the Provision of Telepharmacy Services by Community Pharmacistst

CODES / SUBTHEMES	THEMES
Legislation & Policies	**Governance**
a. Lack of regulatory framework	
b. Legal implications	
c. Integration within healthcare system	
d. Regulatory differences across countries	
e. Lack of political interest	
Security	**Technological**
a. Data and privacy protection	
Accessibility to Technology	
a. Lack of appropriate technology or infrastructure	

CODES / SUBTHEMES	THEMES
b. Internet access	
c. Operational difficulties	
d. Lack of expertise	
Social Acceptance	**Humanistic**
a. Public acceptance	
b. Healthcare provider acceptance	
c. Scepticism on pharmacist's ability	
d. Lack of public awareness on telepharmacy services	
Patient Aspect	
a. Digital literacy	
b. Lack of human touch	
c. Economic status and affordability	
Cost	**Economic**
a. Cost justification	
b. High startup cost	
c. Limited resource	
Monetary motivation	
a. Lack of reimbursement for pharmacies	
b. Willingness-to-pay by customer for direct service	

Barriers in the Provision of Telepharmacy Services

Themes generated pertaining to barriers existing in the provision of telepharmacy services were governance, technology, humanistic and economic. Various studies have reported lack of telepharmacy integration within the healthcare system (Nazri et al., 2021; Ng & Sze, 2022; Viegas et al., 2022) likely attributed by lack of regulatory framework in most countries (Unni et al., 2021 ; International Pharmaceutical federation) An interesting note is that 74% of pharmacies in the European countries indicated the existence of laws regulating online pharmacy in their country, however majority of countries and Africa and all countries in South-East Asia do not have them (Dineen-Griffin & Abu Bakar, 2021). This might be due to the lack of political interest in this area in developing or undeveloped countries and delays by policymakers, differences in interinstitutional policies and lack of governmental support to reduce market tension. (Amran et al., 2022).
Technological barriers include slows uptake of telepharmacy due to lack of appropriate technology (Baldoni et al., 2019; Nduka et al., 2022). Operational difficulties such as technical issues caused disruption in the usual workflow (Yap et al., 2021). Furthermore, some patients need to be assessed physically or given further diagnostic assessments which could not be done online (Nazri et al., 2020).

Humanistic barrier included social acceptance in securing rapid uptake as some patients and healthcare providers are skeptical on the ability of pharmacists as well as their ethics and motivations on providing pharmaceutical care, as community pharmacists are known to be sales oriented (Amran et al., 2022; Viegas et al., 2022). Furthermore, in many parts of the world, pharmacists are underutilised resource despite their education, training, and accessibility to the public (Rehman & Hani, 2022; Kibicho et al., 2015).

Economic barrier prevented lower income groups from being able to get access to healthcare (Lazar & Davenport, 2018), hence it comes as no surprise that there were concerns over affordability of telepharmacy services fees (Unni et al., 2021). A study by Adamma et al. in 2022 found that in developing countries, less than half of the customers are willing to pay for telepharmacy services due to poor income. This is corroborated by other studies that concluded less than half of the survey participants were willing to pay for telepharmacy services (Park et al., 2022; Tjiptoatmadja & Alfian, 2022). Moreover, due to lack of regulatory framework and integration of telepharmacy into the healthcare system, patients are unable to get reimbursement for telepharmacy services from their insurance providers and bear the costs themselves (Baldoni et al., 2019; Begnoche et al., 2022; Unni et al., 2021).

The software and technology needed to deliver telepharmacy services can be costly (Adamma et al., 2022; Baldoni et al., 2019, Ng & Sze, 2022), hence placing a huge burden especially on small, independent pharmacies having limited resources (Amran et al., 2022; Baldoni et al., 2019). Community pharmacies inability to obtain reimbursement for their telepharmacy system and concerns over return on investment of the telepharmacy model (Ng & Sze, 2022, Amran et al., 2022; Ng & Sze, 2022; Muflih et al., 2021, Nduka et al., 2022) delay offering these services.

CONCLUSION

Although telepharmacy services has the potential to deliver many benefits to patients such as triage and management of minor ailments smoking cessation, vaccination advocacy, medication review and medication counseling to improve medication adherence, it faces multiple barriers. However, some barriers can be addressed by establishing a sound regulatory framework for telepharmacy services, training community pharmacists to adopt technology and educating the public on the potential benefits of telepharmacy.

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Readiness of Community Pharmacists as Online Health Providers for Geriatric Medication Review

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ABSTRACT

Introduction: Geriatrics have many non-communicable diseases and multiple prescriptions that cause medication problems. Rational medication use requires adequate monitoring by healthcare providers. Pharmacists as online health providers could provide an efficient way to maintain geriatric health by reviewing medications online.

Objective(s): This study aimed to identify the readiness level of community pharmacists in Malaysia to provide online geriatric medication review,compared demographic factors and readiness levels and identified the expected remuneration by pharmacists.

Methodologies: This was a cross-sectional study conducted among Malaysian community pharmacists. Convenience sampling was used to disseminate an online survey form via email, Facebook groups, and messaging services such as WhatsApp and LinkedIn.

Results: Majority (54.8%) of community pharmacists have a moderate level of readiness while (45.2%) were highly ready to conduct geriatric medication review via an online platform. There was no difference found in the level of readiness between males and females (p=0.389), independent and chain pharmacy (p=0.657), full-time and part-time pharmacists, (p=0.451) and between undergraduate and postgraduate pharmacists (p=0.584). Similar findings existed in all age groups, locations of community pharmacies and regardless of their working experience. Pharmacists are also expected to be remunerated with an average amount of RM21-30 for a 30-minute geriatric medication review via an online platform.

Conclusion: Pharmacists have moderate level of readiness in conducting geriatric medication review via an online platform. Adequate remuneration and addition of this service to pharmacists current work-load remain areas requiring consideration to offer the service.

Keywords: Online health; Geriatric; Medication Review; Community Pharmacists

INTRODUCTION

Healthcare workers need to reinvent services to combat geriatric issues. Merrell (2015) reported that 92% of older adults have at least one chronic disease, and 77% suffer from at least two. Geriatrics have a greater prevalence of non-communicable diseases and are therefore frequently administered several medications, which increases the likelihood of drug issues. In Malaysia, a systematic review and meta-analysis reported that medication-related problems were high among elderly population with polypharmacy (49.5%), potentially inappropriate medications (28.9%), nonadherence to medications (60.6%), and medication related falls (39.3%) (Chang et al., 2021). Fernández et al. (2020) found that inappropriate medication was associated with a worsening health self-assessment, increased frailty, a higher incidence of falls, and prevalence of depression. According to Pharmaceutical Care Network Europe (PCNE), medication review is a structured evaluation of a patient's medicines with the aim of optimizing medicines use and improving health outcomes which involves detecting drug-related problems and recommending interventions (Griese-Mammen et al., 2018). In England and Wales, community pharmacists conducted medication reviews as part of the Medication Use Review (MUR) programme (Blenkinsopp et al., 2012). In Malaysia, however, clinical pharmacists conducted medication reviews through Home Medication Review (HMR), which was only available to those under Ministry of Health follow-up. A recent study by Loh et al. (2021) revealed that higher percentage (68.8%) of community pharmacists provide medication review services at pharmacy compared to HMR due to a pharmacist shortage that prevented them from leaving their pharmacies. Online health services could play a vital role in ensuring all geriatric patient, especially those with limited access to get sufficient service from the healthcare provider. Gorman, (2006) has defined the word 'online' as anything digital, from any source at any time. This study aimed to determine the readiness level of community pharmacists as online health providers for geriatric medication review and the expected remuneration by community pharmacists to provide the service.

METHODOLOGY

A cross-sectional study used a self-administered, close-ended questionnaire and was carried out using an online survey google form. A set of questions comprised three sections with 5-point Likert scales and single-choice responses. The questionnaires have been adopted and adapted from the previously validated questionnaire by Elnaem et al. (2022). The sample population was the whole population of community pharmacists in Malaysia that were selected by convenient sampling method through the Official Portal of Pharmaceutical Services Programme Ministry of Health Malaysia. Based on the list, there were a total of 5414 of license A holder for 'retail only' and 'wholesale and retail' in Malaysia. The sample size was calculated using Raosoft software. The questionnaires consisted of 20 questions, divided into three sections; demographic background, readiness of community pharmacists as online health providers for geriatric medication review and expected remuneration by community pharmacists to provide the service. Experts internally assessed the survey for content validity. They included a community pharmacy practitioner with over 20 years' experience and two academicians with expertise in this area. A pilot study involving 10 participants was conducted through online platforms before the actual study. Face validity was performed by providing a feedback section at the end of the pilot survey. Responses then were analysed for reliability test using IBM Statistical Package for Social Science (SPSSs) software, version 29. The actual data collection was conducted from January 2023 to February 2023. A 1-time reminder was sent if there was no response received within 14 days. Participants were also provided with information about the study, the contact number of the researcher, and informed their right to withdraw from the study at any time they wish. They were required to pledge their consent by clicking on agreement button prior to filling the survey. A complete and submitted survey indicates their consent to this study. This study was strictly on a voluntary basis; therefore, no incentive was offered. IBMs Statistical Package for Social Science (SPSS) for Windows version 29 was utilised to analyse the obtained data. The demographic data were analysed by descriptive analysis and normality tests were done using Kolmogorov and skewness tests.

Assessment Level of Readiness

The level of readiness was calculated based on the scoring system. Based on a 5-point Likert-type scale, the total score for each respondent was totalled up and represented as a percentage. A score less than 40% and below indicated poor readiness, 41-74% moderate readiness and 75% and above indicated good readiness.

Comparison between Sociodemographic Factor and Level of Readiness

Mean score of readiness was calculated through SPSS to obtain average score of readiness. This score was used to compare level of readiness between demographic factors. T-test was used to compare the readiness level between two groups such as gender, type of community pharmacy, education level, and employment status of community pharmacists. ANOVA test was applied to compare the readiness level for sociodemographic factor with more than two groups, such as age group, location of community pharmacy and working experience.

The study received ethical approval number UOC/CRERC/ER/491 on 12 January 2023 from University of Cyberjaya Research Review Committee.

RESULTS

This study received 42 responses with response rate of 10.63%. Cronbach alpha test to assess the internal consistency of the readiness section was 0.824. The demographic background of respondents was summarized in Table 1.

Table 1: Demographic Background

Sociodemographic Characteristics	Participants N (%)
Gender	
Male	16 (38.1)
Female	26(61.9)
Age (Years)	
23-39	28(66.7)
40-59	9(21.4)
60+	5(11.9)
Education Level	
Undergraduate	37(88.1)
Postgraduate	5(11.9)

Sociodemographic Characteristics	Participants
	N (%)
Working Experience	
≤1 year	8(19)
2-10 years	19(45.2)
>10 years	15(35.7)
Employment Status	
Full time	36(85.7)
Part Time	6(14.3)
Licence A ownership	
Retail Only	29(69)
Retail & Wholesale	13(31)
Type of Community Pharmacy	
Independent	18(42.9)
Chain	24(57.1)
Location of Community Pharmacy	
Rural	12(28.6)
Urban	15(35.7)
Suburban	15(35.7)

Assessment of Readiness Item

Table 2 shows the assessment of readiness items. Half (52.4%) of the respondents were ready to conduct geriatric medication review via an online platform, even without an incentive. However, almost two fifth (38.1%) of them were still unsure for that statement. Similarly, majority respondents (40.5%) were undecided about working after office hours to deliver the service. Another 31% expressed that they were strongly disagree and disagree to work beyond office hour. Following that, statements 3, 4, 5, 6, 7, 9, and 10 received the greatest number with strongly agree and agree responses. Most of the respondent expressed their readiness to conduct drug counselling (71.4%), assess patient on device skill (73.8%), communicate with caregiver (71.4%), communicate with geriatric patient (61.9%) via an online platform or through two ways video consultation. The highest readiness level can be seen in statement 5: "I am ready to undergo training and ethics in legal issues related to online geriatric medication review services' and 'I am ready to improve and reduce risk of medication error among geriatric patient through online medication review'. Yet, a large proportion of respondents were uncertain about their readiness to handle the increase in workload when conducting geriatric medication review via an online platform.

Table 2: Assessment of Readiness Items

Readiness Item	No. of respondents (%)				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I am ready to conduct geriatric medication review via an online platform, even without an incentive.	0(0)	4(9.5)	16(38.1)	15(35.7)	7(16.7)
I am ready to work after office hour if needed.	7(16.7)	6(14.3)	17(40.5)	7(16.7)	5(11.9)
I am ready to conduct drug counselling via two-way video consultation such as telephone call, text message, or voice call through mobile application.	0(0)	1(2.4)	11(26.2)	22(52.4)	8(19)
I am ready to assess patient on how they use their drug delivery device (e.g., inhaler, insulin pen) properly through video consultation.	1(2.4)	2(4.8)	8(19)	19(45.2)	12(28.6)
I am ready to undergo training and ethics in legal issues related to online geriatric medication review services.	0(0)	0(0)	9(21.4)	22(52.4)	11(26.2)
I am ready to face the implementation of online health services in community pharmacy setting	0(0)	2(4.8)	8(19)	21(50)	11(26.2)

Readiness Item	No. of respondents (%)				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I am ready to improve and reduce risk of medication error among geriatric patient through online medication review.	0(0)	0(0)	8(19)	24(57.1)	10(23.8)
I am ready to carry the increment of workload when conducting geriatric medication review via an online platform.	1(2.4)	5(11.9)	19(45.2)	13(31)	4(9.5)
I am ready to communicate with the caregiver through an online platform for geriatric medication review.	0(0)	1(2.4)	11(26.2)	21(50)	9(21.4)
I am ready to communicate with the geriatric patient through an online platform for medication review.	0(0)	2(4.8)	14(33.3)	18(42.9)	8(19)

Assessment Level of Readiness

Majority of the respondents (54.8%) have moderate level of readiness to conduct geriatric medication review via an online platform while another (45.2%) shows good level of readiness. None of the respondent had poor level of readiness as online health provider for geriatric medication review. Table 3 shows the result for readiness level.

Table 3: Percentage Level of Total Readiness Score

Score, %	N(%)	Readiness Level
<40	0	Poor
41-74	23(54.8)	Moderate
>75	19(45.2)	Good

Comparison between Sociodemographic Factor and Level of Readiness

The total mean score of readiness was 37.4. There was no significant difference in the level of readiness among the three age groups, location and working experience (p>0.05). Similarly, there was also no significant difference of readiness level between gender, type of community pharmacy employment status of community pharmacists and education level. Table 4 summarize the analysis of comparison.

Table 4: Comparison between Sociodemographic Factor and Level of Readiness

Demographic variables	n (%)	Readiness Score	
		Mean (SD)	p-value
Gender [a]			
Male	16(38.1)	38.44(7.47)	0.389**
Female	26(61.9)	36.77(4.97)	
Type of Community Pharmacy [a]			
Independent	18(42.9)	37.89(6.22)	0.657**
Chain	24(57.1)	37.04(5.96)	
Employment Status [a]			
Full time	36(85.7)	37.69(5.80)	0.451**
Part-time	6(14.3)	35.67(7.53)	
Education Level [a]			
Undergraduate	37(88.1)	37.59(6.29)	0.584**
Postgraduate	5(11.9)	36.00(3.39)	
Age Group [b]			
23-39	28(66.7)	37.82(6.22)	0.067**
40-59	9(21.4)	39.22(3.53)	
>60	5(11.9)	31.80(6.06)	
Working Experience [b]			
≤1 year	8(19)	39.50(4.98)	0.535**
2-10 years	19(45.2)	36.63(6.40)	
>10 years	15(35.7)	37.27(6.12)	
Location of Community Pharmacy [b]			
Urban	12(28,6)	36.25(5.46)	0.722**
Suburban	15(35.7)	37.60(6.75)	
Rural	15(35.7)	38.13(5.93)	

[a] Independent T-Test [b] One-Way Anova test
**p-value shows no statistical significance

Expected Remuneration

Majority of respondents (81%) agree that customers should pay for the service. Most (31%) prefer to be paid around RM21-30 if they were needed to conduct geriatric medication review. Respondent also answered that they do not mind not receiving any incentives, some answered that they could do it on voluntary basis and others stated that remuneration should be based on satisfaction from customer and caregiver.

DISCUSSION

Majority community pharmacists had extensive knowledge in geriatric medicine review. To begin implementing new services such as geriatric medication review using an online platform, obtaining the assistance of an expert is essential. 57.1% of respondents were employed by a chain pharmacy, while an independent pharmacy employed 42.9%. This may imply that this study was well distributed and able to reach both types of pharmacies in Malaysia. Almost the same number of responses to this study came from pharmacies in rural (28.6%), urban (35.7%), and suburban areas (35.7%). This was in line with a study by Tew et al., (2021) which reported that the geospatial distribution of community pharmacies providing pharmaceutical services were relatively good in Malaysia. Majority respondents demonstrate a moderate level of preparedness. Even without an incentive, majority pharmacists were ready to do geriatric drug review using an online platform. However, many of them were not sure and disagree to work after office hour if needed. Similarly, many of them were aware of the increase in workload, yet the majority lacked confidence in their ability to handle it. This may be related to stress level in extended working hours. Teong et al. (2019) revealed that the number of working hours per week is a significant factor affecting pharmacists' stress levels. This implies that if this practice was applied in a community pharmacy setting, it should only occur during working hours. Moreover, most of them also agreed that they were ready to conduct patient and device counselling through an online platform supported by Chua et al. (2013) that community pharmacists are highly skilled in pharmaceutical care services, yet their skills were not sufficiently utilised by the public. A study by Lim et al. (2020) shows that the technology skills of community pharmacists in Malaysia were good. This may be an area of opportunity for community pharmacists in Malaysia to expand their roles by providing geriatric medication review virtually.

Comparison Level of Readiness Within Demographic Factor

There is no significant difference among the three age groups. This explained previous finding by Broady et al. (2010) where older and younger adults have similar attitudes and abilities when it comes to using computer and technology. The difference in technology literacy between older and younger people is not significant nowadays, as both are able to adopt it.

Expected Remuneration

Majority of pharmacists agree to be remunerated for a 30-minute geriatric medication review via an online platform. This finding is crucial as reimbursement is part of the major barriers to conduct the medication review through an online platform (Abu Assab et al., 2022). Earlier finding suggest that issuance of reimbursement could influence pharmacists' readiness to conduct medication therapy management (Lounsbery et al., 2009). Respondents anticipated a remuneration of RM21-30 for a 30-minute online medication review session for geriatric population. In Europe a fixed fee ranging from 30 to 80 euros is charged for each medication review service performed in all nations with coverage by the government or health insurance. (Imfeld-Isenegger et al., 2020).

CONCLUSION

Lack of respondents due to short period of study limits the generalisation that all community pharmacists in Malaysia have moderate level of readiness in conducting geriatric medication review via an online platform. However this study concluded that community pharmacists were ready to conduct geriatric medication review via an online platform. Adequate remuneration and addition of this service to pharmacists' current work-load remain areas requiring consideration to offer the service.

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Knowledge, Perception, and Readiness of Community Pharmacists on Online Smoking Cessation Services in Malaysia

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ABSTRACT

Background: The "Malaysia Quit" or "MQuit" program comprising of public and private facilities was formed as a one-stop smoking cessation service resource for the national tobacco control programme. During the Covid -19 pandemic, the public were heavily engaged with digital technology and accessibility to online services were pertinent.

Objective: This study aimed to assess the community pharmacists'(CPs) knowledge, perception and readiness on online smoking cessation services (OSCS).

Methods: A cross sectional survey using online questionnaire was conducted among registered CPs in Malaysia. The questionnaires were distributed by convenience sampling via email and messaging platform such as WhatsApp.

Results: Seventy-one questionnaires were returned (a response rate of 20%). Majority of respondents showed a good level of knowledge, perception, and readiness. Male and Malay CPs had significantly lower median knowledge score compared to female and non-Malays, respectively. CPs with working experience of more than 5 years had significantly lower median perception score than the CPs with working experience of 5 years and below. There was a significant linear and positive correlation between knowledge score and readiness score ($r=0.48$, $p<0.05$).

Conclusion: In general, CPs demonstrated good knowledge, perception, and readiness regarding OSCS in Malaysia. The result of this study echoes the need for community pharmacists to be certified as smoking cessation service provider to enable them to deliver OSCS as majority CPs in this study are willing to implement the service.

Keywords: community pharmacists; smoking cessation; online smoking cessation services.

INTRODUCTION

The national tobacco control includes the smoking cessation campaign, the "Malaysia Quit" or "MQuit" centres were established as an integrated smoking cessation service including both public and private facilities (Md Bohari et al., 2021). In 2022, 48.9% of all smokers sought to stop, with the proportion being greatest among smokers aged 15 to 19. The incidence of quit attempts rises with education level (Institute for Public Health (IPH), 2020). According to Babar et al. (2007), pharmacists are one of the most relevant and accessible health care practitioners that might assist patients in quitting smoking. Studies worldwide showed that professional pharmacists aiding with smoking cessation programmes are more efficient and result in a longer time of smoking cessation (Brown et al., 2016; Gobarani et al., 2021; Sinclair et al., 2004). Since 2004, the Malaysian Academy of Pharmacy (MAP) and the Malaysian Pharmacists Society (MPS) have conducted program known as Certified Smoking Cessation Service Provider (CSCSP) (Malaysian Academy of Pharmacy (MAP), 2021) . There was an increase in the intensity and competence of consumers to utilise internet services (Li et al., 2021) during COVID-19 epidemic. The public are more inclined to use information technology and digital platforms. This research seeks to identity the factors affecting CPs to implement online smoking cessation services.

METHODOLOGIES

The study was a cross-sectional web-based questionnaire of samples size of 355 community pharmacists. Convenience sampling enabled for immediate availability of collection of data from the intended population on-hand. The questionnaire comprised of demographic, knowledge, perception and readiness sections. The questionnaire was adopted and adapted from previous study by Selvaraj et al., (2020) and Elnaem et al., (2022) and appropriate modifications made following the pilot study. Respondents were required to click the "I Agree" button on the web-based questionnaire to affirm their consent to participate. Confidentiality of data was assured.

RESULTS

A total of 71 respondents out of an estimated 355 sample size of CPs met the inclusion criteria and completed the questionnaire. This corresponds to a response rate of 20% overall.

Demographic Data of Respondents

The distribution of CPs who participated in the study according to their demographic data is summarized in Table 1 below. The age, gender and number of CSCSP were depictive of the current demographic distribution of community pharmacists in Malaysia.

Table 1: Distribution of community pharmacists that participated in the study according to their demographic background and work characteristics (n=71)

Variable	n (%)
Age (years)	
• ≤ 30 years old	42 (59.2)
• > 30 years old	29 (40.8)
Gender	
• Male	28 (39.4)
• Female	43 (60.6)
Ethnicity	
• Malay	55 (77.5)
• Chinese	13 (18.3)
• Indian	3 (4.2)
Place of graduation	
• Local university	61 (85.9)
• Overseas university	10 (14.1)
Highest education level	
• Undergraduate degree	55 (77.5)
• Postgraduate degree	16 (22.5)
Location of community pharmacy (state)	
• Johor	4 (5.6)
• Kedah	2 (2.8)
• Kelantan	7 (9.9)
• Kuala Lumpur	2 (2.8)
• Melaka	1 (1.4)
• Negeri Sembilan	1 (1.4)
• Pulau Pinang	8 (11.3)
• Perak	3 (4.2)
• Perlis	1 (1.4)
• Putrajaya	-
• Pahang	4 (5.6)
• Sarawak	-
• Selangor	25 (35.2)
• Sabah	3 (4.2)
• Terengganu	10 (14.1)
Working experience as CP (year)	
• ≤ 5 years	53 (74.6)
• > 5 years	18 (25.4)
Type of CP	
• Full time CP	68 (95.8)
• Part time CP	3 (4.2)
Type of License A	
• Retail only	54 (76.1)
• Retail and wholesale	17 (23.9)
Type of pharmacy	
• Independent pharmacy	30 (42.3)
• Big chain pharmacy	18 (25.4)
• Small chain pharmacy	23 (32.4)
CSCSP	
• Yes	14 (19.7)
• No	57 (80.3)

Note: CP=community pharmacists; CSCSP=Certified Smoking Cessation Service Provider

Knowledge, Perception and Readiness Level of Score of Community Pharmacists in Conducting Smoking Cessation Services on an Online Platform

Each section's cumulative score was used to divide responses into three categories: poor (≤ 40%), moderate (41% - 74%), and good (≥ 75%) (Elnaem et al., 2022). Table 2 summarises the knowledge, perception and readiness levels of CPs for conducting OSCS on an online platform.

Table 2: Knowledge, perception, and readiness level of score on online smoking cessation services among respondents (n=71)

Level of score	Number of respondents, n (%)		
	Knowledge	Perception	Readiness
≤ 40% (Poor)	2 (2.8)	2 (2.8)	6 (8.5)
41% - 74% (Moderate)	16 (22.5)	19 (26.8)	19 (26.8)
≥ 75% (Good)	53 (74.6)	50 (70.4)	46 (64.8)

Differences in Knowledge, Perception and Readiness Score with the Community Pharmacists' Demographic Data and Work Characteristics Towards Online Smoking Cessation Services is summarized in Table 3.

Table 3: Differences in knowledge, perception and readiness score with the demographic data and work characteristics towards online smoking cessation services

Variables	n (%)	Knowledge Score		Perception Score		Readiness Score	
		Median (IQR)	*p*-value	Median (IQR)	*p*-value	Median (IQR)	*p*-value
Age group[a]							
≤ 30 years old	42 (59.2)	10.0 (3.0)	0.524**	20.0 (3.0)	0.171**	19.5 (5.0)	0.434**
> 30 years old	29 (40.8)	10.0 (2.0)		19.0 (3.0)		20.0 (8.0)	
Gender[a]							
Male	28 (39.4)	9.5 (3.0)	0.032*	19.5 (3.0)	0.211**	19.0 (8.0)	0.424**
Female	43 (60.6)	11.0 (2.0)		20.0 (3.0)		20.0 (5.0)	
Ethnicity[a]							
Malay	55 (77.5)	10.0 (3.0)	0.018*	20.0 (4.0)	0.162**	20.0 (6.0)	0.274**
Non-Malay	16 (22.5)	11.0 (3.8)		19.0 (5.0)		19.0 (6.0)	
Place of graduation[a]							
Local university	61 (85.9)	10.0 (3.0)	0.212**	20.0 (3.0)	0.516**	19.0 (6.0)	0.410**
Overseas university	10 (14.1)	11.0 (2.5)		18.5 (7.0)		20.0 (9.0)	
Highest education level[a]							
Undergraduate degree	55 (77.5)	10.0 (2.0)	0.940**	20.0 (2.0)	0.086**	20.0 (5.0)	0.406**
Postgraduate degree	16 (22.5)	10.0 (4.8)		18.0 (7.0)		18.0 (9.0)	
Working experience as community pharmacist[a]							
≤ 5 years	53 (74.6)	10.0 (3.0)	0.623**	20.0 (4.0)	0.036*	20.0 (6.0)	0.186**
> 5 years	18 (25.4)	10.0 (2.3)		19.0 (3.0)		19.0 (6.0)	
Type of pharmacy[b]							
Independent chain	30 (42.3)	11.0 (2.3)	0.144**	20.0 (3.0)	0.671**	20.0 (8.0)	0.262**
Big chain	18 (25.4)	10.5 (3.3)		19.5 (3.0)		19.0 (5.0)	
Small chain	23 (32.4)	10.0 (3.0)		20.0 (4.0)		20.0 (4.0)	
CSCSP[a]							
No	57 (80.3)	10.0 (3.0)	0.637**	20.0 (3.0)	0.595**	19.0 (6.0)	0.375**
Yes	14 (19.7)	10.5 (2.8)		19.0 (4.0)		20.0 (7.0)	

[a]Mann-Whitney test, [b]Kruskal-Wallis test, **p*-value < 0.05 shows statistical significance, ***p*-value > 0.05 shows no statistical significance

Correlation of Knowledge and Perception Score Towards Readiness Score on Online Smoking Cessation Services Among Respondents

The correlation between knowledge score and readiness score was not significant ($p>0.05$). Thus, there was no correlation between the knowledge score and the readiness score. Nonetheless, there was a linear and positive correlation of perception towards readiness ($p<0.001$). The correlation was moderate ($r=0.48$) and statically significant. As CPs perceptions towards OSCS increase, their readiness for OSCS will increase as well.

Table 4: Correlation between knowledge and perception towards readiness score in OSCS among respondents (n=71)

Variable	Readiness score
Knowledge score	0.17[a] (p = 0.158)*
Perception score	0.48[a] (p < 0.001)**

[a]Pearson correlation coefficient, r
*p-value > 0.05 shows no statistical significance
** p-value < 0.05 shows statistical significance

DISCUSSION

Demographic Data of Respondents

Only one-fifth of respondents have are certified smoking cessation providers. This may be attributed to CPs not attending or finishing the online CSCSP course owing to their hectic work environments. The CSCSP course also needs participation in examitnation and workshop (MAP CSCSP, Commonwealth Pharmacists Association, 2022).

Knowledge Among Community Pharmacists in Conducting Online Smoking Cessation Services

Most of the respondents knew information and communication technology (ICT) and a strong internet connection are important and necessary to carry out an OSCS. Apart from that, more than half of respondents are aware that an OSCS is accessible in Malaysia. Yet, over half of the respondents do not know or are unsure about the availability of OSCS in Malaysia. This might be attributed to a lack of advertising for the online course and smoking cessation websites (Helmy Jaafar et al., 2021) Almost half of the respondents certain that OSCS provides better counselling in terms of privacy and length of the session and better assessment and information for patients in rural areas. Prior studies stated online services provide a better level of confidentiality than one-on-one or phone-based consultations, making the patient more comfortable and attentive during the session (Taylor et al., 2017). Internet services provide more privacy and a longer period of counselling (Poudel & Nissen, 2016). Telepharmacy is also beneficial when a compressed video, rather than the standard package insert instructions, is utilised to demonstrate metered-dose inhaler procedures. (Poudel & Nissen, 2016).

Perception and Readiness Among Community Pharmacists in Conducting Online Smoking Cessation Services

There were more than half of the respondents 'agreed' that OSCS is one of the effective alternatives and that it also will improve the patient's adherence to the medication. There was a finding stated that increased website usage was mostly a consequence of participation in online communities. Even after adjusting for motivation, those who engaged in the community had a greater effective rate of stopping and keeping abstinent from smoking than less intense users (Graham et al., 2013). Majority of respondents 'agreed' that the online service would increase the CPs' workload. These results might be attributed to a lack of willingness among people who have been in primary care professions for some time to broaden their skills beyond responsibilities requiring medication administration and optimization (Butterworth et al., 2017). Majority respondents 'agreed' that pharmacists should be qualified, and that pharmacy schools should include computer and IT education programmes to evaluate and help an OSCS in the future. This assertion is backed by prior research, which found that after receiving CSCSP intervention, understanding of smoking cessation counselling improved (Saraswathi Simansalam, 2015). Moreover, education technology, which is introduced as early as undergraduate school, supports the growth of patient care (Michael A. Smith, 2015).

Moreover, more than half of the respondents were willing to give counselling and educate patients about smoking cessation programmes using an online platform. Also, fewer than half of the respondents were prepared to shoulder the burden while performing OSCS, with the remainder undecided or unprepared. This might be connected to the CPs' perceptions from the survey for this research, in which many of them believed OSCS would raise their burden, hence increasing their commitment and effort supported by Loh et al. (2021). CPs reported a desire to integrate pharmaceutical care practices but highlighted a variety of impediments to achieve this goal. Some of the obstacles include a lack of labour, a lack of training, and a lack of material supplies to deliver the service This reflects the reality that, although most CPs are prepared to advise and instruct the patient, they are not prepared to carry out the duty of performing the OSCS. Despite this, the respondents were mostly ready and willing to undergo training in ethics and legal issues related to OSCS. According to one of the earlier research projects, many CPs have shown a readiness to try out telepharmacy in community settings. Yet, majority of them believe that there are insufficient pharmacists to utilise telepharmacy, and that pharmacist training should be increased effectively (Ng & Sze, 2022). This is also corroborated by recent research, which indicated that most CPs feel that telepharmacy needs extra training for pharmacists before they can provide the service to patients (Muhammad et al., 2022).

CPs supported the notion of providing OSCS with IT educational and training assistance. CPs are willing to be trained for this programme, indicating that they may be better prepared to execute and commit to the programme upon receiving certification.

Knowledge, Perception and Readiness Level of Score of Community Pharmacists in Conducting Smoking Cessation Services on An Online Platform

The majority shows a positive outcome and has a good level of knowledge, perception, and readiness. However, a quarter of the respondents showed a moderate level of knowledge, perception, and readiness. These might be due to low patient demand, low training, and a lack of educational materials for smoking cessation services among retail pharmacies, as stated in the previous article, where these are the barriers hindering the provision of smoking cessation services (Sakka et al., 2022).

Differences in Knowledge, Perception and Readiness Score with The Community Pharmacists' Demographic Data and Work Characteristics Towards Online Smoking Cessation Services

There was a statistically significant association between gender and knowledge on OSCS ($p<0.05$). Based on the result in Table 3, females are more knowledgeable about OSCS compared to males. One of the reasons might be due to the sample size, where the respondents that involved in this study have more female than male. Based on a previous study, they stated that women had a higher mean compared to men in terms of their attitude score towards expanding their prescribing role (Mhailan et al., 2022). This shows that women had more interest in gaining more knowledge to improve their role as pharmacist. Thus, this might be the reason of why compared to men, women are more informed about OSCS. Moreover, there was a statistically significant association between ethnicity and knowledge on OSCS ($p<0.05$). Based on the result in Table 3, non-Malays were more knowledgeable on OSCS compared to Malay. This can be supported by the previous study, in which they revealed the mean attitude score of non-Malays was higher compared to Malay (Selvaraj et al., 2020). However, there is a statistically significant association between working characteristics as a CP and perception on OSCS ($p<0.05$). Based on the result in Table 3, CP that have the experience of 5 years and below had more positive perception on OSCS compared to CP that works for more than 5 years in community settings. This may be due to the strong desire of newer pharmacists to serve the community, as they are just entering the workforce. A recent study found that young CPs had a more optimistic outlook and were more open to technology. They have a better understanding of the vocabulary, functions, and manuals used in IT. In addition, they are adept at adapting quickly to constant change in the workplace. (Ng & Sze, 2022).

In general, female and non-Malay CPs were more knowledgeable about OSCS and CPs with working experience of 5 years and below perceived more positively towards OSCS.

Correlation Between Knowledge and Perception Towards Readiness Score on Online Smoking Cessation Services Among Respondents

There is a linear, positive, and moderate correlation of perception score with readiness score and the correlation is statistically significant. According to a prior study, there are wide variations in people's comprehension of the role of a pharmacist and how the training course affected their views. Perceptions of pharmacists also vary depending on their experience level and working role. Their level of experience, combined with the training they received, affected their confidence in the assigned job. They all recognized the difficulties and uncertainties pertaining to the future direction of the position (Butterworth et al., 2017). Thus, a better perception was related to improved readiness for the online service. The perception of CPs plays an important role in influencing their willingness to use online platforms for smoking cessation counselling and teaching.

CONCLUSION

Although majority of CPs in this study demonstrated a lack of readiness to perform OSCS, they were willing to undergo training for this programme, There is a need to intensify the uptake of the training to undertake implement the service. CPs in Malaysia must be prepared to use innovative technology (IT) as part of the CSCSP requirement.

ETHICAL APPROVAL

Ethical approval was granted by the Cyberjaya Research Ethical Review Committee (CRERC).

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The Present State of Malaysia's Adoption of Cryptocurrencies

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ABSTRACT

Cryptocurrency has revolutionized the digital currency ecosystem, offering a recent and disruptive financial alternative that operates independently from government control and backing. With growing acceptance, the cryptocurrency market has seen a significant expansion. This paper aims to provide an up-to-date analysis on the adoption of cryptocurrencies, identifying its current research stage and highlighting future directions for further studies. In particular, a systematic literature review of ten research publications published between 2018 and 2022 is presented, shedding light on the use of cryptocurrencies in Malaysia. The results of the SLR reveal that there is a lack of study focusing on the factors that are significant influence on the acceptance of cryptocurrency from a human security standpoint. Furthermore, there is also a lack of mixed methods or qualitative methods used in addressing the issues, whereby all of the researchers were only used quantitative. There is also a need to address the factors influencing the adoption for both consumers and merchants to have an overall understanding of the whole cycle of cryptocurrency adoption.

Keywords: Cryptocurrency; Technology adoption; Systematic literature review.

INTRODUCTION

In Malaysia, cryptocurrency is now considered a product of digital assets. Although still in its infancy, the crypto phenomenon is gaining shape in terms of the volume of transactions. There is a continuous level of uptake of cryptocurrency in the market. The crypto market capitalization is at USD 1.007 trillion, while Bitcoin reached USD 41,973 in 2021 (Yusof, 2021). There is a lack of study focusing on the factors that are significantly influenced on the acceptance of cryptocurrency (Redhwan et al., 2019) particularly on the usage of cryptocurrency for the online payment transaction. Online payment systems are a crucial aspect of e-commerce, allowing customers to make secure and convenient transactions. However, the current online payment system in e-commerce is facing several issues, including security breaches, payment failures, limited payment options, high transaction fees, and legal disputes. These issues can have significant implications for both customers and e-commerce businesses, such as loss of customers, negative reputation, financial losses, reduced profitability, legal consequences, and limited growth potential.

If these issues are ignored, it can lead to decreased customer trust, lower satisfaction, and reduced competitiveness. Customers who experience security breaches or payment failures are likely to switch to competitors or abandon online shopping altogether, leading to a loss of revenue for e-commerce businesses. Online payment issues can damage the reputation of e-commerce businesses, leading to decreased trust and lower customer satisfaction. Payment fraud and disputes can result in significant financial losses for both customers and e-commerce businesses. High transaction fees and limited payment options can reduce the profitability of e-commerce businesses, making it difficult for them to compete with other businesses in the market. Payment disputes and fraud can result in legal disputes and regulatory action, leading to financial penalties and damage to the reputation of e-commerce businesses. Ignoring these issues can limit the growth potential of e-commerce businesses, reducing their ability to expand and compete in the market.

Cryptocurrency has emerged as a potential solution to some of these issues, offering benefits such as enhanced security, instant transactions, low transaction fees, and cross-border payments. Cryptocurrency transactions are secured through complex cryptographic algorithms, making them more secure than traditional online payment methods. Cryptocurrency transactions are processed instantly, reducing the likelihood of payment failures due to technical errors or delays.

However, the adoption and use of cryptocurrency still faces challenges and limitations, including limited acceptance, volatility, and complexity. Cryptocurrency is not yet widely accepted by e-commerce businesses, limiting its usefulness as a payment method. Cryptocurrency prices can be highly volatile, making it difficult to predict the value of payments received in cryptocurrency. It is also still relatively complex for some customers to use, with a steep learning curve and technical requirements that can deter some users.

An Overview of The Cryptocurrency

Cryptocurrency is defined as "*a medium of exchange, just like any other currency, but these are only digitally available*" and possess several unique features that strengthen its credibility (Deepak et al., 2020). Cryptocurrency is a digital payment mechanism that does not involve the banking system and is underpinned within the peer-to-peer transaction mode. In essence, all transactions exist in digital ledger entries and are stored in a digital wallet. Security-wise, cryptocurrency uses advanced encryption technology for verification and transmission. To date, there are around 10,000 different types of cryptocurrencies in 2022, with the most popular cryptocurrency on the market (Beau, 2019).

Cryptocurrencies' additional value is derived from both their usability as a form of payment and the trust they inspire in consumers. Financial and payment independence is made possible by the usage of cryptocurrencies; a user can transact with any other user, wherever in the world, without any limitations. Users who do not wish to pay expensive international rates for remittance services can benefit from the lack of limits and the removal of a third party intermediary, which results in effective and profitable savings for the user in each transaction. For the objective of swiftly and cheaply completing financial transactions, cryptocurrency offers an alternative payment option. Figure 1 provides a summary of the concepts of cryptocurrency.

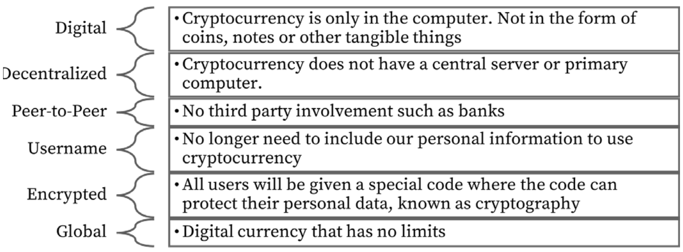

Figure 1: Basic concepts of cryptocurrency.
Source: Adopted from Amsyar, et al. (2020).

METHODOLOGY

This article's goal is to identify the current stage of cryptocurrency adoption and the models that have been used as well as the key factors that influencing the current adoption in Malaysia. In this paper, a systematic literature review (SLR) is performed to identify the carried out research topics related to cryptocurrency adoption and models that have been used as well as the factors influencing the adoption in Malaysia that can be used as reference in future studies. To accomplish this goal, systematic literature review was selected as the methodology to explore relevant papers in scientific databases and to draw a map of current cryptocurrency adoption research. First, an overview of cryptocurrency, and then describes the goal and research questions of the SLR followed by the research process. Following that, the classification achieved from the literature review as well as a summary of the previous related research conducted. Finally, the conclusions are made as well as future research directions. To accomplish the goal of the SLR, research questions were formulated as follows:

RQ1: What study areas have been examined in Malaysia's use of cryptocurrencies?
The primary goal of the SLR is to highlight the areas of existing research on the use of cryptocurrencies. It would be feasible to develop a comprehensive overview of cryptocurrency adoption research and identify the current study fields by compiling relevant publications from academic sources. A greater grasp of the present stage of adoption may be gained by identifying the current study being done on the adoption of cryptocurrencies, which will advance the research on cryptocurrency adoption even further.

RQ2: What models have been used to carry out cryptocurrency adoption research?
It would be able to construct a summary of the work done by the prior studies in this field, as well as the models that were used to conduct the study, by reading all the pertinent articles. At the same time, will make it easier to identify all the significant factors that influence the adoption of cryptocurrency.

RQ3: What are the directions for future research on the adoption of cryptocurrency?
Understanding the potential future research directions for cryptocurrency adoption is a consequence of RQ1 and RQ2. Responding to this research question is helpful in the stage of determining the research cryptocurrency adoption should be directed and what possible factors need to be addressed.

Search Process

The systematic literature review method is a clearly defined technique for locating, analysing, and interpreting all publications that are pertinent to a certain research question, field of study, or phenomena of interest. This study was carried out in accordance with the following SLR criteria (Kannan et al., 2022). Before starting the review job, the concerns were first identified and addressed in the form of concise, precise, and organised inquiries. During the second phase, a variety of resources were employed to conduct a language-free search. The review questions directly influenced the selection of publications. The papers were initially selected based on their titles, and then publications that had no bearing on the subject of the research were eliminated. For instance, the search engine returns publications that have nothing to do with Malaysia's acceptance of cryptocurrencies. These papers were evidently out of the purview from the comprehensive literature evaluation.

Figure 2: Systematic literature review search process (Kannan et al., 2022)

In several instances, it was hard to decide the relevancy level of the papers based on the title. In this instance, articles were moved on to the subsequent stages for a more thorough reading procedure. The researcher reviewed the abstracts in the subsequent stage. Keywords were chosen at the same stage. The keywords accepted, utilised, used, intention, perception, and adoption were used to search the two indicated digital sources (Research Gate and Google Scholar). In the systematic literature review, keywords were utilised to group information and create categories. The reading of all the chosen articles begins after the categories have been grouped. As a result, SLR of clustered categories derived from all pertinent studies pertinent to the research issue was created.

RESULTS

Summarisation of results

Ten articles were found in this section, and they were all published during the last four years. This categorization entails grouping the findings in accordance with the methodology used by earlier scholars (quantitative). The findings clearly show that interest in cryptocurrency adoption research has grown during the years of study. To address the research questions RQ1 and RQ2, the results that were taken from the publications that were evaluated were reported. The answers to RQ1 and RQ2 are shown in the tables and explanations that are supplied below.
A survey and questionnaire were used by the authors to conduct their research for this area (Xia et al., 2022). 176 Malaysians who are familiar with cryptocurrency made

Table 1: Quantitative research

Authors	Area of research	Model	Methodology used	Findings and Conclusion
Xia, C., Mahadi, H.M., & Gazi, M.I. (2022).	Investigated the effects of age, education level and income level differences in an invidual's behavioral intention to use cryptocurrency	Theory of Planned Behavior (TPB)	Online survey and questionnaire	Neither an individual's age, education, nor income level greatly impacts how they behave in regard to embracing cryptocurrency. There may be other characteristics that contribute to the explanation of the observed person's inclination to use cryptocurrencies, this study solely examined changes in age, income, and educational achievement.
Othman, J., & Salehuddin, S. (2022).	Investigate the social factors that influence cryptocurrency awareness among Generation Z in Malaysia.	Developed specific social factors (social acceptance, trust, and confidence)	Survey and questionnaire	Significant relationship between trust, confidence level, society acceptance, and cryptocurrency awareness.
Ruhana, K. M., Mazni, O., Azzah, N.B., & Dada, I.M. (2019)	Investigate the level of awareness, trust and adoption of blockchain technology among blockchain community in Malaysia.	Developed specific social factors (awareness and trust)	Online survey and questionnaire	Blockchain technology is found able to offer a secure and trustworthy platform,
Yoon, C. Y., Khairul, S.K., & Savita,K.S. (2019)	Examine the factors that influence cryptocurrency acceptance.	Unified Theory of Acceptance and Use of Technology2 (UTAUT2)	Online survey and questionnaire	The proposed model are valid and reliable despite the pilot project's very small sample size.
Farris, I.G., Chun, T.L. & Lee, Y.T. (2020).	Examining the factors that affect the behavioral intention to use Bitcoin in Malaysia	Unified Theory of Acceptance and Use of Technology	Online self-administered questionnaire	Performance expectation has the greatest influence on customers' behavioural intention to use.

Authors	Area of research	Model	Methodology used	Findings and Conclusion
Siew, C.W., Teoh, T.T., Yap,K.H. (2022)	Examine the association between bitcoin usage as an extra means of internet/online transaction techniques and output quality, perceived accessibility, outcome demonstrability, and perceived security.	Developed specific factors (Output quality, perceived accessibility, outcome demonstrability, and perceived security)	Survey and questionnaire	High positive association between the adoption of cryptocurrencies by users and the perceived output security, demonstrability, and quality.
Ahmad, S.Z., Awi, N.A., Azwadi, A. (2020)	Assessed the awareness of cryptocurrencies in business transaction among selected Malaysian public	-	Survey and questionnaire	Age group, ethnicity, and occupation status were discovered to have affected respondents' awareness of cryptocurrency among the factors.
Omar, A., & Rana, A. (2018)	Investigates the factors affecting Malaysian Generation Z attitude and intention to use cryptocurrency in their financial decisions.	Developed specific factors (Technology awareness, trust, ensuring customer satisfaction)	Survey and questionnaire	Factors including output quality, outcome demonstrability, and perceived security has significance influence.
Kannan, R. & Basbeth, F. (2022)	Determine the elements influencing the continuance intention of cryptocurrency mobile wallets in Malaysia.	Post-Acceptance Model of IS Continuance	Survey and questionnaire	Perceived security and satisfaction are significant predictors of intention to continue using cryptocurrencies, whereas performance expectations, effort expectations, and social influence are not significant predictors
Yoon, C. Y., Khairul, S.K., & Savita,K.S. (2019)	Explore the between-groups differences in the Malaysia individuals' intention to use cryptocurrency, in terms of age, education level and income level.	Developed specific factors (Age, education level, income level)	Online survey and questionnaire	Individual's behavior toward adopting cryptocurrencies is not significantly influenced by their age, education, or income level.

up the sample. To collect the empirical data, an online survey was conducted using a Google form. The data was then evaluated using one-way analysis of variance (ANOVA) to ascertain how respondents' intentions to adopt cryptocurrency were impacted by demographic characteristics. The results also demonstrated that neither an individual's age, education, nor income level greatly impacts how they behave in regard to embracing cryptocurrency. To reach these individuals, future research may distribute hardcopy survey questions at blockchain and cryptocurrency-related events. This may provide new insights by looking at the real data of respondents with diverse demographic profiles and backgrounds. Second, because there may be other characteristics that contribute to the explanation of the observed person's inclination to use cryptocurrencies, this study solely examined changes in age, income, and educational achievement. For instance, a person's decision to accept cryptocurrencies may be influenced by their gender and amount of information technology skill. In order to validate his idea, another study employed a questionnaire to gather data from 211 Malaysians, the majority of whom were between the ages of 18 and 25 (Othman et al., 2022). The results back up the somewhat positive and significant relationship between trust, confidence level, society acceptance, and cryptocurrency awareness. This suggests that Generation Z's understanding of cryptocurrencies in Malaysia is influenced by social factors such as trust, the degree of trust, and societal acceptability. According to a different survey, knowledge of blockchain technology and cryptocurrencies is still developing, especially in developing countries (Ruhana et al., 2019). During this phase, information from 304 respondents was gathered online using the validated questionnaire in a real survey. However, the majority of respondents are confident and think that blockchain technology can offer a secure and trustworthy platform, which has a positive impact on the use of the technology. Future initiatives could focus on creating blockchain apps and doing awareness research for organisations outside than Malaysia's blockchain organisations.

Other authors have developed a study model that integrates cryptocurrency dimension antecedents with UTAUT2 (Unified Theory of Acceptance and Use of Technology) components in order to analyse the factors that influence the adoption of bitcoin (Yoon et al., 2019).

Based on the use of Gpower software to establish the minimal sample size necessary for real data collection, the findings demonstrate that the measuring items and constructs utilised in the proposed model are valid and reliable despite the pilot project's very small sample size. At the same time, Farris and others in 2020 looked into the factors affecting Malaysians' behavioural intention to use Bitcoin using the UTAUT model. The results show that performance expectation has the greatest influence on customers' behavioural intention to use bitcoin, as compared to other aspects like social influence and enabling conditions. The results suggest that Malaysians' behavior-driven desire to utilise Bitcoin may increase if doing so will benefit the public and businesses, but it is also influenced by the social and enabling environment.

Another study conducted by Siew and others in 2022 looked at the relationships between using bitcoin as an additional method for online/internet transactions and output quality, perceived accessibility, result demonstrability, and perceived security. A sample of 553 respondents, whose ages spanned from under 21 to over 60, provided the data. The findings demonstrated a high positive association between the adoption of cryptocurrencies by users and the perceived output security, demonstrability, and quality. However, there are still a number of issues with this study that need to be resolved in follow-up investigations. First, the selected users' ages varied from 21 to 60. Respondents in this large age range would naturally exhibit a wide range of consumption and adoption behaviours. Therefore, to give study findings that are statistically more significant, it is proposed to apply a quota sampling technique across many generations. Additionally, the current study did not explore the interaction effects between the demographic parameters and the research constructs. Future studies should investigate connections such as those between gender and educational disparities to better understand how these elements influence Malaysians' adoption of cryptocurrencies.

In a different study (Ahmad et al., 2020), the topic of cryptocurrency transactions in commercial settings was covered. The researchers used a survey to look at issues including whether Malaysians are aware that cryptocurrencies exist as a financial instrument and how demographic parameters like gender, age, ethinicity, education, occupation, and residences affect Malaysians' understanding of cryptocurrencies. The results show that, although none of the 400 respondents—nearly three-quarters—owned even one digital currency. Age group, ethnicity, and occupation status were discovered to have affected respondents' awareness of cryptocurrency among the factors.

According to the findings of a study on the variables driving bitcoin adoption in Malaysia, the technology is increasingly being used for online transactions (Omar & Rana, 2018). An individual's use of cryptocurrencies is seen to be possibly predicted by factors including output quality, outcome demonstrability, and perceived security. Future research can look at the influence of additional characteristics in addition to those already discussed, such as perceived usefulness and perceived usability, to assess people' intents to use cryptocurrencies.

Meanwhile, according to another author's description of the empirical data from 106 current cryptocurrency users, perceived security and satisfaction are significant predictors of intention to continue using cryptocurrencies, whereas performance expectations, effort expectations, and social influence are not significant predictors (Kannan et al., 2022). It also demonstrates that one of the crucial factors in the bitcoin industry's ambition to continue is perceived security.

The other study addresses the literature gap by focusing the case of Malaysian individuals (Yoon et al., 2019). This study specifically looked at how disparities in age, education, and income affect people's behavioral intentions to use cryptocurrencies. The sample consisted of 176 Malaysians who are knowledgeable with cryptocurrencies. The empirical data were acquired utilizing a Google form for an online survey. The findings showed that an individual's behavior toward adopting cryptocurrencies is not significantly influenced by their age, education, or income level.

Summary

According to Table 1, all ten of the research projects in the publications were quantitative in nature; neither mixed-methods studies nor qualitative research were conducted. In Figure 3, the writers and subjects that they wrote about are emphasised.

CONCLUSION

This paper addresses three research questions as mentioned above. The first question pertaining to themes covered by cryptocurrencies was addressed by compiling relevant publications from academic databases. Reviewing the methods employed in all pertinent articles provided an answer to the second question, which concerned the models that have been utilized to carry out bitcoin adoption. A thorough literature assessment was conducted to address the third query, which concerned the future course of cryptocurrency research acceptance. This systematic literature review's objective was to determine Malaysia's current adoption status for cryptocurrencies. The articles that were evaluated were solely included for studies on adoption and acceptability; papers on cryptocurrency technology or other unrelated topics were not included. From academic databases, 10 primary publications were retrieved and examined for this investigation.

Factors Affecting Cryptocurrency Adoption in Digital Business Transactions: The Mediating Role of Customer Satisfaction.

- (Xia et.al., 2022)

The Factors Influencing Cryptocurrency Awareness Among Generation Z in Malaysia: The Roles of Trust, Confidence, and Social Acceptance.

- (Othman et.al., 2022)

Determinants of Behavioral Intention to Use Bitcoin in Malaysia

- (Farris et.al., 2020)

Consumers' Intention to Continue Using Cryptocurrency Mobile Wallets in Malaysia.

- (Kannan et.al., 2022)

Trust, Technology Awareness and Satisfaction Effect into Intention to Use 'Cryptocurrency among Generation Z in Malaysia.

- (Ommar et.al., 2018)

Awareness, Trust, and Adoption of Blockchain Technology and Cryptocurrency among Blockchain Communities in Malaysia.

- (Ruhana, et.al.,2019)

Determinants of Cryptocurrency Adoption

- (Siew et.al.,2022)

Cryptocurrency Adoption in Malaysia: Does Age, Income and Education Level Matter?

- (Yoon et.al.,2019)

Cryptocurrency Acceptance: A Case in Malaysia.

- (Yoon et.al., 2019)

Doing Business using Cryptocurrency in Malaysia.

- (Ahmad el.al., 2020)

Figure 3: Summary of cryptocurrency research in Malaysia

FUTURE STUDY

Identify factors that significantly influence users' intention to adopt cryptocurrency.

From a human and security standpoint, this is important. It's crucial from a human factor to take into account elements like usability, social actors, and facilitating conditions. Additionally, it's crucial to take into account moderating variables like government support, which may significantly increase the adoption rate among consumers in Malaysia. On the other hand, from a security standpoint, it is important to address issues like perceived danger, perceived privacy, or knowledge since cryptocurrencies are connected to financial considerations.

Enhancing the methodology utilized in gathering the data.

The systematic literature review demonstrates a lack of technique in the data collection process. Any of the papers that addressed the adoption of cryptocurrencies did not use mixed methods or qualitative research, and when it comes to quantitative methods, there is always a gap in either the population or the sampling size, which emphasizes the need for a better study that thoroughly examines the subject of cryptocurrencies while using an effective data collection methodology.

Focusing the adoption from the widen perspectives.

The need to address the factors influencing the adoption for both consumers and merchants to have an overall understanding of the whole cycle of cryptocurrency adoption.

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COVID-19 Pandemic and Its Association with Anxiety Levels, Dietary Habits and Lifestyle Behaviours among Malaysian University Students in Klang Valley

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ABSTRACT

Introduction: COVID-19 pandemic and the measures implemented to control its spread, including lockdowns, social distancing and emergency remote lessons have significantly affected Malaysian university students. Mental health issues such as anxiety is known to affect the university students' dietary habits and lifestyle behaviours.

Objective(s): This study aims to determine the prevalence of anxiety, dietary habits and lifestyle behaviour, and their relationship among Malaysian university students in Klang Valley during COVID-19 pandemic.

Methodologies: A total of 380 university students have participated in the cross-sectional online survey. Generalized Anxiety Disorder-7 (GAD-7), Starting the Conversation (STC): Diet and Lifestyle Behaviour questionnaires were used to assess the anxiety level, dietary habits and lifestyle behaviour of the participants, respectively.

Results: More than half of the students (52.6%) were reported to have minimal to mild anxiety, while 47.3% with moderate to severe anxiety. Based on the dietary mean score of 6.38 ± 2.48, it can be known that the students were adhering to a healthier dietary pattern. About a quarter of respondents (24.7%) reported neither increased nor decreased in physical activity, 63.7% did not consume alcohol, 80.7% did not have tobacco smoking and e-cigarettes use. There was a significant relationship between anxiety and dietary scores ($r=0.111$, $p<0.05$), and a significant association between anxiety and tobacco smoking frequency ($p<0.05$).

Conclusion: Most of the participants reported mild anxiety and had a healthy balanced diet during the COVID-19 pandemic. The findings suggested that Malaysian university students practiced a healthy lifestyle behaviour to cope with anxiety during pandemic.

Keywords: COVID-19; association; anxiety; dietary habits; lifestyle behaviour

INTRODUCTION

Coronavirus disease-2019 (COVID-19) is a global public health issue caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) (Rauf et al., 2020). SARS-CoV-2 can be typically transmitted directly from one person to another through coughing, sneezing and the spread of droplets or indirect contact such as contaminated objects. The clinical manifestation of COVID-19 infection ranges from asymptomatic to fever, dry cough, sore throat, fatigue, breathlessness, diarrhoea, vomiting, chest tightness and in severe cases, pneumonia, acute respiratory distress syndrome, organ dysfunction and even death (Baj et al., 2020). Hence, numerous public health and social measures inclusive of quarantine, social distancing, wearing masks or medical shields, frequent hand washing, and using hand sanitizer are introduced to reduce the transmission of COVID-19 (Lotfi et al., 2020). To control the spread of COVID-19 and reduce its mortality rate, the Malaysian Government implemented the Movement Control Order (MCO) including the prohibition of movement and mass assembly, suspension of religious activities, closure of certain industries, and all education institutions.

The COVID-19 pandemic has been associated with an increased risk of mental health issue worldwide, leading to an increase in anxiety, depression, and stress.

University students are particularly vulnerable to anxiety as a previous study has reported that the prevalence of anxiety tends to increase from the age of 10 to 19 and reaches its highest point between 20 and 34 years old, which is the age range of many university students (Baxter et al., 2014). The closure of learning institutions, movement restrictions, and stay-at-home order were also shown to strongly impact eating habits (Tan et al., 2021a and 2021b). For instance, the consumption of energy-dense foods such as fast foods, high-fat snacks, and ready-to-eat meals was found to increase during the COVID-19 pandemic (Di Renzo et al., 2020). Besides, the lockdowns and social distancing measures have also led to an increase in sedentary behaviour due to the limited opportunities for outdoor activities. A study revealed that the number of days/weeks of physical activity decreased by 24% and amount of hours/day of sitting increased to 28.6% during home confinement (Ammar et al., 2020). Moreover, stress and anxiety during the COVID-19 pandemic has also had an impact on lifestyle behavioural changes such as alcohol consumption, smoking tobacco and e-cigarettes use.

Thus, this study was carried out to determine the prevalence of anxiety, dietary habits, and lifestyle behavioural changes among Malaysian university students in Klang Valley during the COVID-19 pandemic. The potential relationships between anxiety and dietary habits, and lifestyle behaviour among the university student's population were also explored.

METHODOLOGIES

Participants and Study Design

A cross-sectional study was undertaken between 23 January to 31 March 2022 through the online social media platform. The participants were selected through convenience sampling. The inclusion criteria included Malaysian university student who study in Klang Valley, either in public or private universities, 18-35 years old, and living in Malaysia during the MCO period. On the other hand, the exclusion criteria were students with a history of psychiatric or mental illness or on medication, students who is pregnant at the time of the data collection, international students and exchange student. An online survey was performed using a Google Form and was distributed through various social media platforms including WhatsApp, Facebook, Instagram and UCSI CN. The participants were informed that their personal information would be kept private and confidential. This study has been approved by UCSI's Institutional Ethical Committee (IEC) (IEC-2022-FAS-011). The sample size was calculated based on the Daniel formula (Charan and Biswas 2013) and the expected prevalence of anxiety was 29%. After accounting for the 20% non-response rate among respondents in data collection, the sample size was expanded to 379 subjects.

The formula shown as: $n = \dfrac{Z^2 P\ (1\text{-}p)}{d^2}$

Where:
n = sample size,
Z = Z statistic for a level of confidence,
P = expected prevalence or proportion (in proportion of one; if 20%, P = 0.2),
d = precision (in proportion of one; if 5%, d = 0.05)

Questionnaires

The participants were required to answer all the questions in the Google Form. The first section of the questionnaire was the socio-demographic information of the participants, followed by the Generalized Anxiety Disorder-7 (GAD-7) questionnaire to assess the severity of anxiety. A score of 0,1,2,3 is assigned to response categories of 'not at all', 'several days', 'more than half the days', and 'nearly every day', respectively. Scores 0-4 indicate minor anxiety, 5-9 indicate mild anxiety, 10-14 indicate moderate anxiety, and 15-21 indicate severe anxiety. The total scores were calculated by adding up the scores from all questions, and a score of 10 or higher was considered as the cut-off value for detecting cases of GAD (Spitzer et al., 2006).

Next, the Starting the Conversation (STC): Diet questionnaire, which was adopted from Paxton (2011), was administered to assess the dietary behaviour of the participants. The questionnaire consisted of 8 items that measured various aspects of eating behaviour over the past few months such as the consumption of fast-food meals or snacks, fruit, vegetables, soda or sweet tea, beans, fish, chicken, snack chips or cracker, desserts, margarine, butter, or meat fat. The STC score, which ranged from 0-16, was calculated by adding up all the item scores. Higher scores indicated a need for improvement in dietary behaviour, while lower scores indicated a healthier diet.

In the last section of the questionnaire, the lifestyle behaviour of the participants was assessed using a questionnaire adopted from Zhang et al. (2021). Physical activity was assessed using 5-point Likert-type scale based on the participants' perception and agreement. For alcohol consumption, a dichotomous question adopted from the validated "Alcohol Use Disorders Identification Test-Concise (AUDIT-C)" was used, asking if the participants drank alcohol (Bush et al., 1998). If they answered affirmatively, they are required to respond to the subsequent questions "Since the pandemic, your drinking has" and choose from three choices: "increased", "decreased" or "stayed the same". For tobacco smoking, the questionnaire was taken from the Global Adult Tobacco Survey (Global Adult Tobacco Survey Collaborative Group 2011). The participants were asked if they currently smoked tobacco "on a daily basis", "less than daily", or "not at all". If they answered affirmatively, they are required to respond to the next questions "Since the pandemic, your smoking has" and choose the most appropriate response. The same question format was applied to e-cigarettes use.

Data Analysis

Statistical Package for Social Sciences (SPSS) version 21.0 was used to analyse the collected data. The relationship between anxiety and dietary habits was examined using Pearson's Correlation Coefficient test, while the association between anxiety and lifestyle behaviour was analysed using Chi-square test. The level of significance for all tests was set at $p<0.05$.

RESULTS AND DISCUSSION

Socio-demographic Background of Participants

The socio-demographic background of participants is tabulated in Table 1. It can be observed that half of the participants (50.6%) were aged between 22 and 25 years old, while 46.4% were aged between 18 to 21 years old and only a minority of participants (3.0%) belonged to the 25 to 34 age group. More than half of the participants (57.6%) were identified as female, and the remaining participants were male (42.2%). Additionally, most of the participants were Chinese (61.8%), followed by Malay (28.4%), Indian (7.9%) and 1.8% were from other ethnicities. Majority of the students were single (98.2%), whereas only 0.8% were married and 1.0% were divorced.

Table 1: Socio-demographic background of participants

Description	n(%)
Age (years old)	
18-21	176(46.4)
22-25	191(50.6)
26-29	7(1.9)
30-34	6(1.6)
Gender	
Male	161(42.2)
Female	219(57.6)
Ethnicity	
Malay	108(28.4)
Chinese	235(61.8)
Indian	30(7.9)
Others	7(1.8)
Marital Status	
Single	373(98.2)
Married	3(0.8)
Divorced	4(1.0)
Study Level	
Pre-university	39(10.3)
Undergraduate	323(85)
Postgraduate	18(4.7)
Monthly household income*	
Less than RM2,500	119(31.3)
RM 2,500-RM4,898	98(25.8)
RM 4,898- RM10,959	109(28.7)
RM10,960 and above	54(14.2)
Current mode of study	
Virtual	157(41.3)
Physical	223(58.7)
Current staying with	
Alone	61(16.1)
Friends	157(41.3)
Family	162(42.6)

(n=380)
*The household income range for B40, M40 and T20 is based on Household Income & Basic Amenities Survey Report 2019 (Department of Statistics Malaysia 2020).

Moreover, 85% of the participants were undergraduates, followed by pre-university (10.3%) and postgraduate (4.7%). More than half (58.7%) of participants were pursuing their studies in a physical mode due to the reopening of universities, and the rest were engaged in virtual study mode (41.3%). The B40 income group was reported by most of the university students whereby 31.3% of them have household incomes of less than RM2,500, and 25.8% fell within the RM2,500 to RM 4,898 range. At the same time, 28.7% of the participants belonged to the M40 income group with household incomes ranging from RM4,898 to RM10,959, while only small proportion of participants (14.2%) were from T20 families with household incomes above RM10,960. Despite that, a notable portion of participants reported that they continued to stay with their families (42.6%), whereas 41.3% were staying with friends and 16.1% were living alone.

Prevalence of Anxiety During COVID-19 Pandemic

Figure 1 illustrates the prevalence of anxiety among university students during COVID-19 pandemic. The results showed that the prevalence of anxiety was quite significant, with 28.7% of students experiencing mild anxiety, 27.6% experiencing moderate anxiety, 23.9% experiencing minimum anxiety, and 19.7% experiencing severe anxiety. A similar study reported by Jiang et al. (2021) found that 39.8% of Malaysian university students experienced mild to moderate anxiety and 23.3% experienced severe to extremely severe anxiety. Another study by Sundarasen et al. (2020) found that 20.4% of university students were reported to have minimal to moderate anxiety levels, while 6.6% had marked to severe anxiety levels, and 2.8% experienced the most extreme anxiety level during the pandemic. The main stressors identified in the study were financial constraints, remote online learning and uncertainty about academic performance and future career prospects.

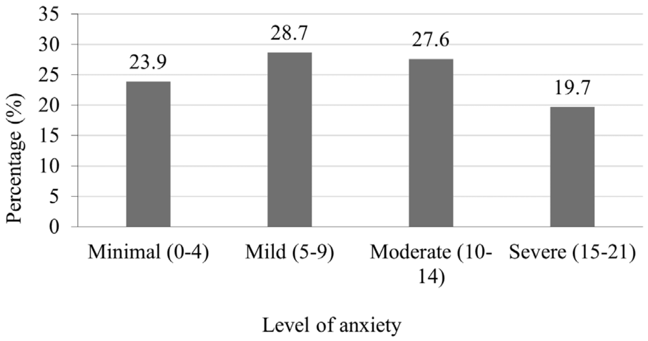

Figure 1: The level of anxiety of participants during COVID-19 pandemic (n=380)

The decrease in anxiety levels among the university students as shown by the findings in this study may be attributed to the timing of the data collection phase. During data collection, the MCO in place was transitioning to the National Recovery Phase (NRP), which involved a gradual relaxation of lockdown measures and the eventual conditional reopening of all sectors (National Recovery Council 2021). It is possible that the easing of COVID-19 restrictions was perceived as less stressful, which in turn contributed to the lower anxiety levels among the student population.

Dietary Behaviour During COVID-19 Pandemic

As shown in Figure 2, the dietary behaviour of Malaysian university students during the COVID-19 pandemic was generally healthy, as indicated by a mean score of 6.38 ± 2.48. Specifically, a total of 58.2% of Malaysian university students reported consuming 3 or more times of beans, chicken and fish each day, 75.3% consumed 2 or less servings of fruits per day and 49.5% consumed 2 or less servings of vegetables each day. This indicates that the participants were consuming a good amount of protein, but the intake of fruits and vegetables were lower. A previous study also reported that the daily intake of fruits and vegetables among Malaysian adults during the COVID-19 pandemic was insufficient, as almost all of the participants (99.8%) did not meet the recommended daily intake of five servings per day (Lo et al. 2020).

Several studies suggested that the COVID-19 confinement period has led to an increase in boredom, which in turn increased the consumption of comfort foods with high fats, sugars and salt (Tan et al., 2022). However, it was observed that a majority of the participants (50.3%) reported consuming fast food 1-3 times per week as opposed to consuming more than 4 times per week (8.9%) which showed that the consumption of fast-food meal has decreased during the pandemic. Cheikh Ismail et al. (2021) found that the number of fast-food meals consumed has decreased during the pandemic (11.1%) compare to before the pandemic (32.5%) among the Lebanese adult population. A similar study also found the percentage of participants has decreased (33.3%) in the consumption of fast food ≥3 times per week during the pandemic compared to 37.7% before the pandemic (Chen et al., 2021).

As for beverages, 60.8% reported consuming regular sodas or glasses of sweet tea less than once per day, and 60% consumed regular snack chips or crackers (not low-fat) 1 time or less each week. Additionally, more than half of the participants (53.7%) reported consuming dessert and sweets once or less per week; and nearly half of them (49.2%) reported using very little of margarine, butter or meat fat to season vegetable or on potatoes, bread or corn. This suggests that the university students were able to limit their intake of unhealthy foods and beverages, while making healthy food choices despite the challenges posed by the pandemic. Overall, Malaysian university students adopted relatively healthy dietary habits during the pandemic and a healthy dietary pattern was shown to mitigate the effect of COVID-19, through reducing the consumption of comfort foods.

Lifestyle Behaviours and Self-Reported Changes during COVID-19 Pandemic

The lifestyle behaviours and self-reported changes of the students during the COVID-19 pandemic are shown in Table 2. Home confinement was found to result in lower physical activity level and increased sedentary lifestyle (Chin et al., 2022). However, almost a quarter (24.7%) of the participants reported a neutral response regarding their physical activity during COVID-19 pandemic, implying that they did not necessarily increase or decrease the physical activity levels. Over 30% of the participants reported an increase in their physical activity, while less than 30% disagreed that they experienced increments in their physical activity levels.

Furthermore, Ting and Essau (2021) conducted a study among university students in Sarawak during the pandemic which revealed that the prevalence of alcohol and cigarettes use was relatively low, with only 12% of the students reported drinking alcohol and 3.9% reported using cigarettes. This result is consistent with the findings of the current study, where majority of the

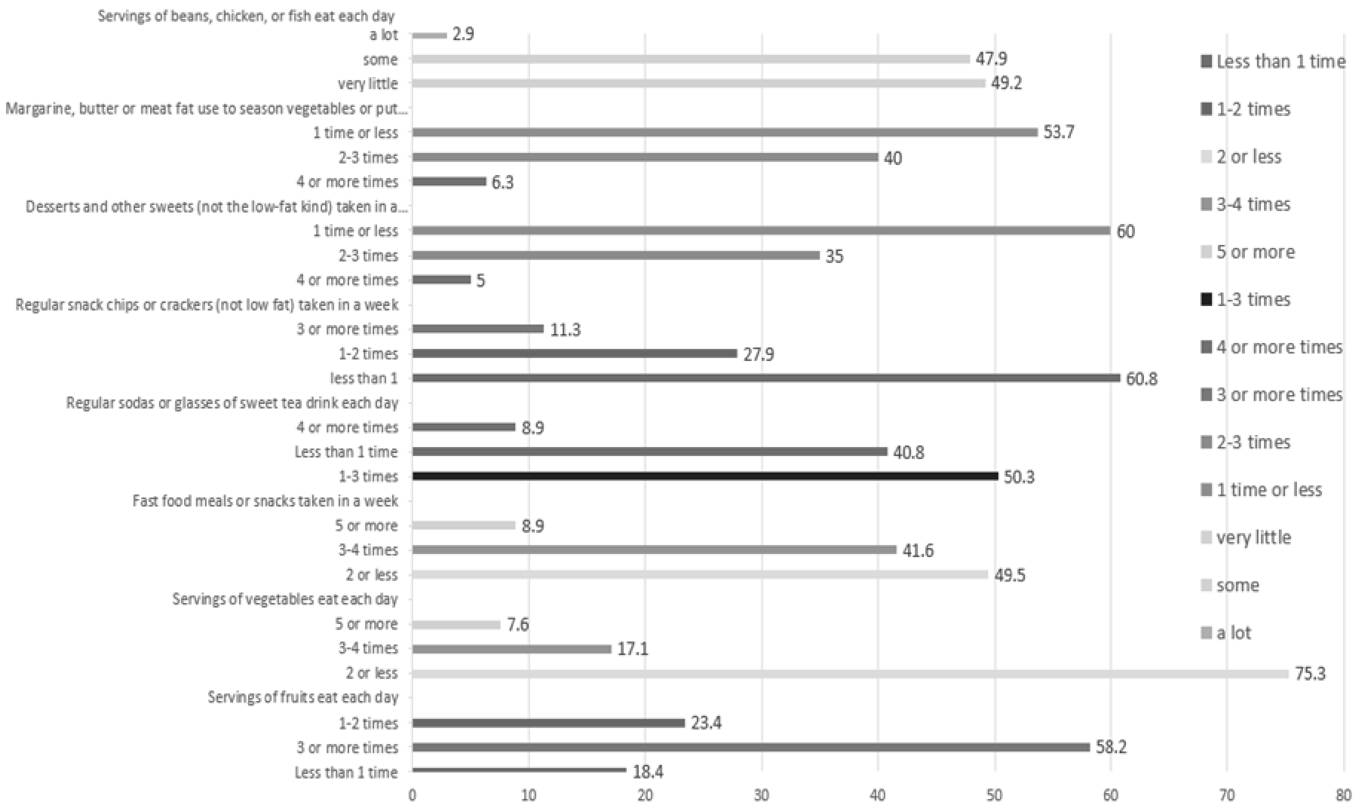

Figure 2: The dietary behaviour of participants during COVID-19 pandemic (n=380)

Table 2: Lifestyle behaviours and self-reported changes during COVID-19 pandemic (n=380)

Lifestyle Behaviours and Self-Reported Changes	n(%)
Increase in Physical Activity	
1 = Strongly disagree	46(10.3)
2 = Disagree	79(17.7)
3 = Neutral	110(24.7)
4 = Agree	97(21.7)
5 = Strongly agree	48(10.8)
Drinking Alcohol	
Yes	96(21.5)
No	284(63.7)
Frequency of Alcohol Use	
Increased	26(5.8)
Decreased	33(7.4)
Stayed the same	39(8.7)
Tobacco Smoking	
On daily basis	10(2.2)
Less than daily	10(2.2)
Not at all	360(80.7)
Frequency of Tobacco Smoking	
Increased	12(2.7)
Decreased	4(0.9)
Stayed the same	4(0.9)
E-cigarette Smoking	
On daily basis	13(2.9)
Less than daily	7(1.6)
Not at all	360(80.7)
Frequency of E-cigarette Smoking	
Increased	11(2.5)
Decreased	2(0.4)
Stayed the same	7(1.6)

respondents (63.7%) reported that they did not consume alcohol during the pandemic. Of those who did consume alcohol, 8.7% reported no change in their consumption habits, while 5.8% increased their alcohol consumption and 7.4% decreased their alcohol consumption. In Malaysia, the legal age for drinking alcohol is 21 years old, and according to Islamic law, Malay ethnics are prohibited from drinking alcohol. The possible reason may be attributed to the closure of bars and pubs during the data collection period, thereby limited their drinking opportunities.

Regarding tobacco smoking, a large majority (80.7%) of respondents reported not smoking tobacco at all and only a small portion (3%) reported an increase in tobacco smoking frequency during the pandemic. Similarly, the vast majority (80.7%) of respondents reported no use of e-cigarettes, and only a small proportion (2.5%) reported an increase in e-cigarette use during the pandemic. The finding is encouraging as tobacco smoking is a known risk factor for respiratory illness.

Overall, the COVID-19 pandemic did not have a significant impact on the physical activity levels, alcohol consumption and tobacco and e-cigarette use of Malaysian university students. Only small proportion of respondents reported changes in these behaviours, while majority of the students reported no change, suggesting that the university students were able to maintain healthy habits during the pandemic.

Relationship between GAD-7 Test Scores and STC Summary Score, Physical Activity

Table 3 presents the correlation between GAD-7 test scores and STC summary score, as well as the physical activity. The results showed a positive weak correlation between the anxiety test score and dietary summary score ($r=0.111$, $p=0.032$) among Malaysian university students during the COVID-19 pandemic. Majority of Malaysian university students reported mild anxiety and healthy dietary behaviours may be due to the increased intake of home-cooked meals when staying with their families, which were usually healthier than eating out. The finding is consistent with a Polish study which revealed that home confinement increased home-cooked food intake and showed that the respondents were taking care of their health (Górnicka et al., 2020). Besides, the study also found that most university students consumed protein frequently, which is important for enhancing the immune system, especially during the pandemic. Protein is vital for cell and tissue healing, as well as the production of antibodies (Iddir et al., 2020).

Table 3: Relationship between GAD-7 test score and STC summary score, and physical activity

Variable	GAD-7 Test Score (n=380)	
	r-value	p-value
STC Summary Score (n=372)	0.111*	0.032
Physical activity (n=380)	0.017	0.739

*Correlation is significant at $p<0.05$.

On the contrary, there was no significant relationship between the anxiety test score and physical activity score ($r=0.017$, $p>0.05$). Physical activity has been found to have a positive impact on mental health, inclusive of reducing symptoms of anxiety. Puccinelli et al. (2021) reported that symptoms of anxiety were associated with low levels of physical activity, low family income, and younger age. Increase in physical activity during the pandemic has also been found to reduce the level of stress and anxiety caused by lockdowns and social isolation, when compared to those who maintained a sedentary lifestyle (Lesser and Nienhuis 2020).

Association between GAD-7 Test Score and Alcohol Consumption, Tobacco Smoking, E-cigarette Use

Table 4 shows the association between GAD-7 test scores and alcohol consumption, and tobacco smoking and e-cigarette use. There was no significant association between anxiety and alcohol consumption, and the frequency of alcohol consumption ($p>0.05$), which is in line with a report by Haynes et al. (2005). Additionally, no significant association was found between anxiety and tobacco smoking ($p>0.05$), but a significant association between anxiety and frequency of tobacco smoking ($p<0.05$) was observed, which is consistent with a study by Williams and Adams-Campbell (2000). The NHMS 2015 reported that Malay and other ethnicities had higher rates of smoking compared to Chinese and Indian ethnicities (Lim et al., 2018). Since the majority of the participants in this study were Chinese, it is possible that the tobacco smoking rate was relatively low even during the pandemic. Most of the non-smoking university students reported mild to moderate anxiety levels, suggesting that they may have used alternative methods to cope with anxiety rather than tobacco smoking. Study conducted in Germany found that 24.3% of respondents smoke before and/or during the lockdown, 45.8% increase in smoking during lockdown period, 31.3% remained the same and 9.0% decreased in smoking (Koopmann et al., 2021). Due to stress, anxiety and worry brought on by confinement and fear of the disease, the psychosocial effects of the pandemic may cause current smokers to use tobacco more frequently and former smokers to relapse (Chen 2020).

A similar result was observed for the correlation between anxiety and e-cigarette use in which there was no significant association between anxiety and e-cigarette use and frequency of e-cigarette use ($p>0.05$). This finding is consistent with a study by Berg et al. (2019), which also found no relationship between anxiety and e-cigarette use. On the other hand, Stokes (2020) revealed that one-quarter of young individuals were concerned about the health effects of e-cigarette, and this acts as a key motivator for quitting e-cigarette use.

Table 4: Association between GAD-7 test score and alcohol consumption, tobacco smoking, and e-cigarettes use

GAD-7 Score	Alcohol consumption (n=380)				Frequency of alcohol consumption (n=98)			
	Yes	No		Sig.	Incr.	Decr.	Same	Sig.
Minimal	27 (23.0)	64 (68.0)		χ^2=6.23 p=0.101	5 (7.2)	11 (9.1)	11 (10.7)	χ^2=4.41 p=0.621
Mild	21 (27.5)	88 (81.5)			4 (5.6)	7 (7.1)	10 (8.4)	
Moderate	33 (26.5)	72 (78.5)			10 (9.0)	11 (11.4)	13 (13.5)	
Severe	15 (18.9)	60 (56.1)			7 (4.2)	4 (5.4)	5 (6.4)	
GAD-7 Score	**Tobacco smoking (n= 380)**				**Frequency of tobacco smoking (n=20)**			
	Not at all	On daily basis	Less than daily	Sig.	Stay the Same	Incr.	Decr.	Sig.
Minimal	87 (86.2)	1 (2.4)	3 (2.4)	FE=4.27[a] p=0.645	0 (0.8)	1 (2.4)	3 (0.8)	FE=10.05[a] p=0.039
Mild	104 (103.3)	3 (2.9)	2 (2.9)		0 (0.1)	5 (3.0)	0 (1.0)	
Moderate	101 (99.5)	2 (2.8)	2 (2.8)		1 (0.8)	3 (2.4)	0 (0.8)	
Severe	68 (71.1)	4 (2.0)	3 (2.0)		3 (1.4)	3 (4.2)	1 (1.4)	
GAD-7 Score	**E-cigarette (n=380)**				**Frequency of e-cigarette smoking (n=20)**			
	Not at all	On daily basis	Less than daily	Sig.	Stay the Same	Incr.	Decr.	Sig.
Minimal	89 (86.2)	1 (3.1)	1 (1.7)	FE=3.89[a] p=0.708	2 (0.7)	0 (1.1)	0 (2.0)	FE=5.58[a] p=0.530
Mild	101 (103.3)	5 (3.7)	3 (2.0)		3 (2.8)	4 (4.4)	1 (0.8)	
Moderate	100 (99.5)	4 (3.6)	1 (1.9)		1 (1.8)	4 (2.8)	0 (0.5)	
Severe	70 (71.1)	3 (2.6)	2 (1.4)		1 (1.8)	3 (2.8)	1 (0.5)	

Note: Chi-square test analysis with significance at $p<0.05$. Data presented as Cell observed values (Cell expected values). n, number of respondents.
[a]Fisher's Exact Test was used when cells have expected count less than 5.

CONCLUSION

In conclusion, this study found that Malaysian university students generally reported mild anxiety levels, exhibited healthy dietary behaviours and increased home-cooked meal consumption during the COVID-19 pandemic. Anxiety possessed a significant association with dietary behaviour and frequency of tobacco smoking, but no relationship between anxiety and physical activity, alcohol consumption, and e-cigarette use. All in all, the findings suggested that during the pandemic, university students may have engaged in healthy lifestyle behaviours and used alternative methods to cope with anxiety. Universities are recommended to provide some programmes such as mental health talks or self-care workshops that may be beneficial for students in managing anxiety.

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The Effect of COVID-19 Pandemic on Stress Level, Food Purchasing and Consumption, and Food Safety Perception of Malaysian Undergraduate Students in Klang Valley

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ABSTRACT

Introduction: COVID-19 pandemic has forced many lifestyle changes and all these become a stressor to undergraduate students. As part of the protective mechanism, students made many lifestyle changes including food purchasing and food consumption behaviour, and food safety.

Objective(s): This study aimed to determine the association between stress levels, food purchasing, food consumption, and perception of food safety among Malaysian undergraduate students in Klang Valley during the COVID-19 pandemic.

Methodologies: A cross-sectional study using convenience sampling for the recruitment of participants and a questionnaire was used to assess the stress level (Depression Anxiety Stress Scale, DASS), food purchasing, food consumption, and food safety perception of the students.

Results: A total of 334 undergraduate students participated in this study, of which 40.7% of them reported to have normal stress levels, 36.6% with mild or moderate stress levels, whilst 22.7% with severe or extremely severe stress. The stress level was associated significantly with the purchase of other fresh products (χ^2=13.737, p=0.017) and non-fresh products (χ^2=11.399, p=0.044), as well as the consumption of fish (χ^2=17.036, p=0.004), fruits and vegetables (χ^2=14.046, p=0.018), frozen products (χ^2=19.650, p=0.001), canned products (χ^2=13.716, p=0.021), cake, and biscuits (χ^2=14.218, p=0.014), respectively. The stress level was also found to be associated with the perceived food safety in restaurants and food delivery (χ^2=10.374, p=0.017).

Conclusion: Stress during the COVID-19 pandemic was found to exert changes in terms of food purchasing and consumption as well as influenced the perceived food safety in restaurants and food delivery of the university students.

Keywords: COVID-19; stress level; food purchasing; food consumption; perceived food safety.

INTRODUCTION

In December 2019, the coronavirus disease (COVID-19) spread rapidly from China to many countries including Malaysia (Costa et al., 2020). The consequence of contracting the virus could be life-threatening, people were forced to practice protective behaviour such as wearing mask and self-isolation to reduce the risk of infection (Al Dhaheri et al., 2021). However, the fear of getting the disease and the inconvenience of changing their daily lifestyle became a stressor to the population. To control the pandemic, the Malaysian government issued the Movement Control Order (MCO), which required all citizens to stay home, and no mass gathering is allowed. As a result, many families met financial constraints and students had to change their study mode from face-to-face classes to online classes (Wilson et al., 2020; Yang et al., 2021). All these caused the stress level of the population, including students, to significantly increase during the pandemic.

Changes were required in daily behaviour, including food purchasing and food consumption during the pandemic. Food purchasing, obtaining food through exchange of money, could be affected by the food attributes, the condition of the market, and the socio-demographic profile, while food consumption, eating food for energy, differs for each individual due to personal and societal factors (Ali et al., 2018; Kabir et al., 2018). During the pandemic, they could be further affected by the food insecurity, stress, and the perception of food safety. Food safety, a scientific method to prevent food contaminants to harm people health, could lead to mild or severe adverse effects when improper food handling and poor food hygiene occur (Hoffmann et al., 2017; Chenarides et al., 2020). Poor immunity may cause the population to be infected with the disease easily, as such the population became more concerned about food safety due to the pandemic.

Thus, this study aims to determine the stress level, food purchasing and consumption, perception of food safety, as well as to determine the association between stress level, food purchasing, food consumption, and perception of food safety among Malaysian undergraduate students in the Klang Valley during COVID-19 pandemic.

METHODOLOGY

Participants and Study Design

This study was a cross-sectional study involving Malaysian undergraduate students aged between 18 and 24 years in Klang Valley during the COVID-19 pandemic. Those who have any medical condition and pregnant mothers were excluded from this study. The sample size was calculated by using the formula as shown in Equation 1, based on the prevalence of stress among Malaysian adults during MCO of 70% (Pourhoseingholi et al., 2013; Perveen et al., 2020).

$$\text{Equation 1: } n = \frac{(Z_{\propto/2})^2 p\ (1\text{-}p)}{d^2}$$

When the level of confident, $\propto$ is 95%, level of precision, d is 5%, $\propto = 0.95$, $Z_{\propto/2} = 1.96$, $d = 0.05$, $p = 0.7$

$$n = \frac{(1.96)^2\ (0.7)\ (1\text{-}0.7)}{0.05^2} = 323$$

The survey questionnaire was shared via social media (WhatsApp, Facebook, and Instagram) and 334 students who meet the criteria had participated in this study. Before answering the questionnaire, consent to participate in the study was obtained from all subjects, and the ethical clearance was obtained from Institute Ethics Committee, UCSI University (IEC-2022-FAS-011) before the commencement of the study.

Survey Questionnaire

The survey questionnaire was created using Google Forms, which was then shared to the participants via a hyperlink and QR code. The question items were adopted from several research studies and consisted of four parts, namely, i) socio-demographic, ii) Depression Anxiety Stress Scale (DASS), iii) Food Purchasing and Food Consumption, and iv) Perception of Food Safety. There were 12 questions under the socio-demographic section to assess information such as gender, ethnicity, religious belief, current living arrangement, household income, location of the university, and the level of study.

The level of stress was assessed using the Depression Anxiety Stress Scale (DASS) with 7 question-items adapted to the COVID-19 setting used by health professionals (Medical Development Division, Ministry of Health Malaysia, 2021). The questions were 4-point Likert scale, ranging from 0 to 3. The score was summed up and categorised into five levels as “normal stress” (0-7), “mild stress” (8-9), “moderate stress” (10-13), and “severe stress” (14-17), and “extremely severe stress” (18-21) (Lovibond and Lovibond, 1995). The third section of the questionnaire assessed the food purchasing and consumption behaviour of the participants during the pandemic adopted with modifications from Janssen et al. (2021) with 10 questions that assessed the frequencies of eating and buying food in terms of food types, as well as the sources to buy different types of food. The last section of the questionnaire was four questions about perceived food safety adopted from AlTarrah et al. (2021).

Statistical Analysis

Statistical analysis was carried out using Statistical Package for Social Sciences (SPSS) 21.0. Descriptive statistics were carried out for all variables to show the percentage, mean, and standard deviation for every question. Chi-square test was used to evaluate the association between stress level and food purchasing and food consumption behaviour, as well as the stress level and perceived food safety. The significance level for all tests was set as $p<0.05$.

RESULTS AND DISCUSSION

Socio-demographic Characteristics of Participants

The socio-demographic characteristics of 334 participants were shown in Table 1. Four-fifths of the students were female (74.3%), Chinese ethnic group (82.0%), and living with their family members (78.1%). Besides that, more than two-thirds of the participants were Buddhists (65.0%), and more than one-third of them lived in M40 families (36.2%).

Table 1: Socio-demographic information of the participants (n=334)

Socio-demographic information	n (%)
Gender	
Male	86 (25.7)
Female	248 (74.3)
Ethnicity	
Malay	40 (12.0)

Socio-demographic information	n (%)
Chinese	274 (82.0)
Indian	18 (5.4)
Bumiputra	2 (0.6)
Religious belief	
Muslim	42 (12.6)
Buddhist	217 (65.0)
Hindu	13 (3.9)
Christian	34 (10.2)
Catholic	14 (4.2)
Other (Wicca, Taoism, Atheist)	14 (4.2)
Current living arrangement	
With family members	261 (78.1)
With friends	39 (11.7)
Alone	34 (10.2)
Household income	
Less than RM 2500 (B40 (B1))	90 (26.9)
RM 2501 - RM 4849 (B40 (B2 - B4))	89 (26.6)
RM 4850 - RM 10959 (M40)	121 (36.2)
RM 10960 and above (T20)	34 (10.2)

Stress Level

During the pandemic, more than half of the participants had normal or mild stress levels (56.3%), and about one-fifth of them were moderately stressed (21.0%). Not many of them were severely or extremely severely stressed (22.8%) (Figure 1). Studies found that the highest levels of psychological distress were observed during the initial phases of the lockdown, but this quickly declined as people adapted to the new circumstances (Manchia et al., 2022). This is because the lockdown was lifted in Malaysia and long-time practising the protective procedure caused the population to take the lifestyle changes as a new normal. Besides that, the significant drop in hospitalisation number, ventilator use, and death cases allow the students to feel safer hence leading to a lower stress level. Although the students were still stressed about the COVID-19 pandemic, they may try to carry out some coping strategies such as practising relaxation methods and being physically active to manage their stress (Waselewski et al., 2020).

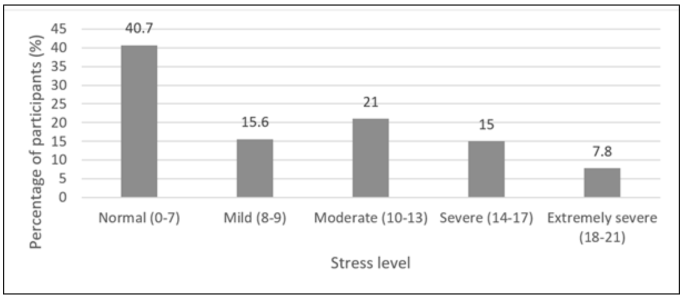

Figure 1: Stress level of the respondents during COVID-19 pandemic (n=334)

Food Purchasing and Food Consumption

As shown in Figure 2, the distribution of fresh foods purchasing, including fresh vegetables and fruits, fresh meat and fish, and other fresh food were quite similar. Students had no time during the weekdays due to their occupation or the academy and tried to buy fresh food during the weekends, causing "once a week" to be the highest. As fresh foods are important components of the human diet, a low buying frequency may cause the students to not have enough fresh foods to eat, therefore buying fresh products less than once a fortnight or never were the least. Although canned food, frozen food, and pre-cooked food could save time, as well as physical and mental effort, they are less healthy options due to being highly processed (Raj et al., 2021). Additionally, the drinks (categorised as non-fresh food) were usually high in sugar to taste better, which may lead to many health consequences by consuming it frequently. As the students could be more aware of their health, the common frequency to buy these foods was between once a week and once a fortnight.

Fresh vegetables, fruits, and meat are the most important part of our diet, and most of the students ate them frequently. For bread, it was the most common breakfast, but people may not be willing to eat it every day. Thus, the frequency of fish, bread, and dairy consumption varied according to their desire. The consumption of non-fresh foods was highly dependent on the participants. Those who preferred canned food, frozen food, and ready-made foods to save time, might eat them more frequently. Those who liked to prepare food from raw food ingredients might then consume less of these foods. Besides that, although students were clear that snacks such as cakes, biscuits, chocolates, and candies were unhealthy, some of them still ate several times a week to fulfil their satisfaction, while a part of them could manage a low intake for their health. Not many students consumed alcoholic drinks frequently. This may be because the frequency of alcohol consumption among the participants was not high, supported by the prevalence of alcohol used in Malaysia of 11.6% only (Mutalip et al., 2014).

Perception of Food Safety

Figure 3 shows the perceived food safety of the participants towards food from supermarkets, restaurants, and food delivery services during the pandemic. Most of the participants reported that they somewhat trust the food from both the supermarkets (56.3%) as well as restaurants and food delivery services (66.5%). There were not many participants who reported that they do not trust the food

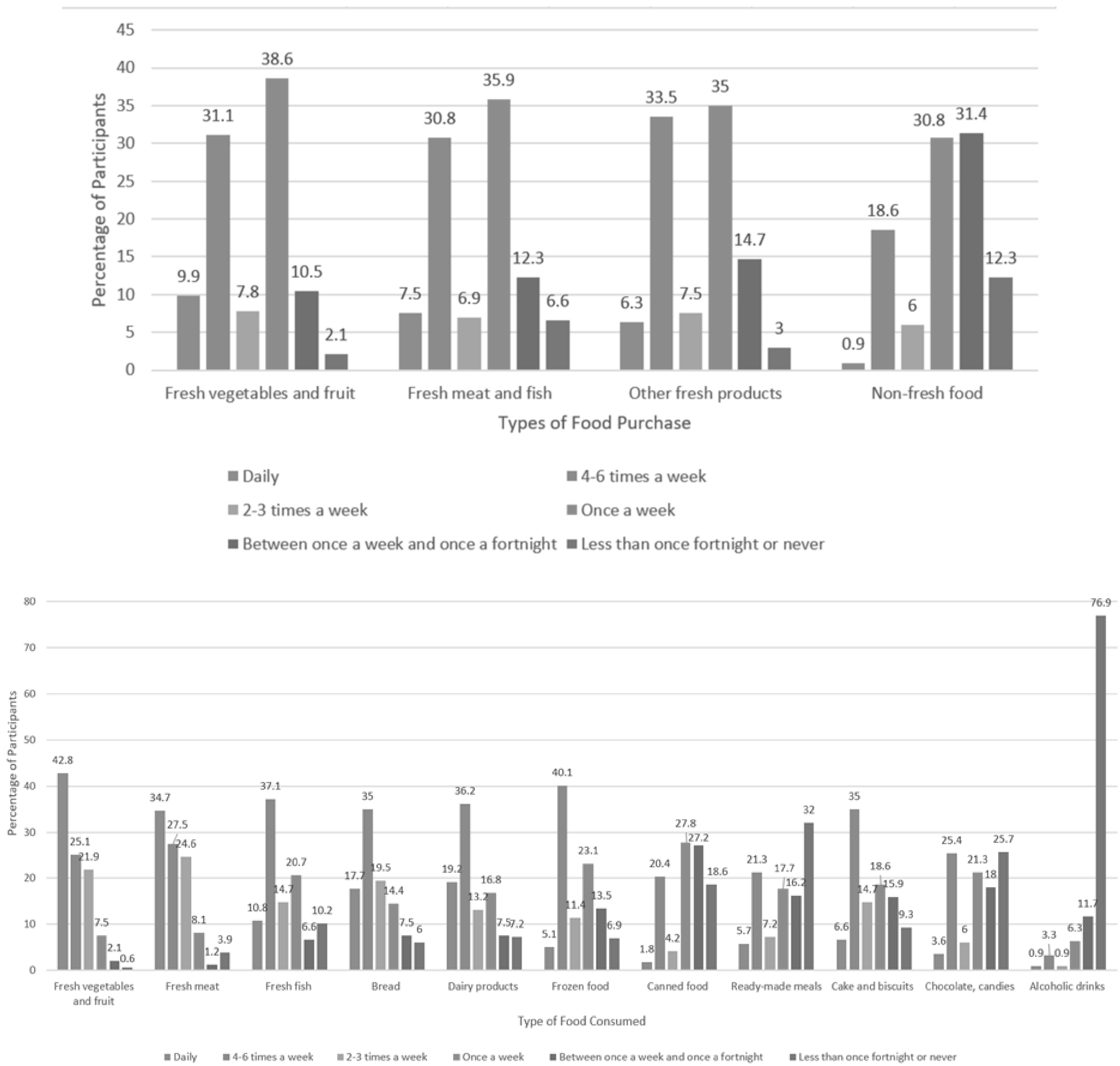

Figure 2: Food purchasing and consumption during the COVID-19 pandemic (n=334)

they buy as they knew that the coronavirus could not multiply in food packaging (WHO and FAO, 2020). As long as they remain aware of the cleanliness of the packaging or containers, they could reduce the risk of infecting COVID-19. Moreover, a study has shown that the perceived risk of food safety among the population is mainly based on the hazardous effects or the dreadful experience of consuming unsafe food (Frewer et al., 2009). Therefore, the students will highly likely be confident towards food safety as long as they did not experience any sort of infection from the food they purchased.

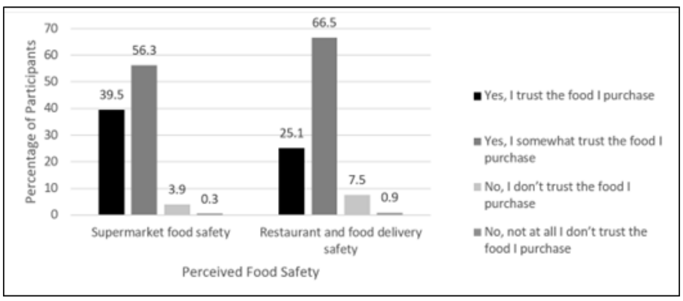

Figure 3: Perceived food safety of participants during COVID-19 pandemic (n=334).

Stress Level and Food Purchasing

Table 2 shows a significant association between stress level and purchasing frequency of other fresh foods and non-fresh products purchasing. The other fresh products here referred to foods such as bread, milk, and cheese, while non-fresh foods were frozen, canned, and pre-cooked food and drinks. As these foods could become the "comfort food" for some of the population to feel emotionally better, the consumption would be affected by the stress level. Studies showed that the "comfort food" could increase during the lockdown period, leading to higher purchasing frequency (Bennett et al., 2021).

Table 2: The chi-square table for associations between stress level and frequency of food purchasing (n=334).

	Number of respondents, n (%)		χ^2	p-value
	Low Stress	High stress		
Fresh vegetables and fruit	259 (77.5)	75 (22.5)	4.762	0.446
Fresh meat and fish			6.274	0.280
Other fresh products			13.737	0.017*
Non-fresh food			11.399	0.044*

Note: *The statistical significance level is p<0.05.

Stress Level and Food Consumption

The association between stress level and frequency of food consumption is shown in Table 3. In this study, there was a significant association between stress levels and vegetables and fruit consumption. The fruit and vegetable consumption is negatively associated with stress. This situation happened because fruits and vegetables could improve individuals' mental health by enhancing happiness (Głąbska et al., 2020). In other words, students having fruits and vegetables frequently would result in lower stress levels. It could be supported by a research study involving around 11,000 adults who also reported that they had higher fruit and vegetable consumption under lower odds for higher worries, tension, and lack of joy (Radavelli-Bagatini et al., 2022). Next, the frequency of fresh fish consumption was highly associated with stress levels. It was supported by a study conducted in Australia by Papier et al. (2015) as it showed that mild to moderate stress had a positive association with fish consumption among males.

Moreover, stress levels and frequency of frozen food and canned food consumption were significantly associated. This outcome was supported by Cortes et al. (2021) which showed a high perceived stress level leading to a high intake of these ultra-processed food. This may be due to the students are more prefer these simple and convenience food rather than spent long time and effort on food preparation under stressful condition. There was a significant association between stress level and frequency of cake and biscuit consumption. The cake and biscuits consumption decreases when the stress level of students increases. This may because the students had loss their appetite under stressful condition, leading them to eat lesser cake and biscuit. This finding was supported by a study by Mohamed et al. (2020) reported that the frequency of cake and cookie intake were associated with perceived stress, while a study in Dubai mentioned that stress was associated with less cake and cookie consumption (Mohamad et al., 2022).

Table 3: The chi-square table for associations between stress level and frequency of food consumption (n=334).

	Stress level, N (%)		χ^2	p-value
	Low Stress	High stress		
Fresh vegetables and fruit	259 (77.5)	75 (22.5)	14.046	0.018*
Fresh meat			2.278	0.729
Fresh fish			17.036	0.004*
Bread			9.639	0.086
Dairy			8.150	0.148
Frozen food products			19.650	0.001*
Canned food			13.716	0.021*
Readymade meals			4.351	0.500
Cake and biscuit			14.218	0.014*
Chocolates, candies			9.608	0.087
Wine, beer and other alcoholic drinks			0.632	0.957

Note: *The statistical significance level is p<0.05.

Stress Level and Perception of Food Safety

The association between stress level and perceived food safety is shown in Table 4. In this study, the stress level and perceived restaurant and food delivery food safety were associated. 93.1% of the low-stressed students trust or somewhat trust the food they purchase, but only 86.8% of the highly stressed students believed in their food. This indicates that higher stress could reduce the perceived food safety. The main reason leading to a lower perceived food safety among highly stressed students is due to the perception of COVID-19 as a foodborne disease (Faour-Klingbeil et al., 2021). As the COVID-19 stress may probably be due to the fear of getting the disease, the students may not decide to put themselves at risk of disease, especially when they believed that outside food may contain the coronavirus. As a result, the perceived restaurant and food delivery food safety affected the students' stress levels.

Table 4: The chi-square table for associations between stress level and frequency of food purchasing (n=334).

	Low stress, N (%)		High stress, N (%)		χ^2	p-value
	Trust & Somewhat Trust	Don't Trust & Not Trust At All	Trust & Somewhat Trust	Don't Trust & Not Trust At All		
Supermarket food safety	251 (96.9)	8 (3.1)	69 (92.0)	6 (8.0)	6.439	0.090*
Restaurant and food delivery safety	241 (93.1)	18 (7.0)	65 (86.8)	10 (13.3)	10.374	0.017*

Note: *The statistical significance level is p<0.05.

CONCLUSION

This study found that most of the participants have a normal stress level during the prolonged pandemic. COVID-19 stress was found to be associated with food purchases and food consumption. The frequency to purchase other fresh products and non-fresh products was associated with the stress level, as well as the consumption of fresh fish, fresh vegetables and fruits, frozen food products, canned food, cake, and biscuit. Besides that, the association between perceived food safety from restaurants and food delivery services with the COVID stress was significant during the pandemic. Although this study provided some information about the effects of COVID, there were still some limitations that needed to be considered when interpreting the findings. Since convenience sampling was used to recruit participants, the subjects may not be able to generalise to the overall population. The findings could be more representative and accurate if other sampling methods such as random cluster sampling or stratified sampling methods are selected.

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Knowledge on Safe Sex Practice Among University Students in Selangor

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ABSTRACT

Introduction: Safe sexual behavior is a preventive measure used to stop unplanned pregnancies. The chance of these students developing a sexually transmitted infection (STI) disease is also influenced by their awareness of safe sexual behavior.

Objective(s): The general objective was to collect statistics on how much students in universities in Selangor know and comprehend about safe sex practices. The specific objectives were to determine the proportion of students who are knowledgeable about safe sexual practices and to research the relationship between student awareness of safe sex practices and age, gender, and health-related and non-health-related courses.

Methodologies: A cross-sectional study was carried out on 132 students from various universities in Selangor who were selected through convenient sampling method. Data was collected from June 2022 until October 2022 and categorized into good and poor knowledge on safe sex practice. Data analysis was done using Jeffrey's Amazing Statistics Program (JASP).

Results: The study showed that 40.9% of the respondents had a good knowledge of safe sex practice while 59.1% of them had a poor knowledge.

Conclusion: University students in Selangor need to be educated on safe sex practices. Universities can frequently implement educational programs about understanding and engaging in safe sex practices.

Keywords: Knowledge, Safe Sex Practice, University Students, Malaysia

INTRODUCTION

Safe sex practice is any prevention taken to avoid the pregnancy. Knowledge on safe sex practice and sexually transmitted infection (STI) is important for adolescents with the age range of 10 to 19 years old, as defined by WHO, because these group are at high risk from several negative health consequences associated with unsafe sexual activities, including STI and unwanted pregnancies (Burrell et al., 2019). Sexual knowledge refers to an individual's knowledge and awareness on sex and sexuality (including physiological aspects, reproduction, performance and individual sexual behaviour) (Soltani et al., 2017). In previous years, there were studies concentrated on knowledge of safe sex and STI but without focusing on factors that affected levels of knowledge of safe sex and STI among adolescents.

To give the evidence of not majority of these adolescents had a good knowledge of safe sex, there were a few studies that have gathered data from high school students in Vientiane City, Lao PDR on sexual knowledge and its determinants. The study's findings revealed that nearly half of the participants (49.5%) were knowledgeable about safe sex. By gathering this statistics, comprehensive sexual education might be implemented (Inthavong et al., 2020).

According to a study, unsafe sexual practice among adolescents is a major barrier in fighting against HIV transmission (Kalolo et al., 2019). Malaysia has a concentrated HIV epidemic, with prevalence rates remaining above 5% among key population from 2009 to 2018. In the year 2018, the mode of HIV transmission has changed from injecting drugs to sexual transmission in Malaysia (Ministry of Health Malaysia, 2019).

Based on the data, we decided to do a study on the knowledge of safe sex practices among the University students, specifically the students from universities around Selangor. With the data from the research, University management can take a few steps to prevent these unsafe sex practices, at least among the students in university locality. Infectious diseases and unwanted pregnancies can be reduced with increased knowledge and the corresponding risky sexual behavior (Tseng et al., 2020).

METHODOLOGIES

This cross-sectional study was carried out among students from various universities in Selangor, Malaysia aged 18 years and above regardless higher education qualification. The method used in recruiting studied respondents was convenience sampling. The calculated sample size(n) was 117 by using formula of $n = (Z/m)2 * p(1-p)$ with a Z score (Z)of 1.64, margin of error (m)of 8%, and the proportion in the population of previous study (p)of 49.5%, with additional of 10% non-respondents or dropout. We achieved our sample size target as the response rate is 113%. The data has been collected through an online questionnaire using Google Forms from June 2022 until October 2022. All participants that met the inclusion criteria such as aged between 18 years and above, local and international university students in Selangor regardless of education level, health-related (health science comprises a wide range of sub-disciplines that are focus on applying science to health) (UOW Malaysia KDU, 2022) and non-health-related course and had provide valid consent to participate in this study. Meanwhile, the exclusion criteria include students who are on medical leave or absent during questions distribution, who do not have a registered and valid student identification, and who do not complete all the survey questions. The questionnaire is adapted from a validated source (Inthavong et al., 2020). The questionnaire consisted of two sections with total questions of 19 questions as following; Section A which consists of 6 questions on sociodemographic characteristics, and Section B which consists of 13 questions on knowledge about safe sex practice. Correct answer for knowledge received one point each. The scoring for knowledge of safe sex practice was divided into two categories with mean as the indicator; <10 is classified as poor knowledge, and ≥10 is classified as good knowledge (Inthavong et al. 2020). All data was analyzed using Jeffreys's Amazing Statistics Program (JASP) version 0.14.1 and Pearson chi-square was used to determine the association between dependent and independent variables.

RESULTS AND DISCUSSION

A total of 132 students in Selangor had responded to the questionnaire which gives the response of 113% response rate. Our main objective is to obtain the data about how far the students in University around Selangor know and understand about the safe sex practices. This study is important to assess the level of knowledge among students in Selangor as they are at high risk of early and unsafe sexual activities including STIs and unintended pregnancies (Kotchick et al., 2001). Table 1 shows the majority of respondents were female (75.8%), aged 18-22 years old (73.5%) and from health courses in university (76.5%).

Table 1: Descriptive on sociodemographic factors of respondents (n=132)

Sociodemographic factor		Frequency, n	Percentage, %
Gender			
	Male	32	24.2
	Female	100	75.8
Age Classification			
	18-22	97	73.5
	23-27	30	22.7
	≥28	5	3.8
Study Courses			
	Health Courses	101	76.5
	Non-Health Courses	31	23.5

In this study, it was found that 59.1% of university students have good knowledge of safe sex practice as shown in Table 2. This percentage showed there was a 9.6% difference with the research that was conducted previously in Lao PDR which resulted in 49.5% of the participants having a good knowledge of safe sex (Inthavong et al., 2020). This could be due to our smaller sample size of 117 and only targeted to university students in Selangor, and to compare with the study in Lao PDR, it was more than half of the sample size.

Table 2: Knowledge of Safe Sex Practices among Students (n=132)

Level of Knowledge (score)	Frequency, n	Percentage, %
Poor Knowledge (<mean)	58	40.9
Good Knowledge (≥mean)	74	59.1

Our study additionally concentrated on the association between socio-demographic with level of knowledge of safe sex practice and the results are reported in Table 3. There was a significant association between study courses and the level of knowledge (p=<0.01), but no significant association was found for the other two variables.

The majority of students in all age groups have a good knowledge regarding safe sex practices with age group 23-27 highest percentage (63.3%). However, the result shows there was no significant association (p=0.86) between age classification and level of knowledge of safe sex practices. Our findings concur with another study among foundation students, which found that the older age group had a higher level of knowledge, however there was no clinical significance between the two variables (Othman et al., 2020). From Piaget's cognitive development model, interaction with the environment is one of the factors of the accumulation of sexual knowledge, hence older age groups might have better resources and cognitive ability to comprehend sexual knowledge compared to younger adults (Siti Nor et al., 2017).

Our research also found that males have the highest prevalence of good knowledge in safe sex practices (62.5%) compared to females, which was consistent with the same previous study (Othman et al., 2020). Nevertheless, there was no significant association between gender and level of knowledge of safe sex practice. The result was contradicted to the American study which shows women were more knowledgeable about sexual health than men (Burrell et al., 2019). This contradiction may be because the setting of the study is in a clinic and urgent care setting compared to our study that was distributed randomly to the university students in Selangor.

Furthermore, the current study has reported that 71.2 % of the students from health courses have a good knowledge in safe sex practices and 19.4% of students from non-health courses have good knowledge in safe sex practices which is similar to a previous study conducted in Nigeria (Chukwu et al., 2017). Overall, 59% of students from all courses in universities in Selangor have a good knowledge in safe sex practices. Additionally, this result demonstrates a significant association ($p<0.001$) between study courses and knowledge on safe sex practices.

Table 3: Association between Socio-Demographic with the Level of Knowledge of Safe Sex Practices (N=132)

Socio-demographic	Frequency, n	Level of Knowledge of Safe Sex Practices		*p-value
		Good, n (%)	Poor, n (%)	
Age Classification				
18-22	97	56 (57.7)	41 (42.3)	0.86
23-27	30	19 (63.3)	11 (36.7)	
≥ 28	5	3 (60.0)	2 (40.0)	
Gender				
Male	32	20 (62.5)	12 (37.5)	0.65
Female	100	58 (58)	42 (42)	
Study Courses				
Health Courses	101	72 (71.3)	29 (28.7)	<0.001
Non-health Courses	31	6 (19.4)	25 (80.6)	

*Chi-square test, $p<0.05$ as significant 95% CI.

Our study used an online questionnaire to investigate Selangor university students' knowledge of safe sex practices, and this approach came with several drawbacks. Since our sample was obtained primarily through convenience sampling, it mostly focused on universities in Sepang, Selangor instead of focusing on other districts, too. Similarly, our results are from private universities for the most part of the result. Because of these issues, bias was introduced and may interfere with knowledge of safe sex practices outcomes. On top of that, we failed to identify respondents who had or had not received sexual health education. Along with it, we did not retrieve data with whom students live. These factors may have a big influence on a student's safe sex knowledge as parents may be an important source on gaining information about sexual and reproductive health (Kaale et al., 2017).

CONCLUSION

According to the study's findings, majority of university students in Selangor have an adequate knowledge of safe sex practices. The degree of knowledge and study courses have a strong correlation. Due to the increased danger of contracting STI, it is crucial to teach people about safe sex practices regardless of what they study in school. Universities can frequently implement educational programs about understanding and engaging in safe sex practices because universities are the ideal place to get all the knowledge about not just safe sex practices, but sexual health because the material can be presented by specialists in that area.

Following the completion of this research, it was proposed that future studies should investigate a narrower age classification to discover knowledge within the same generation. This might make it easier to determine exactly what needs to be changed in sex education. In addition, it is necessary to investigate the variables that affect the students' knowledge. For instance, the environment in which these students reside is crucial for determining the sources of knowledge on sexual practices.

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The Association of Burnout and Quality of Life among Undergraduate Medical Students in Malaysia

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ABSTRACT

Introduction: Widely understandable that medical education can be challenging because of the workload and program structure, which can lead to burnout in undergraduate medical students. Further, this may compromise their quality of life and interfere with their ability to accomplish the optimal level of education and future ability as a clinician. Objective: This study aims to evaluate the prevalence of burnout and its association with the quality of life of Malaysian undergraduate medical students.

Objective(s): This study aims to evaluate the prevalence of burnout and its association with the quality of life of Malaysian undergraduate medical students.

Methodologies: This study was a cross-sectional study conducted on 362 respondents from public and private universities in which an online questionnaire was distributed randomly. The questionnaire consisted of sociodemographic, academic evaluation, and two validated questionnaires: the Copenhagen Burnout Inventory student survey (CBI-SS) and the World Health Organisation Quality of Life-BREF (WHOQOL-BREF).

Results: Overall, the prevalence of burnout was 31.5%, with the studies-related burnout having the highest mean scores of 14.1 ± 5.2. Age, academic years, and several academic factors were significantly associated with burnout in undergraduate medical students. In multivariate analysis, physical health was predicted by personal-, studies-, and colleagues-related burnout. Personal- and studies-related burnout predicted psychological health. The social relationship was predicted by studies- and colleagues-related burnout. The environment was only predicted by studies-related burnout.

Conclusion: Our study found that the overall prevalence of burnout was high among undergraduate medical students from all medical schools in Malaysia. Our study was also the first in Malaysia to demonstrate a significant association between burnout (CBI-SS) and quality of life domains (WHOQOL-BREF): physical, psychological, social relationships, and environment.

Keywords: Burnout; Quality of life; Medical students

INTRODUCTION

It is widely understandable that medical education can be challenging because of the workload and program structure. To be a successful medical student, one must balance the stresses of learning new subjects, maintaining demanding training schedules, increasing demands for clinical performance, and the enormous amount of student loans. Unfortunately, the rigorous nature of medical school may threaten students' mental health, resulting in burnout among undergraduate medical students.

Burnout is a concept that was coined in the early 1970s to depict the psychosocial problems experienced by people who are doing 'people work', such as social workers, doctors, nurses, teachers, and customer service sectors (Kristensen et al., 2005). While a comprehensive definition of burnout is still lacking, it encompasses emotional, mental, and physical tiredness (Wing et al., 2018). According to Campos et al., (2013) chronic burnout syndrome is defined by total exhaustion of personal energy and a high level of irritation with work-related tasks (Campos et al., 2013).

Poor quality of life paired with burnout can jeopardize students' ability to accomplish optimal levels of education and future ability as clinicians. Quality of life is a multi-centered study conducted by the World Health Organization (WHO) that examines an individual's impressions of their place in life in the context of the culture and values in which they live and their objectives. Expectations, standards, and worries are some terms used to describe it. However, the WHO's interpretation of the quality of life does not establish a minimum standard for age, gender, occupation, or culture (World Health Organisation, 1996). As a result, quality-of-life judgments are subjective, transient, and challenging to quantify and compare (Tempski et al., 2012). The fundamental goal of quality of life is to improve mental and physical health, followed by social, relational, and environmental factors. Medical school admission impacts the student's health and quality of life because it necessitates coordination and lifestyle modifications. Quality of life is directly linked to health; however, medical students occasionally neglect the importance of maintaining their well-being (Pagnin & de Queiroz, 2015). Thus, to comprehend medical students' quality of life, they must grasp their learning environment and difficulties at medical school by voicing their worries (Tempski et al., 2012).

To date, there are numerous studies conducted to evaluate the factors associated with the prevalence of burnout among undergraduate medical students in various universities in Malaysia (Chin et al., 2016; Daud et al., 2020, 2021; Wing et al., 2018). A recent study by Roy et al., (2020) discovered factors associated with quality of life among medical students at Quest International University, Malaysia (Roy et al., 2020). However, no national study has identified the association between the prevalence of burnout and quality of life among undergraduate medical students in Malaysia.

This study aimed to (1) assess the prevalence of burnout among undergraduate medical students in Malaysia; (2) identify the factors associated with the prevalence of burnout among undergraduate medical students in Malaysia; and (3) identify the association between the level of burnout and the quality of life among undergraduate medical students in Malaysia.

METHODOLOGIES

Design

This cross-sectional study analyzed the prevalence of burnout and its association with quality of life among undergraduate medical students in Malaysia. This study was employed between November 2022 and February 2023.

Population, Sampling, and Sample Size

The sampling frame included undergraduate medical students of at least 18 years old of Malaysian nationality and currently studying in medical schools in Malaysia. An online self-administered questionnaire was distributed via emails, Facebook, Twitter, Telegram, Instagram, and WhatsApp through Google Forms. Medical associations from all medical schools were contacted to distribute the online questionnaire to their members. The sample size was calculated by the formula below as attained (Njim et al., 2019):

$$n = \frac{Z^2(1\text{-}P)}{d^2}$$

Where n is the sample size, Z statistic is 1.96 at a 95% confidence interval (CI), the expected prevalence or proportion (P) is 0.32, and the precision (d) is 0.05. A minimum of 335 medical students were required for this study.

Ethical Approval and Consent

This study was approved by the University of Cyberjaya Research Ethics Review Committee (CRERC) with the reference number UOC/CRERC/AL-ER (41/2022). The respondents were asked and required to read a respondent information sheet and give their consent by ticking the consent box in the overview section of the Google Form. The overview also included the study's aim, the questionnaire's structure, inclusion criteria, confidentiality, voluntary participation, and the contact person. Respondents' confidentiality was protected, and their names were not recorded in the system. Additionally, after completing the questionnaire, they were provided an opportunity to receive a pamphlet on burnout prevention and feedback on their scores.

Instrument

The questionnaire was not translated into Malay, as all medical students were expected to be well-versed in English. This questionnaire was divided into four sections. Section 1 comprised six items on sociodemographic variables, including age, gender, ethnicity, the status of the university, year of study, and funding.

Section 2 consisted of six items on academic variables adapted from Daud et al., (2020), including 'Made correct decision in choosing medical course', 'Satisfied with the course', 'Ever failed any course exam', 'Confident in passing in five years', 'Thinking of dropping out', and 'Current cumulative grade point average (CGPA) of the previous semester'. The current CGPA was asked as an open-ended question.

Section 3 measured burnout via the Copenhagen Burnout Inventory student survey (CBI-SS) with 25 items adapted from Wing et al., (2018). CBI-SS consisted of four constructs, which were person-al-related burnout (6 items), studies-related burnout (7 items), colleagues-related burnout (6 items), and teachers-related burnout (6 items). According to Campos et al., (2013) the psychometric properties of CBI-SS were satisfactory, with adequate factorial (construct) validity to the study's sample. The external validity of CBI-SS was shown to have no significance in the structural model fits. The covariance between factors of the two samples (test sample and validation sample) indicated the stability of the proposed factor structure. The convergent, discriminant, concurrent, and divergent validity results of CBI-SS were adequate in this study. The internal consistency (Cronbach's alpha) in CBI-SS for each construct of personal burnout, studies-related burnout, colleagues-related burnout, and teachers-related burnout were 0.88, 0.76, 0.90, and 0.94, respectively, indicated the questionnaire was valid to be used (Wing et al., 2018). Permission has been granted to reproduce CBI-SS by the first author of this study via email. The answers for all 25 items were rated positively using a five-point Likert scale from 0 (never) to 4 (always), except for question 10. The total score of each participant was categorized into burnout (>50) and no burnout (≤50) (Wing et al., 2018).

Section 4 analyzed the quality of life among medical students. This section utilized the WHO Quality of Life-BREF (WHOQOL-BREF) adapted from WHO (2012), comprising 26 items. The first two items were global (overall quality of life and general health quality). The other 24 items were divided into four domains of quality of life: physical health, psychological, social relationships, and environment. According to a study by Krägeloh et al., (2011), the overall internal consistency (Cronbach alpha) of the WHOQOL-BREF questionnaire was 0.89 (Krägeloh et al., 2011). It ranged from 0.74 to 0.77 for individual domains, indicating adequate internal consistency with alpha values of more than 0.70. All items were scaled positively except items 3, 4, and 26. The answers for all items were scored on a five-point Likert scale ranging from 1 (not at all / very poor / very dissatisfied / never) to 5 (completely / very good / very satisfied / an extreme amount / extremely / always). The total raw score for every domain was transformed into the linear scale of 0 – 100 based on WHO (1996), by which 0 was the least favorable, and 100 was the most favorable (Roy et al., 2020; World Health Organisation, 1996). Permission to reproduce the WHOQOL-BREF questionnaire has been authorized by the WHO Permissions team, with our request identification being 389683.

Statistical Analysis

All the data collected were analyzed using Jeffrey's Amazing Statistics Program (JASP) version 0.16.1.0. Demographic and academic data were described in frequency and percentage to assess the distributions of the respondents. Each construct of CBI-SS was described in the mean score. A Chi-square test was used to determine the categorical factors associated with the prevalence of burnout. Significant factors predicting burnout on univariate analysis were entered into multiple logistic regression analysis. The assumption of normality of the burnout and quality of life variables was carried out by the Shapiro-Wilk test, by which the p-value was less than 0.05. As our data showed a deviation from normality, a Mann-Whitney U test was used to determine the association between burnout and quality of life. Multivariate analysis was done by linear regression between each construct of CBI-SS and the domain of WHOQOL-BREF. A significance level of 5% was applied for statistical analysis, by which results with a p-value <5% ($p < 0.05$) were considered statistically significant.

RESULTS AND DISCUSSION

Factors and The Prevalence of Burnout in Medical Undergraduate Students

Overall, 362 undergraduate medical students from different medical schools in Malaysia responded to the online survey. From Table 1, the majority of the respondents were distributed between the ages of 21 to 23 (61.9%), whose mean age was 22 ± 2.8 years (data not shown), females (61.0%), Malays (60.5%), fourth-year students (33.7%), studied in the medical schools of private universities (62.4%), and funded by the educational loans (53.0%). The majority of the medical students made the right decision entering the medical school (56.4%), were satisfied with the medical course (66.6%), had no dropout intention (55.0%), and were confident in passing in five years of medical school (52.2%). Besides, most medical students had never failed any course examinations (75.4%) and had a passing grade of their current CGPA (87.0%).

Next, the overall prevalence of burnout in undergraduate medical students was 31.5% (Figure 1). Studies-related burnout had the highest mean scores, followed by personal burnout, col-leagues-related burnout, and lecturers-related burnout at 14.1 ± 5.2, 12.5 ± 5.0, 9.6 ± 4.8, and 8.0 ± 4.9, respectively. From Table 1, age groups, academic years, medical students who made the right decision entering the medical school, were satisfied with the medical course, had no dropout intention, were confident in passing in five years of medical school, and never failed any course examinations were significantly associated with burnout. The age group of 24 to 26 years was reported to have the highest prevalence of burnout among other age groups at 56.8% (χ^2=12.3, p=0.01). As expected, fifth-year medical students had the highest prevalence of burnout at 48.7% compared with other academic years (χ^2=10.8, p=0.03). The respondents who made the correct decision in choosing the medical course had a lower prevalence of burnout than those who did not (22.1% vs. 73.3%, χ^2=26.0, p<0.001). The respondents who were not satisfied with the course had a higher prevalence of burnout than those who were (66.7% vs. 22.8%, χ^2=27.1, p<0.001). The respondents suffering from burnout were likelier to have failed any course examination (44.9% vs. 27.1%, χ^2=9.9, p<0.001). As expected, the respondents who were confident in passing in five years were less likely to suffer from burnout than those who were not (24.9% vs. 60.9%, χ^2=14.1, p<0.001). Finally, the respondents with dropout intention were more likely to experience burnout than those without (57.6% vs. 15.6%, χ^2=57.1, p<0.001). Burnout was not associated with gender, ethnicity, the status of the university, funding with burnout, and current CGPA.

Table 1: Association between students' sociodemographic and academic factors with burnout.

Respondents' Characteristics	N(%)1	Burnout N(%)[2]	No burnout N(%)[2]	χ^2(df)	p-value
Age					
18 – 20	91 (25.1)	27 (28.7)	64 (62,3)	12.3 (3)	0.01
21 –23	224 (61.9)	63 (28.1)	161 (71.9)		
24 – 25	37 (8.3)	21 (56.8)	16 (43.2)		
26 & above	10 (4.7)	3 (30.0)	7 (70.0)		
Gender					
Male	141 (39.0)	44 (31.2)	97 (68.8)	0.009 (1)	0.93
Female	221 (61.0)	70(31.7)	151 (68.3)		
Ethnicity					
Malay*	219 (60.5)	78 (35.6)	141 (64.4)	7.2 (3)	0.07
Chinese	56 (15.5)	10 (17.9)	46 (82.1)		
Indian	77 (21.3)	22 (28.6)	55 (71.4)		
Other	10 (2.7)	4 (40.0)	6 (60.0)		
University status					
Public	136 (37.6)	47 (34.6)	89 (65.4)	1.0 (1)	0.33
Private	226 (62.4)	67 (29.6)	159 (70.4)		
Funding					
Self-funded	62 (17.2)	29 (26.8)	79 (73.2)	1.6 (2)	0.45
Education loan	192 (53.0)	65 (33.9)	127 (66.1)		
Scholarship	108 (29.8)	20 (32.3)	42(67.7)		
Academic year					
Year 1	75 (20.7)	15 (20.0)	60 (80.0)	10.8 (4)	0.03
Year 2	57 (15.8)	19 (33.3)	38 (66.7)		
Year 3	71 (19.6)	26 (36.6)	45 (63.4)		
Year 4	122 (33.7)	36 (29.5)	86 (70.5)		
Year 5	37 (10.2)	18 (48.7)	19 (51.3)		
Have you made the correct decision in choosing a medical course?					
No	15 (4.1)	11 (73.3)	4 (26.7)	26.0 (2)	<0.001
Maybe	143 (39.5)	58 (40.6)	85 (59.4)		
Yes	204 (56.4)	45 (22.1)	159 (77.9)		
Are you satisfied with the course?					
No	12 (3.3)	8 (66.7)	4 (33.3)	27.1 (2)	<0.001
Maybe	109 (30.1)	51 (46.8)	58 (53.2)		
Yes	241 (66.6)	55 (22.8)	186(77.2)		
Have you ever failed any course exam?					
No	273 (75.4)	74 (27.1)	199 (72.9)	9.9 (1)	<0.001
Yes	89 (24.6)	40 (44.9)	49 (55.1)		
Are you confident in passing in five years?					
No	23 (6.4)	14 (60.9)	9 (39.1)	14.1 (2)	<0.001
Maybe	150 (41.4)	53 (35.3)	97 (61.7)		
Yes	189 (52.2)	47 (24.9)	142(75.1)		
Have you thought of dropping out of the course?					
No	199 (55.0)	31 (15.6)	168 (84.4)	57.1 (2)	<0.001
Maybe	64 (17.7)	26 (40.7)	38 (59.4)		
Yes	99 (27.3)	57 (57.6)	42 (42.2)		
Current CGPA**					
Fail	1 (0.3)	0 (0)	1 (100)	2.8 (2)	0.24
Pass	315 (87.0)	101 (32.1)	214 (67.9)		
Not applicable	46 (12.7)	12 (26.1)	34(73.9)		

Abbreviations: N, number; SD, standard deviation; df, degrees of freedom.
[1]Baseline descriptive characteristics for each factor.
[2]Chi-square test was performed for CBI-SS category (burnout >50 and no burnout ≤50).
*Malay and Bumiputera were combined.
**Cumulative grade point average taken from the previous semester. Pass if the respondent answered ≥2.00, pass and ≥C grade. Fail if the respondent answered <2.00, fail, and <C grade. Not applicable when no answer was given.

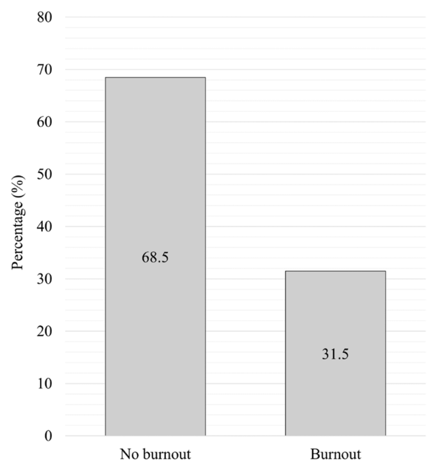

Figure 1: The overall prevalence of burnout in undergraduate medical students in Malaysia.

A logistic regression model in Table 2 included all sociodemographic and academic factors associated significantly with burnout (p<0.05) from the univariate analysis. The model showed a statistically significant χ^2 (345) = 85.989, p<0.001. The model correctly classified 73.2% of cases. Only age (aged 21 to 23 vs. aged 18 to 20: OR=0.33, p=0.017), academic years (second- and third-year medical students vs. first-year medical students: OR=3.46, p=0.012; OR=4.05, p<0.016; respectively), correctly decided to choose medicine (made a correct decision vs. who did not: OR=0.45, p=0.045), and dropout intention (had thought of dropping out vs. had not: OR=5.27, p<0.001) were still significantly associated with burnout.

Table 2: Multiple logistic regression model of possible factors predicting the medical students' burnout.

Respondents' Characteristics	OR	Confidence Interval		p-value
		Lower	Upper	
Age				
18 – 20	1.00(ref)			
21 –23	0.33	0.13	0.82	0.017
24 – 25	1.05	0.27	4.13	0.95
26 & above	0.47	0.08	2.75	0.401
Academic year				
Year 1	1.00(ref)			
Year 2	3.46	1.32	9.10	0.012
Year 3	4.05	1.30	12.68	0.016
Year 4	2.88	0.96	8.63	0.06
Year 5	3.74	0.89	15.94	0.074
Have you made the correct decision in choosing a medical course?				
No	1.00(ref)			
Maybe	0.52	0.13	2.60	0.33
Yes	0.45	0.11	1.96	0.045
Are you satisfied with the course?				
No	1.00(ref)			
Maybe	0.69	0.16	2.97	0.613
Yes	0.50	0.11	2.26	0.37
Have you ever failed any course exam?				
No	1.00(ref)			
Yes	1.132	0.62	2.053	0.684
Are you confident in passing in five years?				
No	1.00(ref)			
Maybe	0.715	0.26	1.99	0.52
Yes	0.474	0.17	1.34	0.16
Have you thought of dropping out of the course?				
No	1.00(ref)			
Maybe	2.736	1.33	5.69	0.007
Yes	5.274	2.77	10.05	<0.001

Abbreviations: OR, odd ratio; ref, reference category.

It is known that burnout was initially established in groups of physicians when they were in medical schools (Santen et al., 2010). Besides, medical students were possibly more prone to stress due to transitioning from preclinical years to clinical years with the curriculum advancement, following ward rounds every morning, increasing assignment workloads, and high expectations of their performance in clinical settings by their clinicians. In our current study, we found the prevalence of burnout in year three medical students to be 10% higher than in year two medical students, similar to that of studies conducted in a Malaysian public medical school (Daud et al., 2020 & Nik Ahmad Arif et al., 2021) and Nepal (Shrestha et al., 2021). Furthermore, studies in Hong Kong and New Zealand indicated that burnout was higher in clinical than preclinical years (Lee et al., 2020 & Farrell et al., 2019). The causes of burnout may be due to the number of stressors placed on the students, such as clinical skills, increased workloads, high parental expectations, and uncertainty of future careers (Muzafar et al., 2015).

Medical students are constantly exposed to various psychological stressors and perceived events in their academic years, which can be the potential determinants of psychological toxicity (Njim et al., 2019). Learning activities in medical schools can be stressful and perceived as a toxic academic milieu, making medical students susceptible to burnout. Every medical student must maintain their academic performance to be competent and high-performing. A study in Iran supported the significant negative relationship between burnout and academic performance in medical students, which means an increase in burnout leads to a decrease in academic performance (Ghadampour et al., 2016).

The association between burnout and the quality of life

Our study found that the environment domain of quality of life had the highest median of 69 (on a scale of 0 to 100), and the lowest was the social relationship domain, with a median of 56. A Mann-Whitney U test (Table 3) showed that undergraduate medical students with burnout significantly had lower physical health compared to the no burnout group (median=56 vs median=69, U=22711, p<0.001). Undergraduate medical students with burnout status had significantly lower psychological health

Table 3: Association between burnout and physical health of quality of life among medical

Variables	Median	IQR	r_B[1]	U test	p-value
		Physical Health			
No Burnout	69	18	0.607	22711.0	<0.001
Burnout	56	19			
		Psychological Health			
No Burnout	69	19	0.548	21875.5	<0.001
Burnout	50	18			
		Social Relationship			
No Burnout	69	25	0.357	19176.0	<0.001
Burnout	50	38			
		Environment			
No Burnout	69	18	0.453	20541.0	<0.001
Burnout	56	19			

Abbreviations: IQR, interquartile range.
[1]The effect size was given by the rank biserial correlation.

Table 4: Associations between quality of life (WHOQOL-BREF) domains and burnout (CBI-SS) constructs.

Variables	Physical Health			Psychological Health			Social Relationship			Environment		
	β1 (95% CI)	**t**	**p**	**β1 (95% CI)**	**t**	**p**	**β1 (95% CI)**	**t**	**p**	**β1 (95% CI)**	**t**	**p**
Student-related burnout*	-0.53 (-1.01, -0.05)	-2.16	0.032	-0.95 (-1.50, -0.41)	-3.45	<0.001	-0.50 (-1.24, 0.25)	-1.31	0.191	0.006 (-0.57, 0.58)	0.022	0.982
Studies-related burnout*	-1.11 (-1.60, -0.62)	-4.49	<0.001	-1.39 (-1.94, -0.84)	-4.96	<0.001	-0.98 (-1.73, -0.22)	-2.54	0.012	-1.13 (-1.71, -0.55)	-3.85	<0.001
Colleagues-related burnout*	-0.38 (-0.77, -0.00)	-1.98	0.049	-0.20 (-0.63, 0.23)	-0.90	0.37	-0.76 (-1.35, -0.16)	-2.50	0.013	-0.39 (-0.85, 0.06)	-1.70	0.089
Lecturers-related burnout*	0.08 (-0.28, -0.44)	0.43	0.669	0.39 (-0.02, 0.79)	1.89	0.06	0.65 (0.10, 1.21)	2.31	0.022	0.04 (-0.39, 0.46)	0.172	0.863
Burnout status (Burnout)**	-2.90 (1.16, -7.26)	-1.30	0.193	-0.78 (-5.71, 4.15)	-0.31	0.757	-1.76 (-8.55, 5.02)	-0.51	0.61	-1.09 (-6.28, 4.11)	-0.41	0.68

[1]Adjusted regression coefficient.
*Continuous data.
**Categorical data.
Abbreviation: 95% CI, 95% confidence interval.

than those without burnout (median=50 vs median=69, U=21875.5, p <0.001). Similarly, those with burnout had a significantly lower social relationship than those without burnout (median=50 vs median=69, U=19176, p <0.001). The environment domain was significantly lower among undergraduate medical students with burnout than those without burnout (median=56 vs median=69, U=20541, p <0.001).

Multiple linear regression was conducted to predict levels of quality of life (WHOQOL-BREF) domains based on burnout constructs (CBI-SS) and an overall burnout status. For physical health as the dependent variable, only three significant predictors explained 38% of the variance (R^2=0.381, F(5, 356)=45.38, p<0.001). It was found that physical health was negatively influenced by personal-related burnout (β=-0.53, p=0.032), studies-related burnout (β=-1.11, p<0.001), and colleagues-related burnout (β=-0.38, p=0.049). The results of the psychological domain as the dependent variable, two significant predictors explained 38% of the variance (R^2=0.377, F(5,356)=44.64, p<0.001). Psychological health was negatively predicted by personal-related burnout (β=-0.95, $p<0.001$) and studies-related burnout (β=-1.39, $p<0.001$). Three significant predictors of the social relationship domain explained 16% of the variance (R^2=0.158, F(5,356)=14.53, $p<0.001$). The social relationship was negatively predicted by studies-related burnout (β=-0.98, p=0.012) and colleagues-related burnout (β=-0.76, p=0.013) but positively predicted by lecturers-related burnout (β=0.65, p=0.013). Finally, only one significant predictor of the environment domain explained 18% of the variance (R^2=0.183, F(5,356)= 17.20, $p<0.001$). Specifically, studies-related burnout negatively predicted environment (β=-3.85, $p<0.001$).

CONCLUSION

Our study found that the overall prevalence of burnout was high among undergraduate medical students from all medical schools in Malaysia. Burnout was associated with age, academic year, and some academic factors such as making the correct choice for medicine, being satisfied with the course, never failing any examination, being confident in passing the course, and having a dropout intention. To our knowledge, our study was the first to analyze the relationship between CBI-SS and WHOQOL-BREF. A significant association between CBI-SS constructs (student- studies-, colleagues-, and lecturers-related burnout) and quality of life domains (physical, psychological, social relationship, and environment) was demonstrated in our study. Our study indicated that the medical faculty must take strategies to alleviate the well-being of medical students, such as providing individual mentor-mentee meetings, peer support programs, mental health awareness campaigns, and others.

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Switching Intention of Mobile Payment Platforms to Another Alternative

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ABSTRACT

In recent years, mobile payment services are becoming increasingly popular. However, compared to other countries of the world, Malaysia's mobile payment service industry is still in development and in an infancy stage. Which is why, the main focus and purpose of this study is to analyze the factors that affect Malaysian customers' intention to switch towards alternative mobile payment services in the online payments industry. Four hundred out of the four hundred and fifty google questionnaire surveys distributed in the Kuala Lumpur area were usable for this study. The descriptive analysis describes features of the four hundred questionnaires' data, and through the PLS-SEM two-step approach assessed the outer measurement model and the inner structural model. The results show that privacy, convenience and system quality in mobile payment have a significant relationship with the intention to switch to alternatives of mobile payment services in the industry; privacy, convenience and system quality have a significant positive relationship with customer's switching intention; on the other hand, switching cost, habit of user and monetary rewards do not have a significant relationship with customer's switching intention. This study provides a reference for modern smart mobile users, mobile payment application developers and mobile payment technology companies by better understanding consumers' behavior intention. In addition, this study fills the theoretical gap of comprehending the main factors affecting customers' intention to adopt mobile payment and what causes them to switch to other alternative services by this integration model.

Keywords: Mobile payment platforms; Switching intention

INTRODUCTION

With the rise in the development of emerging technologies, a change can therefore be experienced in the existing Business models that are mainly concerned with the mobile payment mechanisms. There is a requirement of new Business models that can be promoted to create value for customers as well as its stakeholders. At the present period, the usage of mobile and smartphones has increased drastically. Therefore, the rise of new business propositions applications and different modes of transactions of payment. Mobile payment is one of those applications that have changed and have given rise to new business ventures. However, over the years the importance of mobile devices has increased exponentially making them a crucial part of consumers' lifestyles. Mobile devices have been used as a mode of payment or transaction and as an alternative for physical debit or credit cards. Therefore, this holds mobile devices as a device that can display the information of a card in a digital format (Kuo, 2020). The rise in mobile wallets not only provides convenience for the users. A safe mechanism through which payment can be made cashless as well as without the application of swiping the credit or debit cards in offline stores.

Problem Statement

The switching behaviour of users of mobile payment services has generated little interest in two researchers as the majority of the studies have focused on users' adaptability to this service in recent times. The use of the mobile payment in Malaysia become popular during 2018-2019 and this implicated the various mobile platform options that can be used in the markets. With the gradualism in the context of the mobile payments in Malaysian markets, the common phenomenologies have significantly increased. with high variability of mobile payment options in the markets, the users are opting for various other payment options. this one of the quintessential elements in the markets of Malaysia. Dissatisfaction among users with mobile payment platforms is one of the main reasons for their switching intentions. With the perspective of the push-pull moving Framework, a critical antecedent for the switching intention of users' mobile payment platform services will help in having an effective understanding of this critical topic (Kuo, 2020). The user's intention to switch to alternative methods from mobile payment service platforms is due to the fact of its dissatisfaction with the quality of the system as well as the information quality that this platform holds especially in terms of its visual attractiveness and stability. The phenomenon of consumer switching is widely recognized as a highly unfavourable occurrence. Consequently, it becomes imperative to investigate post-adoption behaviour in order to gain insights into the dynamic process underlying the systematic selection of alternative platforms by customers.

Objectives

I. To find out the monetary rewards as the switching intention of customers
II. To examine that whether switching quality is dependent on the switching operation of m-payments

Literature Review

According to Steinbach (2016), the use of mobile wallets has been forecasted as a Revolutionary change in the culture within consumers. This digital Revolution will change the state of making payments using hard cash or debit or credit cards and cutting the inconveniences through wireless telecommunication. The multifunctional mode of payment that can be conducted on a global platform. Mobile payments are associated with different advantages that have helped in adding to the success of this mode of payment (Steinbach, 2016). One of the main advantages of this form of payment is the ability of the application to store the payment information such as the card number of the credit or debit cards and the cash balance available in that mode of payment. The quick accessibility along with an incredibly user-friendly approach to mobile payments have generated dependability on mobile payments. However, the application of encrypted software solutions has also added to the safety guard for such payment options. However, this escalation of mobile payments has created a competitive atmosphere among the different digital mobile payment platforms. The success behind mobile payment largely depends on the fact that the initial adoption practices helped in the easy mode of payment where transactions could be done at a faster rate and with proficiency (Song et al, 2018). However, the rise in fraudulent activities and several cyber-attacks have affected consumers' intention to switch to alternative methods from mobile payments. To understand the switching intention of consumers it is essential to understand the concept of the push-pull mooring framework to build an effective understanding to choose an alternative option for mobile payment platforms (Fan et al. 2021).

It is observed that the intention of the user is related to the perceived risk of the incumbent mobile payment and is positively related to the switching intention of the customers. The switching cost of the mobile payment has direct proportionality with switching intention. The convenience of the customer has a positive relationship with the switching intention of the customers. The habit of understanding the incumbent mobile payment is negatively related to the switching intention of the mobile payment platform. This provided the relationship between the dependent variable with the independent variables. The theories of the development of the research suggest that all the parameters are directly having a positive impact on the switching intention but the habit of understanding the incumbent mobile payment is negatively impacted on the switching intention of the customers and this is because customer intentions are not always clear about what are their demands and the reasons of why they are not satisfied with mobile payment options that they are currently using.

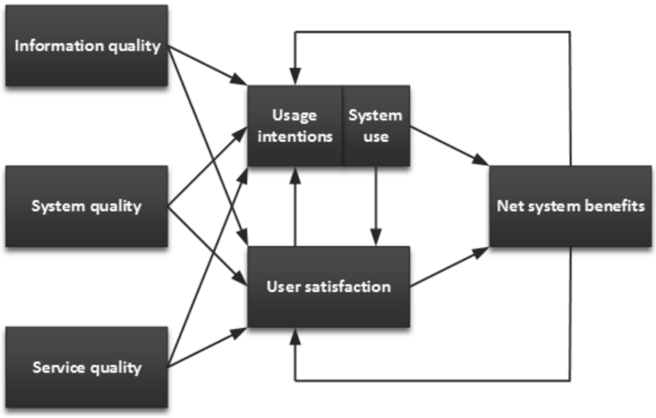

Figure 1: Delone and McLean Information Systems Success Model (self-created)

Delone and McLean in 1992 have provided the best models to depict the information systems that are important to evaluate the working functionality of the IT infrastructure success such as infrastructure that is to be governed within the mobile payment application. The variables that are considered within the evaluation factors: user satisfaction, organizational impact, individual system, system quality, information system, service system with the net system benefits (Almazán et al. 2017). The variables of the D&M IT model also helps in the understanding of the holistic approaches of the influences of the customers and the variable implications that it had on the mobile payment applications. The measurements of quantification help in providing the knowledge of information systems that is adequately important to study the mobile application. According to Ojo (2017), the theory suggests that information quality, service quality, and system quality are directly promoted to customer engagement through the switching intention that is the prime objectivity.

The research aims to understand the Switching Intention of Mobile Payment Platforms to Another alternative through the concepts of the Push-Pull moving framework to build a research framework. This study provides a reference for modern smart mobile users, mobile payment application developers and mobile payment technology companies by better understanding consumers' behavior intention. In addition, this study fills the theoretical gap of comprehending the main factors affecting customers' intention to adopt mobile payment and what causes them to switch to other alternative services by this integration model.

METHODOLOGIES

Sampling

The method used in this research is Probability sampling. Probability sampling is described and explained as a sampling approach wherein the researcher selects samples from a bigger population by using a technique based on probability theory. In order to be classified as a probability sample, a participant must be chosen at random. The most essential factor of probability sampling that everybody in the population must have an equal and clear chance of being chosen. Probability sampling utilizes statistical theory to choose a specific minority of people (sample) at random from a huge population and then forecast that every one of their replies will match the whole population (Elliott, 2020). This sampling approach includes, simple random sampling, systematic, stratified, and clustered sampling.

In this research the systematic random sampling from the probability sampling category will be chosen as its considered convenient, cheap, easy and saves time. The population will be divided into several groups and the 1st respondent will be selected as a sample.

Sample size

The minimum sample size was forecasted according to the 10-times rule method, which consider an important issue within the PLS-SEM. The rule explains how that the minimum sample size must be greater than ten (10) times the maximum number of either the inner or outer model links. Therefore, according to this method, the minimum sample size regarding this study is 30.

Data collection techniques

In this research both primary and secondary data will be used. The primary data will be in a form of questionnaire that will include six sections. The first five sections will measure the independent variables while the last section includes the mediating variable of this study. the secondary data will be to the number of the mobile phone users and M-payment facility users. The secondary data will discuss the service quality effects on customer engagement. Regarding this research, a cross-sectional survey method will be conducted. One of the quantities research methods to use is a structured survey. The structured survey is a type of question design and layout in which the respondents are limited to answer few questions only. Because there are just a minimal number of responses, it is appropriate for a wide spectrum of survey subjects at various levels. This data collecting approach allows for the control and determination of the link among study variables, as well as the measurement and analytical data processing. The most appropriate data collection location is Kuala Lumpur, Malaysia due to its strategic locations and the advantage into reaching a bigger and better audience. The surveys will be vial online due to its advantage being cost efficient and faster.

Data analysis method

In this case study, descriptive analysis is utilised in order to create a statistical description of all the variables used. The descriptive statistics characterise the features and the way the data value is distributed. The basic demographic profile of respondents, includes gender, ager, educational level, monthly income, online payment, number of devices owned and the frequency of using the mobile payment services. Descriptive analysis is commonly used to calculate and measure central tendency is and dispersion. The respondent's demographical data will be represented via frequencies and percentages, the responds opinions and the non- numerical data will be represented via frequencies and percentages as well. As well as averages and standard deviations. Declare that the simplest approach to measure trends is to look at the data's mean and standard deviation. According to the central limit theory, the PLS method may convert non-normal data. This analysis is multi-stage procedure. Reliability and validity can be verifying to evaluate external models. The model states that the number between 0 and 1 offer a measure of internal consistency. If the number exceeds 0.7 is considered reliable.

The structural model is used to evaluate the relationship between one or more dependent hypothesis model constructs. propose a five-step approach for assessing structural models The first step is to address the issue of serial correlation. If the Vif Value (VIF) is less than 0.25, it indicates correlation between independent variables; if the VIF is greater than 4.0, it indicates problematic multicollinearity. The path coefficient is then evaluated in the second phase. Path coefficient values vary from -1 to +1, indicating a connection that is strongly negative to very positive. The coefficient of determination is the third stage. R-square values ranging from 0 to 1 indicate the prediction accuracy of the model. For example, 0.25 indicates a low predictive power, 0.5 indicates a moderate predictive power, and 0.75 indicates perfect predictive accuracy. The fourth stage is to determine the magnitude of the effect. The F-square values are 0.02, 0.15, and 0.35, indicating that perhaps the effect size of the missing construct for a given endogenous variable is small, medium, or high. Cross-validated redundancies is the final stage. The greater the Q-square number, the smaller the gap between the anticipated and original values, indicating the stronger the model's predictive accuracy.

RESULTS

Pilot Test

To ensure the responsiveness of the respondents to the questionnaire and to test the efficiency, effectiveness and the applicability of all the measurement tools a pilot test is usually conducted to check the validity of the questionnaire that is being used to gather responses as all the test run and results of the research depend upon the data collected by the public. The validity and reliability of the questionnaire is absolutely vital to get a complete picture and idea of the research outcome. Various random mobile payment users were approached on different locations like malls, offices, universities etc. by using the mall-intercept method. This method was used as it is considered the most efficient, effective, random and the most unbiased way of collecting data (Business Wire, 2020). Data was collected at the entrances of different locations as listed above which are considered to be key top locations. The results came out to be Cronbach's alpha and composite reliability of this pilot test as shown in the table below above 0.7 which is considered to be highly reliable and so it was concluded that the measurement model is reliable and valid.

Response Rate

Due to a significant impact of the global pandemic i.e. COVID-19 and the uncertain extension of Recovery Movement Control Order (RMCO) till the mid-year 2021 announced by the Malaysian government. Thus, the data of four hundred and fifty respondents was collected by the use of a questionnaire survey for this study that started in August 2021. (Cagliano, 2017). With the help of Google Forms a questionnaire was developed covering all the aspects of our dependent and independent variables. The questionnaire was prepared by using a combination of snowball and purposive techniques. Among all the four hundred and fifty responses that were collected four hundred were considered to be valid which is 88.9 percent of the total responses and this response rate is similar to the response rate of Ghazali et al. (2018) used the same collection method in Malaysia. (Dhule, 2018).

Descriptive Analysis

The descriptive analysis will now describe the basic features of four hundred data samples which include gender, age, income, and the level of income. On the other hand further information will also be explained as the mean, median, mode, minimum, maximum, standard deviation, the excess kurtosis and the skewness.

Regression

The regression model usually tells how statistically significant is our model is. On the other hand, the p-values present in the model with all variables show whether any correlation is present among the independent and the dependent variables. The p-values above 0.05 show a significant level of correlation among all the variables in larger populations as well. For further research, the regression model was assessed for presence of Multicollinearity between all the independent variables. It occurs when high correlation exists between two or more independent variables. It makes difficult to understand the individual significance or contribution of the independent variables on the dependent variable according to Barrow (1988). If the correlation coefficient exceeds the threshold of 0.05, its translates to a very high correlation between the variables. According to the 0.05 benchmark and the aforementioned statement, the highest correlation exists between the monetary rewards with respect to the switching intentions i.e. 0.9 (Law, 2018). Figure 3 shows the regression model of the data samples.

Correlation

Correlation measures the strength of the linear relationship between the variables. As per figures given in the in table above, results of correlation test are positive. The range goes from -1 to 0 to +1 indicating a perfectly negative linear relationship to no relationship to perfectly positive linear relationship respectively. The strength can be assessed as follows:

$0.1 < r > 0.3$ small or weak correlation,
$0.3 < r > 0.5$ medium or moderate correlation and,
$0.5 < r$ onwards is considered large or strong correlation

The relation between system quality and switching intention is 0.830 which is a positive value indicating perfectly positive linear relationship and being above 0.5 indicates strong correlation between the variables. The correlation values are positive and also significant as it is above the standard value of 0.5. the results imply that as the privacy, convenience and system quality increases, the willingness to switch to other alternatives also increases. For our model all values are either very close to 1 or greater than 1 which confirms the fitness of the model. (Lee, 2020).

Figure 4 shows the correlation model of the data samples.

DISCUSSION

Monetary Rewards Quality and Switching Intention

There is no direct significant relationship between monetary rewards and switching intention since the P-Value higher than 0.05, thereby H3 is not supported. This result contradicts some previous studies (Kassim and Abdullah, 2010; Quach et al., 2016). Sheng and Liu (2010) state that monetary rewards cannot improve customer satisfaction and thus no intention to switch exists. This probably can be due to those customers are

	No.	Missing	Mean	Median	Min	Max	Standard D...	Excess Kurt...	Skewness
Gender	1	0	1.440	1.000	1.000	2.000	0.496	-1.951	0.243
Age	2	0	3.200	3.000	2.000	4.000	0.768	-1.230	-0.359
Income	3	0	1.785	2.000	1.000	2.000	0.411	-0.061	-1.393
Payment	4	0	1.532	1.000	1.000	3.000	0.681	-0.388	0.906

Figure 2: Descriptive Analysis

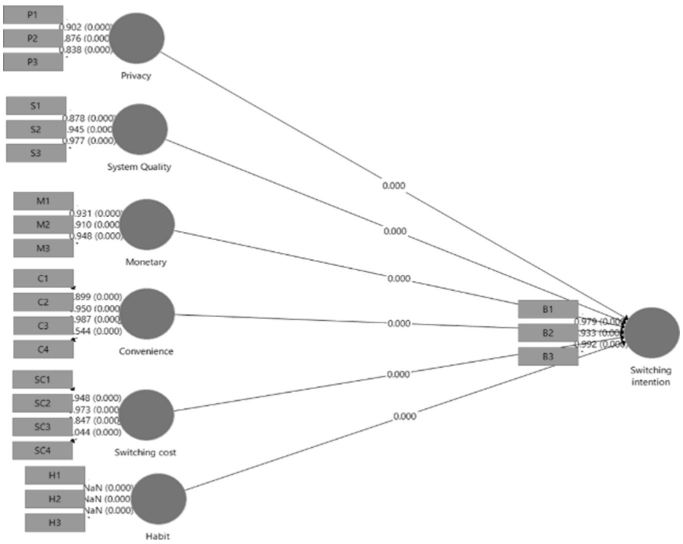

Figure 3: Regression

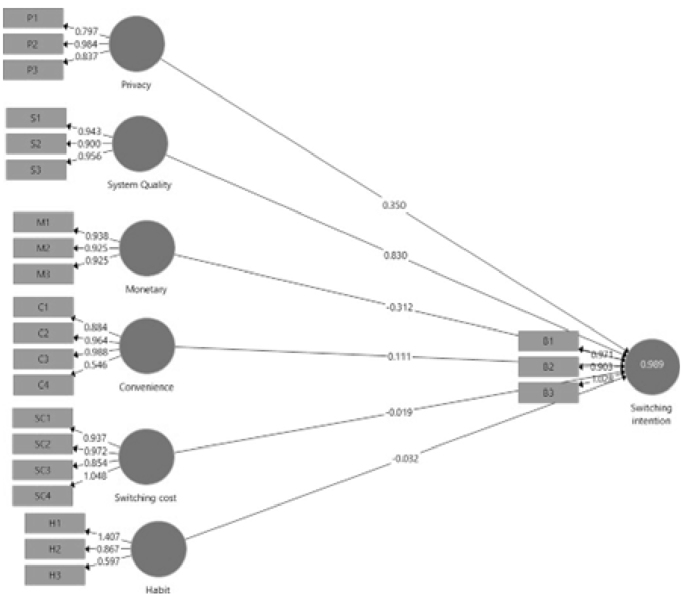

Figure 4: Correlation

more interested enhanced service quality that can bring potential competitive advantages for service providers. However, studies state that value received by customers may determine the relationship between monetary rewards and intention to switch due to service quality and satisfaction. The importance of monetary rewards may depend on the usage purpose.

System Quality and Switching Intention

There is a positive significant relationship between system quality and switching intention since the P-Value below 0.05, indicating that the higher system quality the higher switching intention towards that option of mobile payment. This result is consistent with previous studies (Aldholay et al., 2018; Aparicio et al., 2019; Gonzales & Wareham, 2019; Hsiao et al., 2019). Ye et al (2022) said that user switching intention increases if higher quality of payment system is provided which makes it easy to understand and provides complete information. Sheng and Liu (2010) found that better system quality may improve user experience. Compared with traditional payment methods, the advantage of mobile payment services is the ability to provide payment information. For example, after a customer uses mobile payment service in the retail store, the mobile payment application can automatically generate a payment record. If they don't have the time to check the bill in the retail store, the mobile payment record allowed consumers to query on their mobile devices anywhere and anytime. In addition, accurate, relevant, and timely information can save consumers time and allow consumers to easily control their financial information. The good quality format facilitates consumers to understand the content of the information and improves reading efficiency. Service providers and retailers should focus on improving system quality. That will increase the positive attitude of consumers, promoting satisfaction and willingness to use mobile payment services.

CONCLUSION

Overall, this study uses an integration model to study the behavioural intentions of Malaysian consumers in switching and using mobile payment services in any kind of industry. The findings of this study achieved the research objectives and answered the research questions, have improved the understanding of customers' intention that use mobile payment service in Malaysia and enriched the literature. Pointed out the limitations of this research and provided suggestions for future researchers. The results made it quite clear that the loyal customers highly prefer privacy, convenience and the level of system quality. Overall, the data for all variable's constructs are higher than the trust transfer theory related constructs that means the respondents more agree on all the variable constructs.

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Factors Influencing Malaysian Consumer Purchase Decision Towards Online Shopping for Apparel Products

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ABSTRACT

The study aims to identify the influential factors on consumers' purchasing decisions towards online shopping for apparel in Malaysia. The scope of the study is based on the profiles of Malaysia consumers who have experience with online shopping. This study is quantitative research, using a structured questionnaire to collect the data from 166 consumers who have been shopping online. The researcher analyses data variables using correlation analysis, regression analysis, and descriptive analysis with SPSS software to test hypotheses and answer the research questions. The study identifies independent variables including motivation factors (security, accessibility, information quality), and perception factors (product review, support services, factual evidence). The dependent variable is the consumers' purchase decisions in Malaysia online shop. The result shows that both motivation factors and perception factors have significant relationship with the consumers' purchasing decisions in Malaysia.

Keywords: motivation; perception; purchase intention; consumer behaviour

INTRODUCTION

In 2020, according to Bank Negara Malaysia, the Malaysian online retail industry contributed a total GDP of 19.1% in 2020, compared to the previous year of 8.4% in 2019, the department of Statistic Malaysia (DOSM) also indicated that online retail sales index in Malaysia was around 33% at the end of 2020, versus 22% at the beginning of 2020 (Idris, 2021). The impact of Covid-19, alongside with other factors such as substantial rise in disposable income, internet penetration, the attraction of cost savings, the convenience of online shopping, and the shift in consumer purchasing patterns are all contributing factors to the enormous development.

Apparel is a necessary and compulsory item, and consumer clothing preferences are often influenced by variables such as fashion or a desire to possess a certain clothing brand. The apparel, accessories, and footwear category were the most lucrative section in 2021, with a total market value of 1.9 trillion in 2019, this impressive feat is estimated to increase even more in the next decade by approximately 70% (Johnson, 2021).

Online clothing buying has grown increasingly popular in Malaysia, especially the younger generation, such as Generation "Y" and Generation "X," not only because of the trend, convenience and low prices, but also because of the availability of the newest fashion trends that are easily accessible. Setting up an online store on Facebook or Instagram is fast and simple for online merchants, which is why there are many online stores accessible. The variables that will affect a consumer's purchasing choice, on the other hand, are the source of the most worry for online stores and merchants. It is critical to understand why consumers choose to purchase at an online business (i.e., their buying motives) and how their behavior varies depending on whether they are predisposed to customized online shopping or not (Muller, 2021).

Finding the greatest price, looking for product promotions, online shopping convenience, stimulation from the contact with websites, getting customized services, the quality of the obtained services, perceived value, or the availability of information are all examples of such incentives (Bucko et al., 2018). The purpose of this research is to determine the variables that will affect a consumer's choice to buy clothing via the use of the internet. According to the authors, concentrating on the factors that influence purchasing decisions will be able to assist retailers in better understanding the emerging complex pattern of clothing retailing, as well as better understanding apparel consumption and providing insights for apparel marketers wishing to improve their strategies for reaching all types of customers.

METHODOLOGIES

Research design

After extensive study and evaluation of research publications, questions were adapted from relevant studies and modified to fit this study. The questionnaire was created using Google Forms and is separated into 2 sections: the 1st section, titled section (A), contains a few questions on demographics and one question to screen and remove offline shoppers; the 2nd section, titled section (B), contains a set of questions on purchase decision, online shopping motivations, and perception. The research used a Likert-type scale style with four points, with the median point removed to prevent a mutual response. The questionnaire was distributed online through various social media platforms used in Malaysia, such as LinkedIn, Facebook, and Wechat.

Sampling design

Non-probability sampling was conducted whereby a total number of 180 respondents from Klang Valley of Malaysia were participated in this research.

Data collection

The participants were required to review and respond to the same series of questions in a predefined sequence without the presence of an interviewer before submitting the questionnaire online. The data collection took place for approximately 2-week time starting from mid-August 2021 until the end of August 2021.

Data analysis

Cronbach's Alpha (reliability) test was used to pre-test and evaluate the internal consistency of the questionnaire before being distributed, and the Pearson's product moment correlation coefficient (PMCC) was used to assess the connection between the variables. The coefficient of determination (also known as the regression coefficient) test was also performed to determine how strong the connection is between the dependent variable and the independent variables. To determine the reliability of the questionnaire, a pilot test was carried out on a small sample of participants to determine whether a technique that is planned to be utilized in a larger size research will be feasible to implement. A total of 25 questionnaires were distributed to students and lecturers from UCSI University as well as working adults from various parts of the Klang Valley.

RESULTS AND DISCUSSION

Reliability test

A reliability score of 0.5 or above implies that the study variables are reasonably dependable (Wagemaker, 2020). Both the dependent and independent variables were subjected to a statistical test. The purchase intention was identified as the dependent variable for this research, and the result is presented in Table 1. The results of the test of independent variables which were motivation and perception are shown in Table 2. It was revealed that Cronbach's Alpha reliability score is 0.651, indicating that this variable is adequate and acceptable in terms of reliability. The motivational score is 0.692, and the perception score is 0.782, respectively. Thus, both variables are acceptable and adequate in this context.

Table 1: Crocbach's Alpha reliability test results

Variables	Cronbach's Alpha	N of items
Purchase decision	.651	5
Motivation	.692	6
Perception	.782	6

Correlation analysis

To investigate the significance of the factors that encourage customers to buy online and their purchasing decisions, a correlation study was carried out. The results showed that the Pearson correlation coefficient was 0.769, with a p-value of less than 0.05. As seen in Figure 1, the results were as expected. Most respondents perceived that security, accessibility, and information quality are essential factors that influence their decision to make a purchase over the internet. Customers' purchase decisions are heavily influenced by the factors explored in this study. If these factors are not effectively given, this might have an impact on the customers' choice, causing them to think twice about making a purchase from the online business in the first instance. Consider the following: the greater the security of an e-commerce platform, the more accessibility to the variety of items and services offered, and the higher the quality of information accessible in the platform will all inspire and enhance the tendency for customers to make an online purchase in the given platform (Azami, 2019).

Correlations

		PD	Motivation	Perception
PD	Pearson Correlation	1	.769**	.610**
	Sig. (2-tailed)		.000	.000
	N	166	166	166
Motivation	Pearson Correlation	.769**	1	.700**
	Sig. (2-tailed)	.000		.000
	N	166	166	166
Perception	Pearson Correlation	.610**	.700**	1
	Sig. (2-tailed)	.000	.000	
	N	166	166	166

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

Figure 1: Correlation analysis for dependent variable and independent variables

The decision to conduct a correlation analysis was fundamentally based on the purpose of determining the significance between the perception of online shopping and purchase decision. The results revealed that the Pearson correlation coefficient was 0.610, with a p-value of less than 0.05. As observed in Figure 1 above, the results were as expected. In accordance with the response rate, many respondents believe that their impressions of product reviews, customer service, and factual evidence provided by the online store take priority in making their purchase choice. To put it in another way, customers are very inclined to rely their purchasing decisions on third-party evaluations of an online store and the types of services it provides.

Regression analysis

A regression analysis is carried out to determine the significance between the factors of motivation and purchasing choice. The R2 value shown in Figure 2(a) below was 0.592, which corresponds to a 59.2 percent correlation coefficient. This suggests that the equation can accurately anticipate more than 50% of the variance in the data. The standardized coefficients are as follows: The beta value was computed and found to be 0.769, indicating that there is a statistically significant association amongst the two variables which are motivation and purchasing choice respectively. Figure 2(b) shows the significance value of 0.000. As a result, the test was found to be statistically significant.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.769[a]	.592	.590	1.68851

a. Predictors: (Constant), Motivation

b. Dependent Variable: PD

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.151	.463		6.808	.000
	Motivation	.615	.040	.769	15.426	.000

a. Dependent Variable: PD

Figure 2: (a) Model Summary and (b) coefficients of regression test between motivation and purchase decision.

The research has also undertaken a regression test to see whether there is any correlation amongst perception and purchasing choice. The R square value is shown in Figure 3(a) below as 0.372, which is 37.2 percent. In other words, this indicates that the variance in the equation is less than 50 percent in this case. The standardized coefficients are as follows: The beta value was computed and found to be 0.610, indicating that there is a statistically significant association amongst the two variables: perception and purchasing choice. The significance value indicated in Figure 3(b) is 0.000. As a result, the test was found to be statistically significant.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.610[a]	.372	.369	2.09407

a. Predictors: (Constant), Perception

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.686	.563		8.329	.000
	Perception	.491	.050	.610	9.866	.000

a. Dependent Variable: PD

Figure 3: (a) Model Summary and (b) coefficients of regression test between perception and purchase decision.

Summary of hypothesis testing

H1: There is a positive relationship between motivation and consumer purchase decision towards online shopping for apparel.

H2: There is a positive relationship between perception and consumer purchase decision towards online shopping for apparel.

The correlation between motivation (the independent variable) and purchase choice (the dependent variable) assessed in section above has produced a value of r = 0.769, with a p-value of 0.000, which demonstrated a positive value, and therefore, the hypothesis result for H1 is considered valid. Moreover, the correlation coefficient between perception (the independent variable) and purchasing intention (the dependent variable) was 0.610, with a p-value of 0.000 for the study. Consequently, the hypothesis result for H2 is also accepted since it demonstrated a positive value. Table 2 provides a summary of the hypotheses.

Table 2: Summary of tested hypotheses

Item	Hypothesis Descriptive	Pearson Correlation	Regression Analysis	Supported Hypothesis
		r value	*p* value	
H1	There is a positive relationship between motivation and consumer purchase decision towards online shopping for apparel.	0.769	0.000	Accepted H1
H2	There is a positive relationship between perception and consumer purchase decision towards online shopping for apparel.	0.610	0.000	Accepted H2

Both hypotheses examined, H1 and H2, were found to be valid. The hypotheses were backed by the data gathered and analyzed. The association amongst purchase choice and the driving factors that lead to online buying is significant and favorable, as is the correlation between purchase decision and perception of the purchasing process. As a result, online shops and retailers must not take these aspects for granted. Past studies have revealed that these characteristics influence customer buying decisions, and the results of these present questionnaires demonstrate that this is true for apparel shopping done online. According to the findings of the questionnaire, it was discovered that the aspect of motivation had a larger association with purchasing decisions compared to perception. One of the primary factors of online buying is security, which is followed by accessibility and information quality, which are all considered as very important factors.

CONCLUSION

The outcome of the questionnaire revealed that customers' perception of online apparel shops is slightly lower than the motivating factors. Nevertheless, this does not imply that product reviews, customer support services, and factual evidence are any less significant to customers than they are now. According to the results of the data analysis, a large proportion of participants believed that product reviews, particularly unfavorable reviews, are an essential element in their purchasing choice. Online shops and merchants must recognize that these aspects are significant and that they will have an impact on their business performance. While e-commerce is currently mostly a domestic affair, with customers placing their orders predominantly from shops in their own nation, this is beginning to shift.

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From Victim to Perpetrator: The Tendency of Cyberbullied Adults to Cyberbully: The Role of Online Disinhibition

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ABSTRACT

Introduction: Past studies suggested that young adult individuals who experienced cyberbullying victimization were likely to develop tendency to be involved in cyberbully perpetration. As online disinhibition was also reported to predict the tendency to cyberbully others, we hypothesized that online disinhibition might moderate the association between the victimized experience and the tendency to perpetrate cyberbullying.

Methods: To test the hypothesis, a quantitative cross-sectional study was conducted by recruiting 100 young adult respondents through non-probability sampling. They voluntarily responded to Cyberbullying Victimization Scale to measure tendencies of cyberbullying victimization (CV) Online Disinhibition Effects Scale to evaluate the level of online disinhibition (OD) among users, and Cyberbullying Perpetration Scale to measure tendencies of cyberbullying perpetration (CP). Bootstrap analysis with 5000 samples at 95% confidence interval was conducted through PROCESS Macro 4.0 for SPSS to analyze the data.

Results: the results suggested that ODE significantly moderates the relationship between CV and CP, with the effect of CV on CP being stronger at higher levels of OD.

Conclusion: Individuals who have experienced cyber victimization may be more likely to engage in cyberbullying themselves, particularly when communicating online, where they feel freer to express themselves in ways that deviate from their typical in-person behavior.

Keywords: cyberbullying; cyber-victimization experience; online disinhibition.

INTRODUCTION

The rapid development of information and communication technologies has resulted in the constant use of digital tools such as mobile phones, computers, and the internet in people's daily lives (Iftikhar et al., 2020). This increased usage has given rise to a new scientific field called cyberpsychology, which focuses on the psychological phenomena resulting from human interaction with digital technology, particularly the internet (British Psychological Society, 2022). Cyberpsychology has existed for over three decades and originated in the mid-1990s with the first academics studying online behavior (Suler, 2004).

Malaysia is rapidly transitioning into a digital nation, with the percentage of individuals using the internet and mobile phones increasing significantly (Department of Statistics Malaysia, 2022). However, despite the benefits of internet use, cyberbullying, cyber-stalking, and online predation are serious concerns affecting a significant percentage of internet users, particularly in Malaysia. A study on the prevalence of cyberbullying among Malaysian students in higher learning institutions indicated that 66% of the respondents had experienced cyberbullying, with Facebook and mobile phone social apps being the most common platforms (Lai et al., 2017). Moreover, the United Nations Children's Fund even stated that Malaysia ranks second in Asia for cyberbullying among youths (UNICEF, 2020). Cyberbullying refers to an aggressive and intentional act committed using electronic devices, targeting victims who are incapable of defending themselves, and can take several forms such as flaming, harassment, cyberstalking, denigration, masquerading, trickery, outing, and exclusion (Watts et al., 2017; Topcu & Erdur-Baker, 2017; Peled, 2019).

Despite the existence of literature on factors that lead to cyberbullying, such incidents persist in Malaysia, with the problem assuming alarming proportions. A study by the United Nations Children's Fund (UNICEF) on cyberbullying against young people in thirty different countries revealed that one in three young adults in Malaysia is a victim of cyberbullying, with the problems that arise from cyberbullying potentially leading to a person's death (UNICEF, 2019). For instance, in 2022, a victim of cyberbullying in Malaysia ended her life due to the unbearable stress and depression caused by the toxic and negative individuals she was exposed to online social interaction (Selvam, 2022).

The ease with which online harassment can be committed, coupled with the online disinhibition phenomenon where people feel freer to engage in negative behavior online, has made online bullying and harassment easier than other forms of bullying (Ben-Joseph, 2022; Wang et al., 2022). The online disinhibition effect has led to the creation of fake sites and gossip accounts, with more people engaging in such behavior (Katz, 2022). Cyberbullying not only leaves a digital trace but also has physical and psychological consequences such as anxiety, depression, and the cessation of internet usage (Dixon, 2023; Hui et al, 2019; Saikia et al., 2019). In addition to these implications, it was also reported that cyberbullying exerts negative effects on young people's personal privacy and many other aspects of their lives.

The role of online disinhibition in the phenomena of cyberbullying can be explained by the routine activities theory of crime, coined by Cohen and Felson in 1979 that crime is likely to take place when the presence of three elements namely motivated offender, a suitable target, and the absence of a capable guardian. (Jones & Pridemore, 2019). In the context of cyberbullying and cybervictimization, the online disinhibition represents the absence of a capable guardian; despite artificial intelligent-based algorithms might filter some offensive contents in posts, the victims are virtually suitable and without guardian in the anonymous online interaction. Moreover, the potential offenders are not likely to be aware whether their potential victims are being guarded; their perceived absence of the victim's capable guardian tend to motivate them further to commit their crime, which is contextually cyberbullying.

The tendency of former cyberbullying victims to conduct cyberbullying can be explained by The Victim Precipitation Theory, which suggests that victims of crime may become offenders themselves as a result of their victimization experience. In the context of cyberbullying, former victims are more likely to engage in cyberbullying behaviors themselves; (Wang et al, 2020) This phenomenon has been referred to as "the bully-victim cycle" (Falla et al, 2022). This phenomenon has been reported to be more prevalent during the pandemic, where the social distancing protocol was enforced, leaving individuals connected to one another via online, and the reliance on social media for social feedback was increased significantly, up to the point where satisfaction with life among Malaysian urban adult was determined by the online social interaction (Prihadi, et al., 2021). Findings of the aforementioned study indicated that internet users' emotion was significantly affected by online interaction, including the cybervictimization behavior among themselves.

One possible explanation for the phenomena where the cyber-victimized individuals turned into perpetrators was that victims of cyberbullying may feel a sense of powerlessness and a desire for revenge or retaliation. They may also internalize the negative messages and behaviors of the cyberbully, which can lead to a perpetuation of the same behaviors (Fabris, et al., 2022).

Another explanation is that former victims of cyberbullying may become desensitized to the impact of their actions on others. They may also see cyberbullying as a way to assert power and control over others, particularly if they have experienced a loss of power and control in their own lives, yet the online disinhibition put them into the higher sense that they matter and empowered by the anonymity (Nga, et al., 2022).

The victim precipitation theory and the bully-victim cycle have important implications for the prevention and intervention of cyberbullying. It suggests that interventions should not only focus on the cyberbully, but also on the victim and their potential for becoming a perpetrator. By addressing the underlying causes of the bully-victim cycle, such as feelings of powerlessness and revenge, interventions can help break the cycle and prevent further victimization and perpetration of cyberbullying behaviors.

METHODS

The study utilizes survey research as its primary methodology to collect information from adults aged 18-25 in Malaysia regarding cyberbullying perpetration and victimization. The target population of the study is adults aged 18-25 in Malaysia, as this population is the most prevalent user of internet and communication technology platforms and is also at risk of being cyberbullied.
The demographic information section of the survey consists of questions relating to the participant's age, gender, ethnicity, location, and social media application usage. This study employs a non-probability convenient sampling technique to select participants who have convenient accessibility to the researcher. The sample size of 100 participants was selected using G*Power software, which calculates statistical power based on various tests, power, and alpha level. The participants' inclusion criteria are they must be internet users in Malaysia, able to comprehend English, and willing to complete the survey voluntarily. The instrument consists of four sections, namely demographic information, cyberbullying victimization, online disinhibition effect, and cyberbullying perpetration.

The cyberbullying victimization section of the survey contains items from the Cyberbullying Victimization Scale (Cronbach's α=.973) is used to evaluate the online disinhibition effect, which contains 23 items and six dimensions: dissociative anonymity, invisibility, asynchronicity, solipsistic introjection, dissociative imagination, and minimization of authority. Cyberbullying Perpetration Scale (Lee, 2022), with the reliability of Cronbach α = .987 was used to assess the cyberbullying perpetration tendency.

Bootstrap analysis with 5000 samples at 95% confidence interval was conducted through PROCESS Macro Model 1 (Hayes, 2018) for SPSS to analyze the data.

RESULTS AND DISCUSSION

The results of the PROCESS Macro model 1 is depicted in Table 1 to 3 below.

Table 1: Model Summary of the Bootstrap Moderation Analysis Results

Outcome Var: CP	R	R^2	MSE	F	df1	df2
	.964	.929	59.052	1282.0511	3.000	296.000

Table 2: Contribution of the predictor and the moderator on the outcome variable.

Model	coeff	se		t	p	LLCI	ULCI
Constant	12.323	4.3994		2.801	.005	3.664	20.9806
CV	.3097	0670		4.623	.0000	.1779	.442
OD	-.097	0971	.0430	2.255	.025	-.182	-.0124
Int_1	.003	.001		5.773	.000		.0042

Int_1 = CVxOD, R^2change = .0080,

Table 3: Conditional effects of the focal predictor at values of the moderator(s)

OD	Effect	Se		t	p	LLCI	ULCI
Constant	12.323	4.3994		2.801	.005	3.664	20.9806
CV	.3097	0670		4.623	.0000	.1779	.442
OD	-.097	0971	.0430	2.255	.025	-.182	-.0124
Int_1	.003	.001		5.773	.000		.0042

Focal Predictor = CV (X; Moderator Var = OD (W)

Table 1 indicated that the overall model was significant ($F = 1282.05$, $p < .001$), where being cybervictimized (CV) explains 92.85% of the variance in the tendency of cyberbullying perpetration (CP). Furthermore, both CV ($b = 0.31$, $SE = 0.07$, $t = 4.62$, $p < .001$) and ODE ($b = -0.10$, $SE = 0.04$, $t = -2.26$, $p = .025$) had significant main effects on CP. The interaction effect of CV and ODE was also significant ($b = 0.003$, $SE = 0.0005$, $t = 5.77$, $p < .001$).

To further interpret the moderation effect, we conducted simple slope analyses at different levels of ODE. The effect of CV on CP was stronger at higher levels of ODE, with the effect increasing from 0.57 ($SE = 0.03$, $t = 21.46$, $p < .001$) at ODE = 83 to 0.76 ($SE = 0.02$, $t = 33.30$, $p < .001$) at ODE = 145. This result suggested that ODE significantly moderated the relationship between these two variables. Specifically, the effect of CV on CP was stronger at higher levels of online disinhibition, indicating that it exacerbates the impact of CV on CP.

These findings have important implications for understanding the development of cyberbullying perpetration among our population. Online disinhibition, which refers to a lack of restraint in online communication, can increase the likelihood of engaging in cyberbullying perpetration, particularly among those who have experienced cybervictimization. Therefore, interventions aimed at reducing cyberbullying perpetration should consider targeting both CV and OD, as they are both important factors in predicting cyberbullying perpetration.

Discussions

Our data analysis results supported our hypothesis that OD moderates the link between CV and CP. Our finding is in line with the Victim Precipitation Theory where the victimization experience pushed one to perpetrate the same crime that victimized them before. This motivation to perpetrate by the former victim was enough to put them as a motivated offender, which, as explained by the Routine Activities Theory, is one of the main elements for the cyberbullying to happen. Combined with the potential suitable victims, which is represented by other internet or social media users, and the absence of guardianship, which is represented

As individuals who were victimized would likely to perpetrate, and the internet has already offered the anonymity that increase the likelihood of the former victims to perpetrate, it would be challenging to stop or even to reduce the cybervictimization phenomenon among the internet users, especially the younger generations. As cybervictimization negatively predicts general mental health, it is imperative for future research to explore any possibility to cut the cycle of cybervictimization, either by protecting individuals online safety or by improving the anti-cybercrime filters and algorithms to protect every users from being victimized.

More importantly, educators, parents, and mental health professionals should educate adolescents about responsible online communication and provide them with skills and strategies to deal with cybervictimization experiences. This could help reduce the prevalence of cyberbullying perpetration and promote a safe and healthy online environment for adolescents. Overall, this study highlights the importance of understanding the complex interplay between individual and contextual factors in predicting cyberbullying perpetration.

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Workaholism and Job Satisfaction in Predicting Subjective Well-Being

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ABSTRACT

Introduction: Workaholism among the average Malaysian is not a new phenomenon. Malay Malaysians have witnessed a family member or at least a friend that have displayed this kind of trait throughout their lives. Other than affecting the lives of the people around them, many have wondered how workaholism affects the workaholic themselves, as many reporting different effects on their job satisfaction and subjective well-being. However, the exact consequences of workaholism have been heavily debated upon, some citing its benefits to their work while others citing its negative effects on personal well-being.

Objective(s): This current study aimed to determine whether workaholism and job satisfaction significantly predicts subjective well-being among working adults in Klang Valley. The submitted abstract should follow the formatting provided in this template.

Methodologies: A total of 139 respondents participated in this study. This study is a cross-section designed study. Scales used in this study were Workaholism Battery (WorkBAT), Minnesota Satisfaction Questionnaire (MSQ) Short Form, and Satisfaction with Life Scale (SWLS).

Results: Mediation analysis found that job satisfaction partially mediates the relationship between workaholism and subjective well-being.

Conclusion: Results found that despite people are workaholic, they are satisfied with their work and can still be happy. The findings of this study can be used to aid employers to better understand their employees and help to improve their overall well-being.

Keywords: workaholism; job satisfaction; subjective well-being.

INTRODUCTION

Workaholism is an attitude that has a profound effect on the individual and others close to them. It has been defined as working excessively until the exclusion of other aspects of life (Sussman, 2012). Extreme cases of workaholism causes job dissatisfaction and has been linked to emotional exhaustion (Almustafa & Ke, 2022). A recent study showed that higher amount of workload may affect concentration, have a depressed mood, and be filled with constant concern as they have doubts about taking on more work (Pace, 2019). A more recent study in Turkey on 446 high school teachers has found that workaholism had a positive and significant effect on stress and negative effect on well-being (Yilmaz, et al., 2021). Workaholism also affects people's emotions. One study investigated the relationship between workaholism and subjective well-being among Japanese employees. The study found that while workaholism was negatively associated with life satisfaction, it was positively associated with emotional well-being, indicating that workaholics may experience greater positive emotions than their non-workaholic counterparts. These studies showed that workaholics generally are unhappy people. This means that they have lower subjective well-being as subjective well-being is defined simply as happiness (Diener, et al., 2003).

Workaholism also influences people's satisfaction at work. People who are workaholic tend to report lower levels of job satisfaction (Guidetti, et al., 2019). A recent study investigated the relationship between workaholism, job demands, and job resources on job satisfaction among Japanese workers. The results showed that workaholism was negatively related to job satisfaction, indicating that individuals who were more workaholic tends to be less satisfied with their jobs (Shimazu & Schaufeli, 2021). This may be explained by the tendency of workaholics in wanting more each time which then results in being not satisfied with their jobs.

Furthermore, Demerouti, et al., (2022) found that workaholism significantly predicted lower levels of job satisfaction, even after controlling for job demands and job resources. This means that no matter what is required of the them at work and however much resources were given to them at work, workaholics will still not be satisfied with their work (Demerouti, et al., 2022). On the contradictory, a study in Korea found a positive relationship between workaholism and job satisfaction especially among workers with high job resources (Kim, et al., 2022). Workers who are workaholics tend to satisfied with their job particularly if they were placed in an environment that are functional in achieving work goals, reduce job demands, and stimulate personal growth and development (Bakker & Demerouti, 2017).

Individuals who have job satisfaction are those who are satisfied with their job and believed to be happy person (Barmby, et al., 2012). Those who are more satisfied with their job are more often happier than those who are not satisfied with their jobs (Salgado, et al., 2019). This may be because, job satisfaction may serve as a protective factor against negative emotions and therefore, promote positive emotions (Cannas, et al., 2019). Even after controlling for income, job satisfaction has been found to significantly predict happiness (Sironi, 2019). This shows that money did not matter to workers. As long as they are satisfied with their job, they tend to be feel happy.

In conclusion, recent studies suggest that workaholism has a negative effect on overall subjective well-being, but its relationship with job satisfaction is more complex. While there are studies that found that workaholism tend to significantly positively predict job satisfaction, there are also studies that shows that workaholism significantly negatively predict job satisfaction. This inconsistency will be addressed in this study where the researcher examined job satisfaction as the mediator in the relationship between workaholism and subjective well-being. Therefore, this study aimed to examine whether job satisfaction is a significant mediator in the relationship between workaholism and subjective well-being. The researchers wanted to answer the question whether job satisfaction is the significant mediator in the relationship between workaholism and subjective well-being. It was hypothesized that job satisfaction is a significant mediator in the relationship between workaholism and subjective well-being. The mediation model can be seen in Figure 1.

METHODOLOGIES

Research Design

This study of subjective well-being among working adults in Klang Valley is a cross-sectional study, studying participant's subjective well-being for a specific period of time of the questionnaire distribution. Cross-sectional studies also tie into this research design, as it is carried out to investigate the risk factors and outcomes of interest and the data are collected only once (Levin, 2006). This is also quantitative research, as the research tools involves questionnaires to collect data, and computer software to analyse the data (Babbie, 2010).

Sampling Method

The target population of this study is full-time working adults in Malaysia who are fluent in English, age range from 18-64 years old. A minimum sample of 134 participants were required as calculated by G*power (Erdfelder & Buchner, 2009). In this study, 174 participants (51 males, 122 females, and 1 unspecified) were recruited. Participants were recruited using convenience and snowball sampling.

Measures

Workaholism was measured using the Workaholism Battery (WorkBAT) developed by Spence and Robbins (1992). This instrument comprised of three self-report subscales measuring work involvement, drive and work enjoyment. It consists of 25 items in total; 8 items for work involvement, 7 items for drive, and 10 items for work enjoyment. Workers answered the item on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Each subscale in WorkBAT has good reliability scoring $\alpha = 0.63$, $\alpha = 0.82$, and $\alpha = 0.84$. As a whole, the reliability of this scale is $\alpha = .90$

Job satisfaction was measuring using the Minnesota Satisfaction Questionnaire (MSQ) Short Form, developed by Weiss, et al., (1967). This short form MSQ comprised of 3 subscales, intrinsic, extrinsic, and general satisfaction on a 5-point Likert scale ranging from very satisfied to very dissatisfied. It includes 20 items. The reliability of this scale was $\alpha = .85$.

Subjective well-being among the participants was measured with the satisfaction with life scale (SWLS), developed by Pavot and Diener, 1993. This instrument is a short 5 items instrument measured with a Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). This instrument showed good reliability, $\alpha = .90$.

Data Collection Procedures

Questionnaires were first distributed online with circulation through friends and family that fit the sampling criteria. It was then posted on online forums. We also approached companies who were interested in participating in this study. Participants then completed the questionnaire either online or through physical copies. Those who have completed the questionnaire were then asked to pass long the link or set of questionnaires to others. It took the participants approximately 20-30 minutes to complete the questionnaire.

RESULTS AND DISCUSSION

Note: * indicate p <.001

Figure 1: The mediation of job satisfaction in the relationship between workaholism and subjective well-being.

The results generated from SPSS PROCESS Macro indicated that job satisfaction partially mediates the relationship between workaholism and subjective well-being (refer to Figure 1). Job satisfaction partially mediates the relationship between workaholism and subjective well-being as both the direct (*b*= .1037, 95% BCA CI [.0334, .1741] and indirect paths are significant (*b*= .1177, 95%BCA CI [.0745, .1653].

Based on the findings presented in this study, it can be concluded that job satisfaction plays a significant role in mediating the relationship between workaholism and subjective wellbeing. The results revealed that workaholism is positively associated with subjective well-being, but this relationship was partially mediated by job satisfaction.

This finding is not consistent with previous research which found that workaholism was negatively associated with subjective well-being (Yilmaz, et al., 2021). This may be because, this study was conducted in an Asian setting where workaholism may be viewed differently in other settings. Workaholism is often characterized by excessive working to the point of exclusion of other aspects of life (Sussman, 2012). This however, may be a positive trait as one may be viewed as hardworking by the community. Future research are needed to further explain the factors of workaholism so that we can better understand workaholism in Asian context.

Another result of this study, where workaholism was significantly positively associated with job satisfaction, supported the findings from a study in Korea (Kim, et al., 2019). Workers in this study's context may, similarly as the study in Korea, have high job resources. As this study did not examine job resources received by the workers, future research could examine whether job resources or other variables could be a factor that associated positively with job satisfaction in workaholics.

Similar to past studies such as Salgado et al., (2019) and Sironi (2019), job satisfaction was found to be positively associated with subjective well-being. Those who are satisfied with their job tends to be happy with their life. This happened may be because, those who are satisfied with their jobs have felt sense of purpose and achievement (Cannas et al., 2019). They may feel that they are contributing to something meaningful and important.

Finally, job satisfaction was found to be significantly mediating the relationship between workaholism and subjective well-being but only partially. The prevalence of subjective well-being that might be explain by other variables than workaholism and job satisfaction. Further study is needed to further explain this relationship by including other possible variables that could affect this relationship.

CONCLUSION

In conclusion, this study has provided evidence that job satisfaction is important in ensuring those who are workaholics to be happy in their lives. The result also suggested that people who are workaholics may feel satisfied at work and therefore, feels happy with their lives. These findings have important practical implications for organisations, as they highlight the importance of promoting a productive work environment and ensuring that workers are satisfied with their jobs. By doing so, employers may be able to improve the well-being of their employees, which can lead to higher productivity and overall organisational success. However, it is important to note that workaholism is a complex phenomenon and additional research is needed to fully understand its effects on individual well-being.

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The Effects of Nanotechnology AI on Future Living Standard: PLS-SEM Algorithm Analysis

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ABSTRACT

Introduction: Nanotechnology AI is a field of science and technology that involves the manipulation of matter on an incredibly small scale, typically in the range of one to 100 nanometers. The unique properties of matter at the nanoscale allow for the development of new materials and devices with unprecedented properties, such as increased strength, flexibility, and conductivity.

Objective(s): We want to investigate the causal relationship and effect between nanotechnology AI on enhancing living standard.

Methodologies: Partial Least Squares Structural Equation Modeling (PLS SEM) algorithm analysis is used to analyze the relationships between different variables related to the effect of nanotechnology AI on enhancing living standard.

Keywords: Nanotechnology AI; Artificial Intelligent (AI); Nanotechnology AI Development; PLS-SEM; Living Standard

INTRODUCTION

A model of Nanotechnology AI offers the potential for new and faster kinds of computers, more efficient power sources and life-saving medical treatments. Its potential disadvantages include economic disruption and possible threats to security, privacy, health and the environment. Artificial Intelligence (AI) drives down the time taken to perform a task. It enables multi-tasking and eases the workload for existing resources. AI enables the execution of hitherto complex tasks without significant cost outlays (Arora et al., 2013).

There are many variables related to nanotechnology AI, which including:

i) *Nanomaterials*: The type and properties of the nanomaterials being used, such as their size, shape, composition, and surface chemistry, can significantly affect their behavior and performance.

ii) *Manufacturing*: The methods and processes used to manufacture nanomaterials and nanodevices can affect their quality, consistency, and cost. Advances in nanomanufacturing techniques, such as 3D printing and self-assembly, are also enabling the creation of more complex and precise nanostructures.

iii) *Health and safety*: The potential risks associated with exposure to nanomaterials, both for workers involved in manufacturing and for consumers using products that contain nanomaterials, are a significant concern. Research is ongoing to understand the potential health and safety risks of nanomaterials and to develop safe handling and disposal practices.

iv) *Regulation*: The regulation of nanotechnology AI products and applications is complex and varies by country and region. Regulatory agencies are working to develop standards and guidelines for the safe development and use of nanotechnology AI products.

v) *Commercialization*: The commercialization of nanotechnology AI products and applications requires significant investment and involves multiple stakeholders, including investors, researchers, manufacturers, regulators, and consumers.

vi) *Intellectual Property*: The protection and enforcement of intellectual property related to nanotechnology AI is an important factor in promoting innovation and investment in the field.

vii) *Societal and ethical issues*: Nanotechnology AI raises ethical and societal issues related to the potential impact of nanotechnology AI on society, including issues related to privacy, equity, and the potential for unintended consequences. These issues need to be considered and addressed as nanotechnology AI continues to develop and commercialize (Fisher et al., 2010).

Overall, there are many variables related to nanotechnology AI that need to be considered and addressed in order to ensure safe and responsible development, and commercialization of nanotechnology AI products and applications towards living standard.

METHODOLOGIES

PLS SEM is used to analyze the causal-effect relationships between different variables related to nanotechnology AI and living standard. We would first need to identify the 7 indicator variables of interest and their relationships with nanotechnology AI. We have investigated the effect of 4 variable indicators related to living standard.

Next, we would collect data on these variables, through surveys, using questionnaire methods, and input the data into the PLS SEM software. The software would then perform a statistical analysis to determine the strength and direction of the relationships between the variables. PLS SEM can also be used to test hypotheses about the relationships between variables, and to identify any mediating or moderating effects that may be present.

Overall, PLS SEM can provide valuable insights into the complex relationships between variables related to nanotechnology AI, helping researchers and practitioners to make more informed decisions about the development and commercialization of nanotechnology AI products.

Seven independent variables (IV) are; Nanomaterials, Manufacturing, Health and Safety, Regulation, Commercialization, Intellectual Property, Societal and Ethical Issues. The analysis of multiple regression is tested again dependent variable (DV) Nanotechnology AI. IV represents an emergent construct that is formed from a set of indicators that have theoretical rationale. Living standard next latent variable has four (4) indicators namely; Environment Remediation, Healthcare, Energy and Electronics.

Formative relationship direction of causality is from indicators to the latent variable. No reason to expect the indicators are correlated indicators and are not interchangeable. Thus, investment in nanotechnology AI construct factors is venture capital, corporate R&D, government funding, public markets and research institutions. Development in nanotechnology construct factors are nanomaterials for energy conversion, nanomedicine, nanoelectronics, nanofabrication, and nano-sensors. Commercialization of nanotechnology products construct factors are electronics, energy, healthcare, food, textiles and cosmetics.

Hence, this research is conducted to investigate the effect of nanotechnology AI towards living standard of artificial intelligent users. The research objective is to study the effect of nanotechnology AI on enhancing living standard. Research question is to ask what is the effect of nanotechnology AI on enhancing living standard. Null hypothesis (H_0): There is no effect of nanotechnology AI on enhancing living standard. Alternative hypothesis (H_1): There is a significant causal-effect of nanotechnology AI on enhancing living standard.

RESULTS AND DISCUSSION

In Figure 1, there are two indicator items with loading < 0.70 are removed. Nanotechnology AI item 2, with loading 0.355 and livingstd3 with loading 0.359. After these modifications, the PLS-SEM model has 9 indicating items. Nanotechnology AI is a factor of higher living standard for us. 86.3% (R^2 = 0.863) of variance of higher living standard is caused by nanotechnology AI. The positive path coefficient (beta) 0.929 indicates that increasing in 1unit Standard Division of Nanotechnology AI will cause 0.929 unit of Standard Division of living standard increased. Hence, we concluded that implementation of nanotechnology AI in industrial, medicine and education has positive effect towards our living standard.

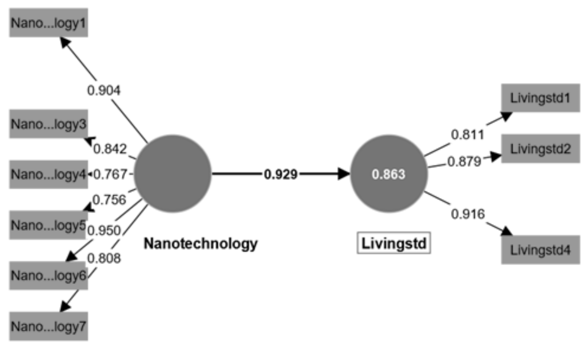

Figure 1: Nanotechnology AI and Living Standard PLSc Algorithm Analysis Result

Investment in nanotechnology AI has been growing rapidly over the past decade, as investors and governments recognize the potential for innovation and economic growth in this field. Here are some examples of investment in nanotechnology AI:

1. Venture capital: Venture capital firms are investing in start-ups and early-stage companies that are developing new nanotechnology AI products and applications. According to a report by Lux Research (Lux is a research and advisory firm, focused on sustainable innovation that is commercially viable. Across all industries, an ever-increasing focus on sustainability is a major driver of change in business as we all strive to meet corporate sustainability goals, government regulations, and consumer expectations.), venture capital funding for nanotechnology AI start-ups reached $1.6 billion in 2019.

2. Corporate R&D: Many large corporations are investing in nanotechnology AI research and development, both to develop new products and to improve existing ones. For example, IBM is investing in nanoelectronics research, while Samsung is developing nanomaterials for use in electronic devices.

3. Government funding: Governments around the world are investing in nanotechnology AI research and development, both through direct funding and through programs that encourage collaboration between academia, industry, and government. In the US, the National Nanotechnology Initiative (NNI) coordinates funding and research efforts across multiple federal agencies.

4. Public markets: Some nanotechnology AI companies have gone public, allowing investors to buy shares in companies that are developing nanotechnology AI products and applications. Examples include Nanometrics, Nanosys, and Nanostart.

5. Research institutions: Universities and research institutions are also investing in nanotechnology AI research, both through funding and through the establishment of dedicated research centres and institutes. (Paunovska, et al. 2019).

CONCLUSION

In the future, nanotechnology AI could also enable objects to harvest energy from their environment. New nano-materials and concepts are currently being developed that show potential for producing energy from movement, light, variations in temperature, glucose and other sources with high conversion efficiency. However, there are also potential risks associated with the use of nanotechnology AI, such as the potential for toxicity and environmental impacts, which need to be carefully evaluated and addressed through regulation and research. Overall, the effects of nanotechnology AI are expected to be significant and wide-ranging, and careful consideration is needed to ensure that the benefits of nanotechnology AI are maximized while minimizing any potential risks.

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