

## ORIGINAL ARTICLE

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# Tablet splitting practice among patients in Kemaman, Terengganu: An exploratory study on practical issues and their association with medication adherence.

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## ABSTRACT

**Introduction:** The practice of tablet cutting is influenced by tablet shape and size, splitting technique, device used and human competency. Difficulties upon tablet cutting could affect patients' medication adherence, resulting in overdose or under-dose therapy. This study aimed to; 1) evaluate patients' practice in tablet cutting, 2) identify problems associated with tablet cutting, and 3) assess the association between tablet cutting related difficulties with medications adherence.

**Method:** A cross-sectional survey was conducted among patients and caregivers aged over 18 years old, with prescription written at least one medication required to be split. Data were obtained from eight health clinics across the Kemaman district from July to September 2020. Trained pharmacists conducted face-to-face structured interviews. This study used a validated questionnaire consisting of three sections: the sociodemographic, practice of tablet cutting and medication adherence. Descriptive and non-parametric tests (SPSSv.26) were used for analysis with  $p < 0.05$  set as statistically significant.

**Results:** The study recorded 383 returned questionnaires with a response rate of 95.8%. The most common technique used was kitchen knife (40.5%) followed by hand breaking (35.8%), scissors (12.8%) and tablet cutter (7.3%). 64.2% perceived they achieved an equal half split after cutting their medications. 25.3% claimed medication to be ruined or broken after splitting. 12.8% took the whole tablet instead of following the required dose because of splitting difficulty and 25.1% discarded parts of their tablets when splitting did not result in equal half based on their perspective. There was no association between practical problems of tablet cutting with medication adherence.

**Conclusion:** In conclusion, knife is the most favourable tablet splitting technique but there is no consensus on the best technique for tablet splitting. In order to overcome problems encounter by patient on tablet splitting, healthcare providers should make every effort to use commercially available oral tablet if available. However, if tablet splitting is still necessary, counselling by pharmacist is compulsory to ensure quality of medication and to optimize patient's adherence as well as medication therapy.

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## Introduction

Tablet-cutting is an act of splitting a whole tablet into half or quarter, which is a common medical practice in clinical settings. Almost 25% of all drugs administered in primary care have their dose altered through cutting medications practice (Chaudhri *et al.*, 2019). The goals of tablet cutting are to ease administration to those having difficulty in swallowing the whole tablet (Marquis *et al.*, 2013), decrease drug-related costs (Mosen & Merwe, 2009) and deliver the desired dose, which is often less than the available manufactured strength (Arnet & Hersberger, 2010).

Most health care settings allow tablet cutting when the expected dosage strength is not commercially available for those admitted to the hospital or treated in primary health clinics (Grissinger, 2010). Many tools are used to cut medications, potentially producing varied dose weight or uniformity. The accuracy of tablet cutting may be affected by tablet shape, size, technique, or device used (Verrue *et al.*, 2010). However, certain medications such as sustained-release preparations and enteric-coated tablets are not expected to be associated with dose alterations in clinical efficacy as these formulation are not meant to be cut (Wright, 2002).

Prior literature showed no identified standards to determine content uniformity of tablet fragments after they have been halved (Freeman *et al.*, 2012). Product information available on drug package leaflets only include information on the suitability of the specific tablet to be cut. (Bosworth *et al.*, 2017). Moreover, hospitals often have their own drug formularies and accompanying drug information, often in conflict, leading to confusion (Chaudhri *et al.*, 2019). Patients' confusion about the correct dose was the leading type of error contributing to a significant prevalence of medication errors in Malaysia (Samsiah *et al.*, 2016). Cutting medications was the additional task to the regimen complexity that will increase the risk of medication errors and adverse drug reactions (Denneboom *et al.*, 2005). High prevalence of medication errors in Malaysia justified the need for a more effective interventional approach (Akram *et al.*, 2018). Therefore, it is timely to review current interventions and routine clinical practices such as High Alert Medications and tablet cutting practice.

Thus, our study aimed to evaluate patients' practice in tablet cutting, identify problems associated with tablet cutting, and assess the association between tablet cutting related difficulties with medications adherence.

## Methodology

### *Study design*

A cross-sectional investigation was conducted among conveniently selected participants from several Kemaman

District Health Clinics: Kerteh, Kemasik, Kijal, Seri Bandi, Batu 2.5, Air Putih, Cheneh and Kuala Kemaman from July to September 2020.

### *Study population*

Four hundred surveys were performed on follow-up patients' ages above 18 years old with at least one medication that needed to be cut. The questionnaires were distributed in outpatient pharmacy, Government Health Clinics of Kemaman District. Patients with cognitive problem, newly started on medication requiring tablet splitting, caregivers not involved with medication administration, and those who did not agree to participate were excluded. Six trained pharmacists conducted face-to-face structured interviews using the validated questionnaire.

### *Sample size*

The calculated sample size using Raosoft Calculator was 377 with a margin of error of 5%, confidence interval of 95%, response rate of 50%, and maximum population size of 20,000. The calculated sample size which is 377 was then rounded up to 400 in order to minimize the dropout rate. Dropout included incomplete returned questionnaire.

### *Study instruments*

The questionnaire consisted of three sections. The first part covered patients' sociodemographic data (7 items). This included patients' living situation whether patients' lived alone, with family or friends or in a foster care. Foster care means patients have been placed into a group home or private home. Then, patients' household income were categorized to B40 (monthly income below RM4849), M40 (monthly income from RM4850 to RM10,959) and T20 (monthly income more than RM10,960) based on the Household income and basic amenities Survey Report 2019, Department of Statistics Malaysia. The following part is close ended questions consisted of the patient's tablet cutting practice and problems associated with tablet cutting (10 items). Finally, the third part (12 items) inquired patient's medication adherence concerning tablet cutting using 4 point Likert scale.

The second part of the questionnaire, particularly for tablet cutting practice and their associated problems, was adapted from a previous study done by Gharaibeh *et al.* (2018). Forward and backward translation was done to suit the native population's language. Translation procedure of the questionnaire was forward translated into Malay with the help of one bilingual expert who is a senior lecturer in University Malaya. Subsequently, the instrument was back translated into English by one additional bilingual expert who works as a senior lecturer in Universiti Teknologi Mara (UiTM). The language experts compared the original English instrument with the back-translated English instrument and edited to obtain the matched Malay version. Following minor adjustments, a final English version was

used to re-evaluate the Malay versions. This section consists of 10 close ended questions.

The validation process was facilitated by Family Medicine Specialists and Senior Pharmacists of the Kemaman district. Each reviewer received an evaluation kit comprising a cover letter, demographic information sheet, and translated instruments prior to review. Experts reviewed the draft of the ten items to ensure its consistency with the conceptual framework. The four dimensions were (a) item consistency to the content area, (b) item wording clarity, (c) perceived item difficulty, and (d) whether (and why) they thought the item should be included in a revised version of the test.

Face validity determined the instrument's appropriateness to evaluate the construct of interest. Face validity did not refer to whether the instrument measured what it measured. Instead, it assessed whether it was superficially valid to the examinees. In this study, face validity was completed via a standardized form to evaluate the Malay version of the tablet cutting practice and their associated problems questionnaire. Ten adult patients were conveniently selected from Klinik Kesihatan Kerteh and completed the face validity form. They evaluated the overall features of the instrument and whether sentences were clear, concise, easy to understand, and free from typographical errors. After further discussion, the final Malay versions of the translated ten items were ready to be used in the study.

For patient medication adherence, 12 items validated questionnaire, Malaysian Medication Adherence Assessment Tool (MyMAAT), was used. This questionnaire is in dual language, Malay and English; no translation was done. Scoring less than 54, indicate moderate and poor adherence while scoring more or equal than 54 indicate good adherence.

### *Ethical approval*

The study was done with the approval from Medical Research & Ethics Committee (MREC), Ministry of Malaysia (NMRR No: NMRR-20-251-52820).

### *Data collection procedure*

Participants that meet the inclusion and exclusion criteria were approached while waiting for their prescription to be filled in the pharmacy. A set of questionnaires was given to the agreed participants, and then collected after dispensing process for data analysis.

### *Data analysis*

Statistical analysis was done using SPSS version 26.0 (IBM SPSS Statistics for Windows, Armonk, New York, USA). Data were analyzed using descriptive and non-parametric tests (Mann Whitney and Kruskal-Wallis test). A p-value less than 0.05 was set as statistically significant.

## Results

A total of 383 completed questionnaires were received with a response rate of 95.8%. Sociodemographic characteristics were summarized in Table 1.

Table 1: Sociodemographic characteristics of participants (n=383).

| Demographic              |                             | n (%)      |
|--------------------------|-----------------------------|------------|
| Age                      | 18-60 years                 | 206 (53.8) |
|                          | More than 60 years          | 177 (46.2) |
| Gender                   | Male                        | 191 (49.9) |
|                          | Female                      | 192 (50.1) |
| Marital status           | Married                     | 359 (93.7) |
|                          | Divorced/Widowed            | 17 (4.4)   |
|                          | Single                      | 7 (1.8)    |
| Living situation         | Live alone                  | 13 (3.4)   |
|                          | Live with family or friends | 367 (95.8) |
|                          | Foster care or group home   | 3 (0.8)    |
| Education                | Primary school              | 111 (29.0) |
|                          | Secondary school            | 210 (54.8) |
|                          | Tertiary education          | 47 (12.3)  |
|                          | No education                | 15 (3.9)   |
| Employment status        | Employed                    | 95 (24.8)  |
|                          | Self-employed               | 49 (12.8)  |
|                          | Unemployed                  | 183 (47.8) |
|                          | Retired                     | 56 (14.6)  |
| Household monthly income | B40                         | 344 (89.8) |
|                          | M40                         | 36 (9.4)   |
|                          | T20                         | 3 (0.8)    |

The most common medication taken by participants that need to be split are Simvastatin 40mg (60.8%) followed by Acetylsalicylic Acid 300mg (20.6%) and Perindopril 4mg (10.7%). Refer Table 2.

Table 2: Most common medication that need to be split (n=383).

| Active ingredient           | Strength | Brand name               | Scored | n (%)      |
|-----------------------------|----------|--------------------------|--------|------------|
| <b>Allopurinol</b>          | 300 mg   | Pharmaniaga Allopurinol® | Yes    | 18 (4.7)   |
| <b>Acetylsalicylic Acid</b> | 300 mg   | Millispirin®             | Yes    | 79 (20.6)  |
| <b>Atenolol</b>             | 100 mg   | Pharmaniaga Atenolol®    | Yes    | 30 (7.8)   |
| <b>Bisoprolol</b>           | 2.5 mg   | Bisocor®                 | Yes    | 13 (3.4)   |
| <b>Frusemide</b>            | 40 mg    | Pharmaniaga Frusemide®   | Yes    | 11 (2.9)   |
| <b>Gliclazide</b>           | 80 mg    | Diamitex®                | Yes    | 16 (4.2)   |
| <b>Hydrochlorothiazide</b>  | 25 mg    | Apo-hydro®               | Yes    | 12 (3.1)   |
| <b>Levothyroxine</b>        | 100 mcg  | Thyrosit®                | Yes    | 7 (1.8)    |
| <b>Metoprolol</b>           | 100 mg   | Betawin®                 | Yes    | 21 (5.5)   |
| <b>Perindopril</b>          | 4 mg     | Provinace®               | Yes    | 41 (10.7)  |
| <b>Propranolol</b>          | 40 mg    | Corbeta®                 | Yes    | 6 (1.6)    |
| <b>Simvastatin</b>          | 40 mg    | Simvor                   | Yes    | 233 (60.8) |
| <b>Others</b>               |          |                          |        | 25 (6.53)  |

Table 3 showed that most (n=374, 97.7%) participants split their medications based on prescription instructions. The most common technique used was kitchen knife (n=155, 40.5%) followed by hand breaking (n=137, 35.8%), scissors (n=49, 12.8%) and tablet cutter (n=28, 7.3%). Nearly two-thirds (n=246, 64.2%) were confident of achieving equal half upon cutting their medications.

Table 3: Practice of tablet cutting among participants (n=383).

| Variables                                    |   | n (%)      |
|--|---|------------|
| <b>Reasons for tablet cutting</b>            | Following the prescribed dose   | 374 (97.7) |
|  | Save cost   | 6 (1.6)    |
|  | Difficulty in swallowing  | 3 (0.8)    |
| <b>Tablet cutting routine</b>                | Split medications once for the whole month and keep in a pill container | 103 (26.9) |
|  | Split medications every time prior administration                       | 280 (73.1) |
| <b>Person who cut the medication in half</b> | Self  | 359 (93.7) |
|  | Caregiver   | 24 (6.3)   |

|  |                                    |            |
|--|------------------------------------|------------|
| <b>Accuracy perception to get equal half split</b> | Confident of achieving equal half  | 246 (64.2) |
|  | Confident not achieving equal half | 98 (24.6)  |
|  | Not sure to achieve equal half     | 39 (10.2)  |
| <b>Technique used for tablets cutting</b>          | Hands                              | 137 (35.8) |
|  | Tablet cutter                      | 28 (7.3)   |
|  | Scissors                           | 49 (12.8)  |
|  | Others                             | 14 (3.7)   |

Table 4 showed most of the participants (62.1%) had no issue regarding tablet cutting. However, more than 20% of participants agreed tablet cutting are too troublesome and would destroy the medications. Majority of participants (n=223, 58.2%) claimed no problem arises due to tablet cutting practice. Only 25% of participants (n=97, 25.3%) claimed medication to be ruined or broken after splitting it into half. Only a tenth of participants (n=49, 12.8%) took the whole tablet instead of following the required dose because of splitting difficulty. 25% of participants (n=96, 25.1%) discarded parts of their tablets when splitting did not result in equal parts from their perspective.

Table 4: Problems associated with tablet cutting (n=383).

| Variable   |   | n (%)      |
|--|---|------------|
| <b>Problems encountered associated with tablet splitting*</b>      | Take quite a long time to cut             | 20 (5.2)   |
|  | Too Troublesome                           | 95 (24.8)  |
|  | Unstable or shaky hands                   | 14 (3.7)   |
|  | Medication ruined or broken after cutting | 97 (25.3)  |
|  | Medication size too small                 | 34 (8.9)   |
|  | Medication has no score line              | 7 (1.8)    |
|  | No problem                                | 223 (58.2) |
| <b>Patients' response due to difficulty of cutting medications</b> | Take the whole tablet                     | 49 (12.8)  |
|  | Discard all parts that inaccurately cut   | 96 (25.1)  |
|  | Use both parts                            | 238 (62.1) |

Multiple answer question\*

As in Figure 1, 83% of participants have good adherence despite have to split the medications.

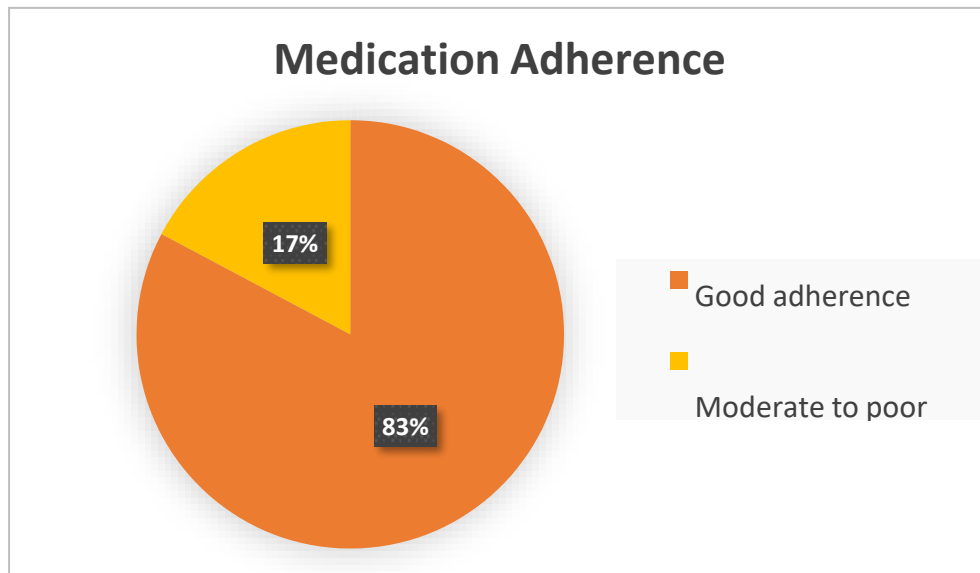


Figure 1: Medication Adherence among participants (n=383).

A statistical test was conducted to determine whether there is a difference in MyMAAT scores between those without and with splitting problems. The result indicated no statistical significant difference between both groups (Table 5).

Table 5: Comparison of median MyMAAT scores between those with and without splitting problems.

| Group (n)                     | Median (IqR) | Z-statistic <sup>a</sup> | P-Value |
|-------------------------------|--------------|--------------------------|---------|
| With splitting problems (160) | 56 (3)       | -0.775                   | 0.438   |
| No problems (223)             | 56 (6)       | -0.775                   | 0.438   |

<sup>a</sup>Mann-Whitney Test was applied

### Discussion

Current study found that most patients would use a knife (n=155, 40.5%) to cut their medications. In contrast, prior evidence showed that more than 60% (68.1%) split their medications without any tool or device (Akram et al, 2018). Another study by Gharaibeh et al (2018) reported that the majority of patients used hands (63.5%), apart from other techniques such as kitchen knives (14.3%) and tablet splitter (9%). Patients educational status and population idiosyncrasies might associated with different preferred techniques observed in this study.

Previous study done in Jordan and Germany were parallel with current study, where the most common reason for tablet splitting was to follow the prescribed dose, save cost, and ease swallowing difficulties (Gharaibeh et al, 2018; Quinzler, Szecsenyi, & Haefeli, 2007). Although the Food and Drug Administration (2013) advised splitting

tablets just before ingestion, the result showed 26.9% of the respondents split their medications once for the whole one month and kept them in a pill container. However, this practice was not recommended because heat, humidity, and moisture content may affect the medications quality & stability which resulting in the possibility of overdose or under-dose therapy.

Studies done by Novartis (2015) and AstraZeneca (2019) found no medications was cut by respondents that were not scored. However, the presence of a score line can be misleading, indicating that tablets splitting is allowed to obtain two equal doses; instead, it is to overcome swallowing difficulties. Therefore, pharmacists need to refer to the medications package insert before dispensing medications to patients and educating other healthcare professionals regarding which medications are suitable for tablet splitting.

More than 60% (n=246, 64.2%) perceived they achieved an equal half split after cutting their medications. Regardless of the patients claiming they would get an accurate cut using any common method, a previous study showed that obtaining an accurate dose from a split tablet is uncertain (Clark, 2002). Thus, there is no agreement on the best technique for splitting tablets (Eserian et al, 2018). Preceding studies recommended avoiding tablet splitting due to inaccuracy (Habib et al, 2014). Although the likelihood of under or overdosage using tablet halves remained a clinical concern, a study by Ashrafpour et al (2018) showed no significant impact of the underlying disease and its complications on tablet splitting accuracy. Nevertheless, health care professionals, patients and caregivers should understand that tablet splitting do cause dosing inaccuracies and could potentially contribute to medication errors.

Our study recorded that nearly half of the participants claimed problems arose due to tablet cutting practice. When splitting did not result in equal parts from their perspective, 25% of participants discarded parts of their tablets, leading to increased healthcare costs. Thus, Pharmacists have a vital role to educate the patients and planning a strategies with other healthcare professionals to overcome the splitting difficulties and reduce the possibility of drug wastage.

There was no association between problem of tablet cutting with medication adherence; meaning that splitting medications was not cause patients to skip their doses. Instead, patients might have been more adherent, probably because of increased awareness and sense of responsibility to split the tablet. Previous study by Gee et al (2002) reported that less than 25% of participants stated that they missed more doses in a month, with most patients being compliant with the tablet-splitting practice. Another study by Gharaibeh (2018) reported that only 25% of study participants sometimes skipped their doses due to tablet splitting difficulties. A systematic review by the Canadian Agency for Drugs and Technologies in Health (2015) confirmed tablet splitting had no impact on adherence or compliance with medications.

### Limitation

The study was conducted in public setting hence the result may not be generalized to other private settings across Malaysia due to differences in medication brand procurement.

### Conclusion

In conclusion, knife is the most favourable tablet splitting technique but there is no consensus on the best technique for tablet splitting. In order to overcome problems encounter by patient on tablet splitting, healthcare providers should make every effort to use commercially available oral tablet if available. However, if tablet splitting is still

necessary, counselling by pharmacist is compulsory to ensure quality of medication and to optimize patient's adherence as well as medication therapy.

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### Conflict of interest

The authors declare that there is no conflict of interest.

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