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Digital Competency Among Technical & Vocational Education Undergraduate Students

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Abstract

The rapid development of digital technology has driven the need for digitalization across various sectors, including education. In Malaysia, digital competence has become a vital attribute for graduates to meet the demands of the Fourth Industrial Revolution. In response, the Ministry of Higher Education Malaysia has implemented initiatives to equip graduates with relevant digital skills. This study aims to assess the level of digital competence among undergraduate students at the Faculty of Technical and Vocational Education (FPTV), Universiti Tun Hussein Onn Malaysia (UTHM), and to examine differences based on gender and programme of study. A quantitative survey was conducted with 344 students, and data were analysed using descriptive statistics via SPSS. The findings indicate that most students demonstrate an advanced level of digital competence. The study provides insights that can help students and the faculty strengthen digital skills to enhance graduate employability.

1. Introduction

The rapid advancement of digital technologies—including artificial intelligence, automation, and cloud-based learning—has significantly transformed Malaysia's education landscape and workforce demands. In alignment with national agendas such as the Industry4WRD National Policy (Ministry of International Trade and Industry [MITI], 2018) and the Digital Education Policy 2021–2025 (Ministry of Education Malaysia [MOE], 2021), higher education institutions are under increasing pressure to cultivate students' digital competence for the Fourth Industrial Revolution (IR4.0).

Digital competence, defined as the ability to use digital technologies critically, safely, and creatively (European Commission, 2022), has become an essential graduate attribute that enhances adaptability, problem-solving, and employability (Ahmad et al., 2023). Recent Malaysian studies have found that students with stronger digital skills, including collaboration and content creation, tend to achieve higher academic performance and are better prepared for remote or hybrid working environments (Abdullah et al., 2023; Chong & Mohamad, 2022).

However, despite nationwide progress, gaps remain. The COVID-19 pandemic revealed a persistent three-level digital divide related to access, skills, and effective use of digital tools, disproportionately affecting rural and underprivileged students (Ibrahim et al., 2023). Moreover, disparities in digital readiness among educators continue to challenge the integration of digital tools into teaching and learning (Rahman et al., 2023).

Recognizing these issues, Malaysia's newly established Ministry of Digital (2023) is expanding infrastructure and promoting digital inclusivity through strategic funding and training initiatives (Ministry of Digital Malaysia, 2023). Within this context, universities play a pivotal role in equipping graduates with relevant digital competencies.

Therefore, this study aims to assess the level of digital competence among undergraduate students at the Faculty of Technical and Vocational Education (FPTV), Universiti Tun Hussein Onn Malaysia (UTHM), and to examine variations based on gender and programme of study. The findings will help inform targeted interventions to strengthen students' digital capabilities and ensure they remain competitive in an increasingly digital job market.

2. Background of Study

Despite various national initiatives, Malaysia continues to face significant digital skill gaps compared to its regional peers. According to the Coursera Global Skills Report 2023, Malaysia ranks behind Vietnam and Singapore in overall digital readiness, highlighting persistent challenges in digital literacy, data analysis, and technological agility (Coursera, 2023). Similarly, a recent Workday survey reported that nearly 80% of Malaysian organisations struggle to keep pace with the rapid evolution of digital technologies and to equip employees with necessary digital competencies (Workday, 2023).

In the education sector, studies have shown that while Malaysian universities increasingly integrate digital tools, disparities in students' digital competence remain, especially among those in rural and technical education settings (Jamaludin et al., 2025; Azizan et al., 2025). Previous research has predominantly focused on general ICT literacy or e-learning readiness but provides limited empirical data on the specific digital competencies of undergraduate students in technical and vocational education programmes, which are critical pipelines for Malaysia's skilled workforce.

This gap in understanding poses a challenge for policymakers and educators striving to align curricula with the demands of the Fourth Industrial Revolution (IR4.0) and Malaysia's Digital Economy Blueprint 2030 (Ministry of Digital Malaysia, 2023). Without targeted data, it is difficult to design effective interventions that enhance graduates' readiness for a digital-driven labour market.

Therefore, this study aims to address this gap by assessing the level of digital competence among undergraduate students at the Faculty of Technical and Vocational Education (FPTV), Universiti Tun Hussein Onn Malaysia (UTHM). It will also examine differences based on gender and programme of study. Findings from this research will inform curriculum development, student support initiatives, and national strategies to strengthen Malaysia's digital talent pool and workforce competitiveness.

3. Conceptual Framework

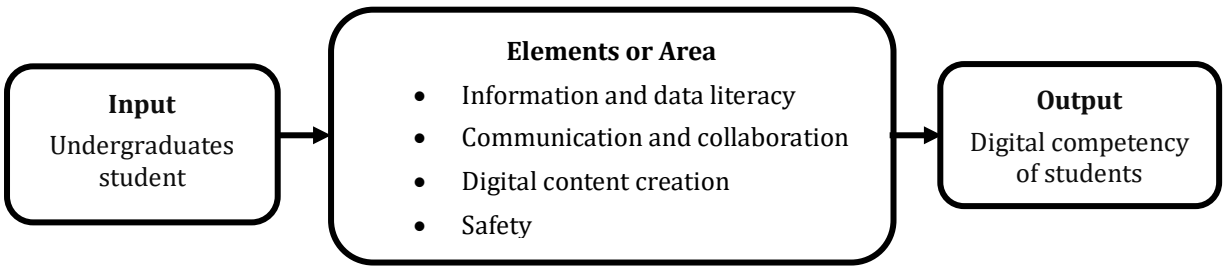

Fig. 1 *Conceptual framework for digital competency*

This study's conceptual framework is based on the European Commission's *DigComp 2.2* model (European Commission, 2022) and focuses on assessing the digital competence of undergraduate students in the Faculty of Technical and Vocational Education (FPTV) at Universiti Tun Hussein Onn Malaysia (UTHM). The input of the framework comprises the students' existing knowledge, exposure, and prior experiences with digital technology, which form the basis for evaluating their digital skills. The framework includes five key elements: information and data literacy, communication and collaboration, digital content creation, safety, and problem solving. Information and data literacy refers to students' ability to locate, evaluate, and manage digital information effectively and responsibly. Communication and collaboration involve using digital tools to share information and work interactively with peers and educators. Digital content creation highlights students' capacity to produce, edit, and disseminate digital materials ethically and responsibly. Safety encompasses awareness and practices to protect digital identity, privacy, and cybersecurity. Lastly, problem solving relates to the strategic use of digital tools to identify, analyse, and address various challenges. The output of this framework is the overall level of digital

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competence demonstrated by FPTV undergraduates, categorised as basic, intermediate, or advanced, reflecting how well they apply their digital skills in academic tasks, collaborative projects, and problem-solving situations relevant to the demands of a technology-driven workforce.

4. Methodology

This study employed a quantitative survey approach to measure the level of digital competence among undergraduate students at the Faculty of Technical and Vocational Education (FPTV), Universiti Tun Hussein Onn Malaysia (UTHM). A quantitative survey was chosen over qualitative or mixed methods because it allowed data to be collected efficiently from a large sample within a limited timeframe and budget. This approach also facilitated the use of structured, standardised questions, making it possible to conduct descriptive analyses and compare digital competence levels across demographic groups.

The questionnaire used in this study was adapted from the European Commission's DigComp 2.2 Framework (European Commission, 2022) and was divided into six sections: Section A captured demographic information (e.g., gender, programme enrolled), while Sections B through F focused on five key elements of digital competence: information and data literacy, communication and collaboration, digital content creation, safety, and problem solving. Each element included multiple items, such as "I can judge the reliability of online information sources" or "I use digital tools to work collaboratively on shared documents." Responses were recorded on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

For the pilot study, 30 undergraduate students from FPTV were selected using purposive sampling to ensure they represented different programmes and year levels. Feedback from the pilot group confirmed that the wording of the items was clear and that the instrument had high reliability, with Cronbach's alpha values ranging from 0.871 to 0.947. Since the pilot results indicated satisfactory reliability and no significant issues, no modifications were required before proceeding to the main data collection.

For the main study, all active undergraduate students enrolled in the FPTV were invited to participate through email invitations and class announcements. The survey was administered online using Google Forms, which allowed respondents to complete it at their convenience. Participation was voluntary, and respondents were informed that their responses would be anonymous and used solely for research purposes. No personally identifiable information was collected, and consent was implied upon submission of the completed questionnaire. Table 1 presents a summary of the reliability coefficients for each section of the questionnaire.

Table 1 *Item reliability values*

Section	Elements	Total items	Reliability value	Accepted / rejected
A	Demographics	6	-	-
B	Information and data literacy	12	0.871	Accepted
C	Communication and collaboration	22	0.924	Accepted
D	Digital content creation	16	0.919	Accepted
E	Safety	17	0.947	Accepted
F	Problem solving	12	0.930	Accepted

Researchers has used a Google Form link to be distributed to all undergraduate students. The data obtained was analyzed using descriptive statistical methods such as frequency and percentage.

5. Finding and Discussion

5.1 Respondent Demographics

Analysis showed that 344 respondents involved in this study consisted of 191 male and 153 female students. Through the statistics that have been recorded, analysis has also been conducted to determine the number and percentage of respondents according to the two main programs at FPTV, namely Ijazah Sarjana Muda Pendidikan Vokasional (ISMPV) and Bachelor Technology (Btech) a total of it was found that the ISMPV field had 167 respondents, constituting 48.5%, while the Btech field had 177 respondents, constituting 51.5%.

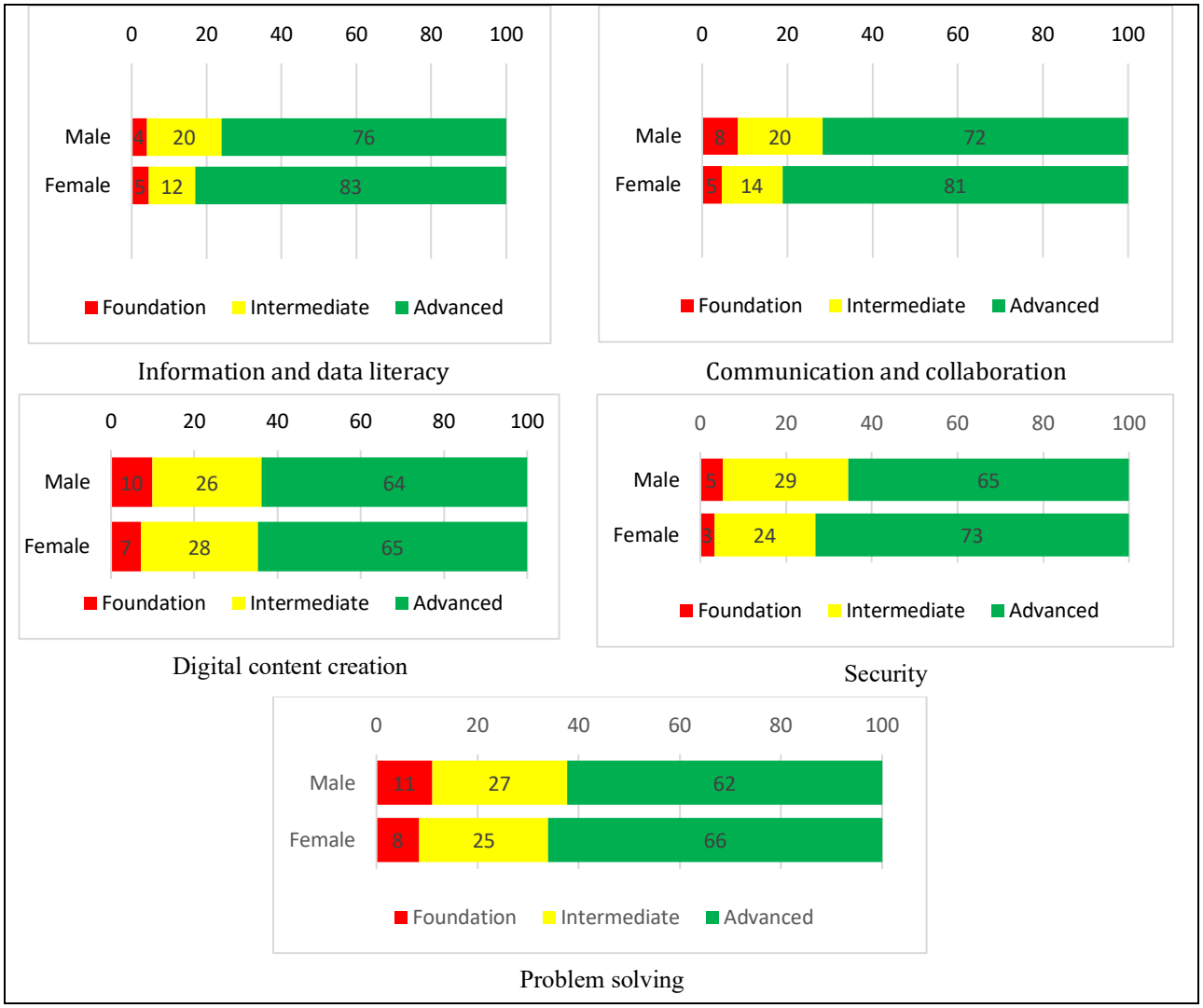

Fig. 2 *Digital competency of students based on gender*

From the obtained data, it can be observed that the majority of students do not face issues with elements such as information and data literacy, communication, and collaboration, as students at the proficient level exceed 70%. However, for other elements, the findings indicate that the proficiency level still exceeds 50%. Nevertheless, improvement is still needed and can be enhanced in the future. This is because, upon detailed examination of digital competencies based on gender, it was found that females outnumber males at the proficient level.

Digital competency based on gender has been studied in several research papers. One study found a relative balance between males and females in technical and information digital skills, with a slight advantage for females. However, males possess more critical knowledge than females (Estanyol et al., 2023). Another study focused on prospective teachers and found statistically significant differences in digital competencies based on gender, with females having lower competencies than males (Rodríguez-García et al., 2022). In a study conducted among hospitality graduates in India, no gender differences were found in most aspects of digital competencies, except for problem-solving skills, where males demonstrated higher competency levels (Prabhu & Malyya, 2022). Similarly, another study found that females have a common perception of their digital competencies compared to males, indicating a lower perception of competence (Huillca-Huillca et al., 2022).

For the safety element, the study findings indicate that most items in the safety aspect show a moderate level. In a study by Berry (2023), only 17% of the study population stated that they were very sensitive to cybersecurity or information security; the same percentage as students who were not aware of information security, while the rest fell between these two extremes. During discussions with students, they trusted the platforms they used and were not aware of risks associated with online activities. In another study by Abdullahi Gabra, Sirat, Othman, & Dauda, (2020), the research findings indicated low awareness of cybersecurity among the studied students in general. Most students did not understand commonly used cybersecurity terms and did not show sufficient awareness of common threats such as phishing.

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As for the problem-solving element, it also shows issues among FPTV undergraduate students. This finding aligns with other studies conducted on students in Myanmar by Thida & ThaZin (2023), where the research findings indicated similar proficiency levels in various elements, i.e., moderate levels for information and data literacy, security knowledge, and problem-solving. Continuous research and collaboration are crucial in fostering a more inclusive and digitally empowered society. Therefore, the obtained results, which may differ from other studies, might be influenced by the unequal distribution of respondents based on gender.

5.2 Digital Competency of Students According to Programs

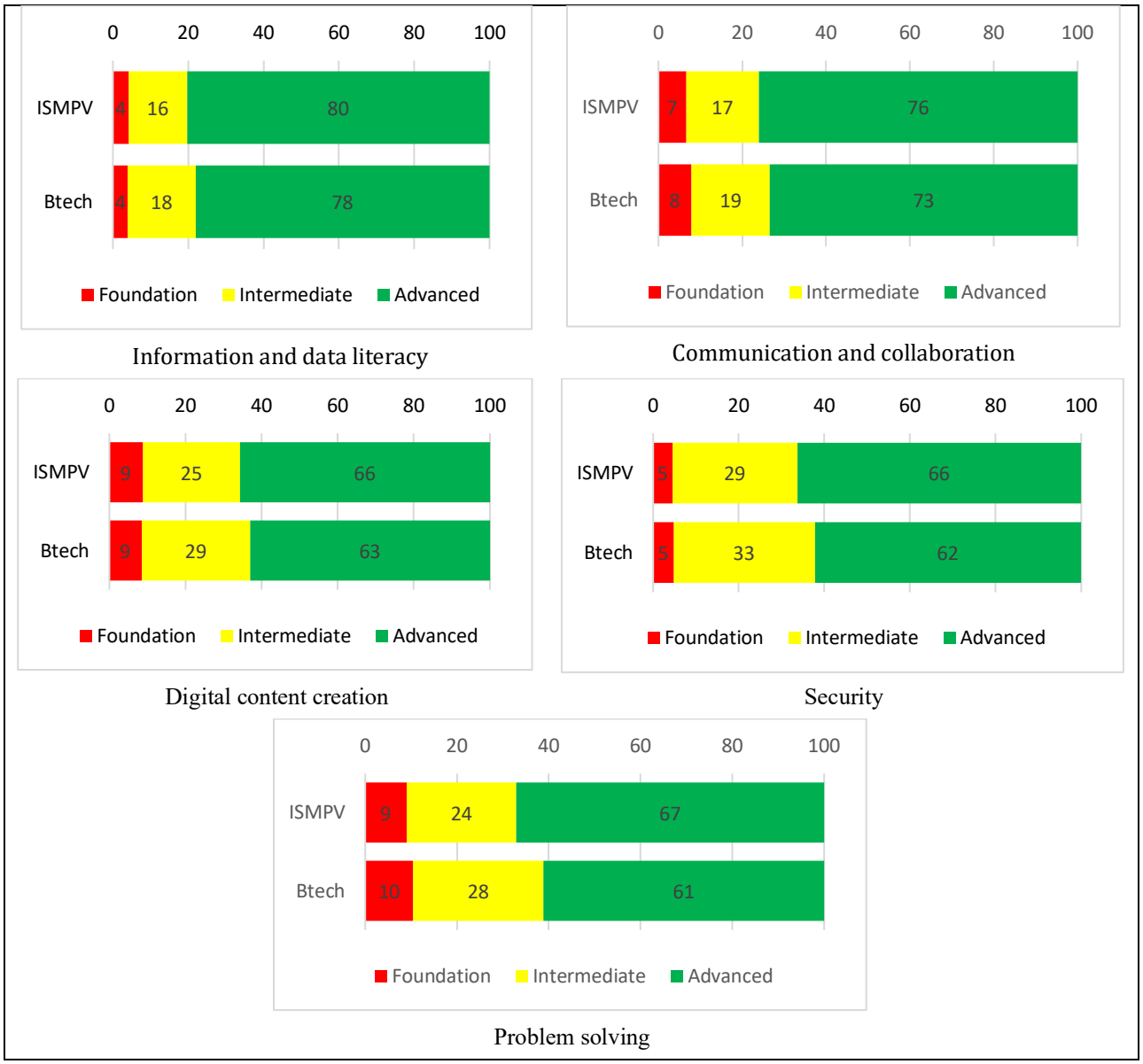

Fig. 3 *Digital competency of students according to program*

The results showed that the overall digital competence of FPTV undergraduate students across both programs exceeded 60%, indicating that most students demonstrated an advanced level of digital skills. This high level of competence can be attributed to the integration of technology-related courses, such as educational technology and digital literacy modules embedded within TVET curricula (Azizan et al., 2025). Additionally, consistent with findings from Jamaludin et al. (2025), students reported frequent use of digital tools in their daily routines, including searching for information, completing assignments, and communicating with peers and instructors. These practices further enhance their familiarity and confidence in using digital technologies (Rahman et al., 2023). Based on these findings, it can be concluded that the digital competence of FPTV undergraduate students

is generally at an advanced level across the programs offered, aligning with Malaysia's broader goal to strengthen graduate digital readiness for IR4.0 and the national digital economy (Ministry of Digital Malaysia, 2023).

However, some other studies show differences in terms of fields studied regarding the level of digital competence. A study by Sarva et al. (2023) found that students in the education fields are less proficient in digital skills compared to students in engineering, management, and science fields. Furthermore, other studies also found significant differences in attitudes toward digital technology among students and graduates compared to university staff and instructors (Kaur & Sharma, 2022). In addition, the level of digital competence of higher education educators varies by field of study and age group (Guillén-Gámez & Mayorga-Fernández, 2020). These findings indicate that the level of digital competence is influenced by the field or program of study and the educational level.

In summary, although the study findings show different results from other research, these findings are complex and influenced by various factors leading to diverse outcomes.

6. Conclusion

Based on the findings, this study successfully achieved its objectives of assessing the level of digital competence among FPTV undergraduate students and examining differences by gender and programme. The results indicated that students from both the ISMPV and BTech programmes generally demonstrated an advanced level of digital competence, with the proportion of students at this level surpassing those at intermediate or basic levels. This reflects positively on the integration of technology-related subjects and students' routine use of digital tools for academic and personal tasks (Azizan et al., 2025; Jamaludin et al., 2025).

A closer examination revealed slight gender differences in certain areas of digital competence. Male students tended to show higher proficiency in problem solving and technical tasks, while female students scored slightly higher in communication and digital content creation, consistent with prior findings (Estanyol et al., 2023). These patterns suggest that tailored interventions might be beneficial: for example, practical workshops could help strengthen problem-solving skills among female students, while initiatives focusing on advanced collaboration and content production could further engage male students. Understanding these nuances is essential for designing inclusive digital literacy programmes that bridge any subtle gender gaps and maximise overall competence.

The results also highlight the need for continuous curriculum innovation and targeted support to address areas where students still face challenges, such as online safety and advanced troubleshooting. Addressing these aspects will not only improve students' academic performance but also better prepare them for dynamic, technology-driven work environments (Rahman et al., 2023).

Given that this study focused on a single faculty within one Malaysian public university, future research could expand the scope to include comparative analyses across faculties, institutions, or even different regions to explore variations in digital competence and gender patterns more broadly. Longitudinal studies could also investigate how digital competence develops over time and how specific interventions influence gender-based outcomes.

In summary, the findings contribute valuable evidence for educators and policymakers to strengthen digital literacy initiatives and create targeted programmes that support all students equitably, thereby enhancing Malaysia's capacity to build a digitally resilient workforce aligned with national digital transformation goals (Ministry of Digital Malaysia, 2023).

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

The authors confirm contribution to the paper as follows: ***study conception and design:*** *Mohammad Hadin, Badaruddin.;* ***data collection:*** *Mohammad Hadin;* ***analysis and interpretation of results:*** *Mohammad Hadin, Badaruddin;* ***draft manuscript preparation:*** *Mohammad Hadin, Badaruddin, Norlida; All authors reviewed the results and approved the final version of the manuscript.*

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