Jurnal Jamu Indonesia (2025) 10(1): 49–54
https://jamu-journal.ipb.ac.id/index.php/JJI/index

ISSN 2407-7178
eISSN 2407-7763

Research Article
Doi: https://doi.org/10.29244/jji.v10i1.311

# Chewable Tablet Formulation from Ethanol Extracts of Betel, Areca, and Gambir as a Substitute for Betel

[Formulasi Tablet Kunyah Dari Ekstrak Etanol Sirih, Pinang, dan Gambir Sebagai Pengganti Menyirih]

**Uce Lestari[1,4]*, Ardi Novra[2,4], Romi Kurniadi[3,4]**

[1]*Pharmacy Study Program, Faculty of Medicine and Health Sciences, Jambi University, Jambi, Jambi Province, 36361, Indonesia*
[2]*Animal Husbandry Study Program, Faculty of Animal Husbandry, Jambi University, Jambi, Jambi Province, 36361, Indonesia*
[3]*Economic Education Study Program, Faculty of Teacher Training and Education, Jambi University, Jambi, Jambi Province, 36361, Indonesia*
[4]*eMedical Science and Technology Center of Excellence (PUI), Jambi University, Jambi, Jambi Province, 36361, Indonesia*

**ARTICLE INFO**

***Article history***
**Received on:** 2023-10-20
**Revised on:** 2024-05-09
**Accepted on:** 2025-01-28

**Keyword:**
betel
betel nut
areca nut
gambier
chewable tablets

**ABSTRACT**

The tradition of betel nut needs to be preserved because it is useful for maintaining oral health and the digestive system, but this betel nut has an impact on oral cavity injuries. Therefore, to prevent injuries to the oral cavity, this research makes an interesting innovation from the betel nut tradition in the form of formulating safe chewable tablets using natural ingredients, such as betel nut, areca nut, and gambier. This study aimed to determine the best chewable tablet formula from three formulas with different concentrations of betel, areca nut, gambier, and whiting, by testing the physical properties of both granules and formulated tablets. The selection of raw materials begins with the extraction of betel, areca nut, gambier, and whiting by maceration using 70% ethanol solvent and the addition of chewable tablet auxiliaries, such as talcum, magnesium stearate, PVP, aspartame, sorbitol, and aerosol. These chewable tablets are designed to provide the same health benefits as betel nuts, without the risk of tooth damage. The results showed that F2 chewable tablets had the best physical properties of the whole formula, namely weight uniformity with an average of 185 ± 1 mg, average tablet diameter of 9.830 ± 1 mm, average tablet thickness of 2.032 ± 1 mm, and average tablet friability of 1.08 ± 1%. The best formulation F2 contains 10% betel extract, 7% areca nut, 7% gambier, and 4% whiting.

**Kata kunci:**
menyirih
sirih
pinang
gambir
tablet kunyah

**ABSTRAK**

Tradisi menyirih perlu dilestarikan karena bermanfaat untuk menjaga kesehatan gigi dan mulut serta menjaga sistem pencernaan, tetapi menyirih ini berdampak terjadinya luka pada rongga mulut. Oleh karena itu untuk mencegah terjadinya luka pada rongga mulut maka penelitian ini membuat suatu inovasi yang menarik dari tradisi menyirih berupa memformulasikan tablet kunyah yang aman dengan menggunakan bahan alami seperti sirih, pinang dan gambir. Penelitian ini bertujuan untuk menemukan formula tablet kunyah yang terbaik dari 3 formula dengan perbedaan konsentrasi sirih, pinang, gambir dan kapur sirih yang berbeda melalui pengujian sifat fisik baik granul ataupun tablet yang diformulasi. Pemilihan bahan baku diawali dengan proses ekstraksi sirih, pinang, gambir dan kapur sirih dengan cara maserasi menggunakan pelarut etanol 70% serta penambahan bahan pembantu tablet kunyah seperti talcum, magnesium stearate, Poli Vinil Pirolidon, aspartame, sorbitol dan aerosil. Tablet kunyah ini dirancang untuk memberikan manfaat kesehatan yang sama seperti menyirih tanpa resiko dapat merusak gigi. Hasil penelitian menunjukkan bahwa tablet kunyah F2 memiliki sifat fisik yang paling baik dari keseluruhan formula yaitu keseragaman bobot dengan rata-rata 185 ± 1mg, diameter tablet rata-rata 9,830 ± 1

mm, ketebalan tablet rata-rata 2,032 ± 1 mm dan kerapuhan tablet rata 1,08 ± 1%. Formulasi F2 terbaik mengandung ekstrak sirih 10%, pinang 7%, gambir 7 % dan kapur sirih 4%.

*Corresponding author:
Uce Lestari (ucelestari@unja.ac.id)

## 1. INTRODUCTION

The betel nut tradition is an ancient practice commonly found in cultures worldwide, especially in Southeast Asia and parts of South Asia. It involves chewing betel leaves infused with ingredients such as areca nut, betel lime, and gambier. The activity is often associated with the cultural, social, and religious aspects of the society in which it is practiced (Arifin & Zainal, 2005). One aspect that is often associated with the tradition of betel nuts is the culture of hospitality and social interaction. *Menyirih* is often a means by which people gather, chat, and share stories. Establishing social relationships, strengthening family ties, and building solidarity within the community are important (Suparlan, 2010).

In addition to the social aspect, when viewed from a health perspective, this betel nut tradition needs to be preserved because it is beneficial for maintaining oral health and the digestive system, but this betel nut has an impact on oral cavity injuries. Therefore, to prevent oral injuries, this research makes an interesting innovation from the betel nut tradition in the form of formulating safe chewable tablets using natural ingredients such as betel nuts, areca nuts, and gambiers (Aisyah et al., 2019). Innovation in the replacement of betel nuts with chewable tablets is an important step in maintaining oral health, which is very easy to use. In general, traditional betel nuts can cause damage to tooth enamel due to friction by the active ingredients of gambiers, betel lime, and areca nuts. Therefore, this chewable tablet innovation can minimise the negative impact of betel nuts. Betel, areca nut, gambier, and whiting are antiseptic, antibacterial, and useful for strengthening teeth and preventing canker sores (Zheng et al. 2020).

This innovation also provides convenience and comfort for its use. Chewable tablets can be easily carried out everywhere, making it easier for individuals to feel the sensation of betel nuts in maintaining oral health. This chewable tablet can not only be used by the elderly but children or all groups can enjoy it, the advantage of this chewable tablet is that it does not leave colour stains on the teeth and mouth compared to chewing directly the active ingredients of betel nut such as betel nut, areca nut, gambier and betel lime (Patel et al, 2019).

In addition, chewable tablets can produce a flavour similar to betel nut, provide a fresh sensation in the mouth, and contain antibacterial active substances found in betel nut, areca nut, and gambier. These chewable tablets can provide health benefits such as strengthening teeth, preventing mouth ulcers, and maintaining oral health. In addition, the chewable tablet formula promotes safer and more sustainable use than the direct use of traditional ingredients, such as betel nut, areca nut, and gambier. The alternative use of chewable tablets is safer and easier to use. The aim of this study was to obtain a replacement tablet formula for *menyirih* that can be useful for maintaining healthy teeth and mouth for those who consume it. This research can also be useful in reducing the negative impacts associated with the direct use of traditional ingredients that can result in tooth enamel damage, give teeth a yellow colour, and cause mouth ulcers. This study is the first step in developing a product that can be used as a substitute for traditional betel nuts. Further research is needed to test the safety and effectiveness of this product in the long term, as well as to understand consumer responses to the use of chewable tablets as a substitute for traditional betel nuts (Kumar et al., 2021).

## 2. METHOD

### 2.1. Tools and materials

The tools used in this study are tablet printing machine (MKS-TBL55), sieve (Retsch), beaker glass (pyrex), glass funnel (pyrex), stainless steel container, digital scales (YH-102R), vernier caliper (mitutoyo), pycnometer (pyrex), oven (Primtech), stopwatch, ruler, millimeter bloc paper, aluminium foil.

The materials used in this study were betel (*Piper betle*) obtained from Tambak Sari village, areca nut (*Areca catechu)* obtained from Betara village North: Riau Province; South: Batanghari Regency; West: Batanghari Regency and Tebo Regency; East: Berhala Strait and East Tanjung Jabung Regency taken in May 2023. gambier (*Uncaria gambir*) and calcium hydroxide were obtained from the Angso Duo market. Borders on Pasar Jambi Sub-district, are Nothern side with Batang Hari River, Southern side with Jelutung Sub-district, Eastern side with Jambi Timur Sub-district Western side with Jelutung and Telanaipura Sub-district taken in May 2023, talcum (Brataco), Magnesium stearate (Brataco), PVP (Brataco), Aspartame (Brataco), Sorbitol (Brataco), Aerosil (Brataco).

The method of making granules of chewable tablets were prepared by wet granulation with the addition of talc, PVP, aerosol, aspartame, and sorbitol until the preparation was easy to clench. The design of the chewable tablet granules is presented in **Table 1**.

For the preparation of granules, the steps began by weighing the ingredients needed for 100 tablets were weighed in the following manner: betel powder, areca nut, gambier, calcium hydroxide, and aspartame were added to the container, sorbitol was added little by little mixed until homogeneous (mass 1), aerosol was added to the mixture, and Poli Vinil Pirolidon partially added the remaining sorbitol little by little until the dough was easily clenched. then

sieved with a 12-mesh sieve, the resulting fine powder was separated. The wet granules obtained were weighed and dried on a drying cupboard at 500 ˚C for 24 h. After drying, sieved with sieve no. 14/30 mesh, the dried granules were weighed to calculate the weight of the remaining Poli Vinil Pirolidon, talc, and Mg stearate needed, the granules were then tested for physical properties, the granules to be mounded were mixed first with the remaining Poli Vinil Pirolidon, talc, and magnesium stearate (Bhattacharya et al, 2020).

**Table 1**. Design of chewable tablet granule formula

| Materials | F1 (g) | F2 (g) | F3 (g) | Function |
|---|---|---|---|---|
| Betel leaf (Piper betle) symplisia | 15 | 10 | 5 | antibacterial |
| Areca nut symplisia *(Areca catechu)* | 5 | 7 | 9 | Healthy teeth and mouth |
| Gambir symplisia *(Uncaria gambir)* | 5 | 7 | 9 | Antiplax |
| Calcium hydroxide | 3 | 4 | 5 | Antimicrobials |
| Talk | 1.8 | 1.8 | 1.8 | Filling material |
| Magnesium stearate | 0.2 | 0.2 | 0.2 | Smoothing agent |
| Poli Vinil Pirolidon | 3 | 3 | 3 | Binder material |
| Aspartame | 2 | 2 | 2 | Sweetening ingredients |
| Sorbitol | 23 | 23 | 23 | Sweetening ingredients |
| Aerosil | 42 | 42 | 42 | Crushing material |

### 2.2. Evaluation of physical properties of granules

After the preparation of chewable tablet granules, testing or evaluation of the physical properties of the granules was performed as follows (Saleh et al., 2019; Lestari et al., 2018): Drying Shrinkage. The granules (1 g) were placed in a porcelain crucible and then placed in an oven at 105° C until the weight remained. Drying shrinkage can be calculated using the following formula:

$$\text{Drying Shrinkage (\%)} = \frac{\text{Initial Volume} - \text{End Volume}}{\text{Initial Volume}} \times 100$$

Description:
Initial Volume: The Volume of the material before drying.
Final Volume: The Volume of the material after drying.

*Moisture Content*. One gram of granules (W1) was weighed, and the sample was dried in an oven at 105 ˚C until a constant weight was obtained. After the drying process was complete (W2), the weight of the water (W1–W2) was calculated. This process provided information on the percentage of water in the granule sample. The moisture content was calculated using the following formula:

$$\text{Moisture Content (\%)} = \frac{(W1 - W2)}{W1} \times 100\%$$

Description:
Water Weight: Mass of water in the sample.
Dry Weight: The Residual mass of the sample after removal of water.

*Mean Granule Diameter Test*. Take a 10 g sample of granules. A series of perforated sieves of varying sizes were used to sieve the sample by shaking or using a mechanical device for 30 min, and the granules that fell on each sieve were weighed to determine the particle size distribution, calculate the cumulative percentage of particle mass that passes through each sieve, plot a sieve curve with the x-axis representing particle size, and the y-axis representing the cumulative percentage, and calculate the average diameter.

*Granule Friability*. A suitable impact tester, that is, an Impact Testing Machine, was used to place the granule sample in the correct position in the tester, press the tester until an impact occurs on the granule sample, observe the extent of damage to the granule sample after the impact, and record the degree of brittleness by recording the number of broken granules. The friability percentage was calculated based on the number of broken granules compared to the total number of granules.

*Assignment or BJ*. Take a 25 g granule sample, prepare a measuring cup accompanied by a tapmeter, and then vibrate the tapmeter so that the measuring cup moves 125 times. The volume height was measured before and after setting, and the percentage was calculated.

*Angle of Silence*. The stationary angle-measuring device was filled with a granular sample of up to 25 g. Note that there was no leakage of granular material from the measuring device. The stationary angle-measuring device was installed on a flat and hard horizontal surface, which was opened slowly to allow the granular material to flow freely, and the angle of repose formed when the granular material started to flow out of the measuring device was observed. The angle with respect to the horizontal surface was measured, and the results were recorded.

*Flow rate and Time*. The diverter was set up according to the test design and the parameters to be measured, such as the degree of slope or the dimensions of the channel, weighing the amount of granules to be tested as 25 g. Switch on the stopwatch and record the time taken for the granules to flow freely. The flow velocity of the granules was calculated by dividing the measured amount of granules by the time taken.

*Fine grade*. Take the remaining fine from the granule when sieving, then weigh the initial granule mass used when sieving, and weigh the resulting fine. The Fine Content was calculated using the formula below:

$$\text{Fine Grade (\%)} = \frac{\text{Fine Mass}}{\text{Granule mass}} \times 100$$

Description:
Fine Grade: Percentage of fine mass in the granule sample.
Mass of Fine: The Mass of separated fines.
Total Mass of granules: Total mass of granule sample before the separation process.

### 2.3. Evaluation of physical properties of Tablets

The evaluation of the physical properties of tablets includes the determination of weight and size uniformity, diameter, thickness, and friability (Saleh et al., 2019; Lestari et al., 2018a; Lestari et al., 2018b):

*a. Uniformity of weight and size*

Take a sample of 20 tablets, weigh each tablet individually using an accurate analytical balance, record the weight of each tablet, calculate the average weight of all tablet samples, calculate the standard deviation of the weight to evaluate the uniformity of weight, determine the specification range for tablet weights based on applicable standards or requirements, and evaluate the uniformity of weight by comparing each tablet weight with the average and specified specification range.

*b. Tablet diameter and thickness*

Take one tablet representing the production batch and place it on a flat and stable place. Ensure that the tablet is in the horizontal position. If calipers are used, their jaws are opened until they are slightly larger than the diameter of the tablet. A micrometer was used to ensure that it was open and ready for use. The measuring device (micrometer) was gently placed over the tablet such that the jaws or anvil touched the tablet at two opposite points. Read the measurement on the caliper scale or the digital display of the micrometer. Ensure that the reading is accurate. The diameter of the tablet was obtained from the measurement record. These steps were performed for each tablet that was to be measured.

*c. Tablet Friability*

Twenty tablets were placed in a friability tester. The device was switched on for 30 min, and each tablet was weighed before and after insertion into the friability tester.

## 3. RESULTS AND DISCUSSION

### 3.1. Granule Evaluation of Sipiga Chewable Tablets

One of the initial stages in the manufacture of chewable tablets is the preparation of the granules (**Table 2**). Granules are the basic materials used in making tablets. These granules typically consist of active ingredients that provide therapeutic effects, fillers, adhesives, and other necessary ingredients. These ingredients are mixed and processed into granules of appropriate size and consistency (Thakur et al., 2022).

**Table 2.** Granule Physical Properties Test Results

| Categories | F 1 | F2 | F3 | Parameters | Literature |
|---|---|---|---|---|---|
| Detection limit(LOD) | 9.908 % | 9.357% | 16.767% | < 0.7% | Lachman et al, 1989 |
| MC (Moisture Content) | 10.997 % | 10.323 %* | 20.145% | 10 % | Lachman et al, 1989 |
| average diameter of granule | 0.5 mm* | 0.5 mm* | 0.5 mm* | 0.5 mm | Martin et al, 1993 |
| granule friability | 11.93% | 9.7 % | 17.17% | < 1 % | Lachman et al, 1989 |
| angle of repose | $6.056^0$ | $29.279^{0}$* | $14.735^0$ | $25^0$-$30^0$ | Wells et al 1988 |
| flow time | 49.26 s | 54.71 s | 41.27 s | < 2.5 s | Staniforth et al, 2000 |
| Flow rate | 1.1063 g/s | 0.9361 g/s | 1.1994 g/s | >10 g/s | Sinvo, 2005 |
| Fine content | 0%* | 0%* | 0%* | < 10% | Lachman et al, 1989 |
| Compressed Specific gravity | 20.48% | 15.61%* | 7.53% | < 2% | Lacman et al, 1989 |

*: formulation that has the best properties


**Figure 1.** Betel, areca nut and gambier ethanol extract granules

The granules formed were evaluated for physical properties, such as % detection limit (LOD), % Moisture Content (MC), the average diameter of granules, granule friability, angle of repose, flow time, flow speed, fine content, and specific gravity until they met the predetermined requirements. The granules of betel leaf simplisia, areca nut simplisia, gambier simplisia, and calcium hydroxide from the three formulas are shown in **Figure 1**.

From the results of the granule evaluation above, it was found that F2 was the best granule and met the requirements in accordance with the predetermined parameters, with a formula consisting of 10 g of betel leaf powder, 7 g of areca nut simplisia, 7 g of gambier simplisia, and 4 g of calcium hydroxide.

Furthermore, after granule evaluation, fillers, lubricants, binders, and crushers, such as talcum, magnesium stearate, polyvinyl pyrrolidone, and Aerosil, were added. All the ingredients were evenly mixed using a mixing machine. Careful mixing is essential to ensure accurate dosage consistency and good tablet quality (Al-Hilal et al., 2020).

The next stage is granule molding; after mixing is complete, the granules are fed into the tablet press. This machine pressed the granules into the desired tablet shape. This process requires appropriate pressure and temperature to prevent tablet breakage. Addition of a protective coating Some chewable tablets have a protective coating to protect the active ingredients from environmental influences or provide a better flavor. This protective coating is typically made of materials such as talcum (Choudhury et al., 2021).

The final stage of the evaluation check continues, as the chewable tablets must undergo a series of quality tests to ensure that they meet the set standards. These tests involve measuring weight, thickness, hardness, and other parameters to ensure that each tablet meets the set specifications (Salama et al., 2022). The results of the evaluation of the physical properties of chewable tablets are presented in **Table 3**.

**Table 3.** Test Results Of Physical Properties Of Chewable Tablets

| Categories | F 1 | F2 | F3 | Parameters | Literature |
|---|---|---|---|---|---|
| Weight uniformity | 255 mg* | 185 mg* | 150 mg* | None of them are more than 300 mg | Depkes RI, 2014 |
| Tablet diameter | 9.957 mm* | 9.830 mm* | 9.906 mm* | Tablet diameter not more than 3 times and not less than 1.3 times the tablet thickness | Depkes RI, 2014 |
| Tablet thickness | 3.099 mm | 2.032 mm* | 1.905 mm* | Tablet diameter not more than 3 times and not less than 1.3 times the tablet thickness | Depkes RI, 2014 |
| The overall weight of the tablet | 60.8 g | 52.3 g* | 36.3 g | According to the desired weight of 50 grams | Depkes RI, 2014 |
| %tablet fragility | 1.96% | 1.08% | 0.67%* | No more than 0.8% | Liebermann et al, 1989 |
| Number of tablets obtained | 294 tablets* | 283 tablets | 231 tablets | The more tablets produced the better | Liebermann et al, 1989 |
| Initial weight of granule and filling material | 74.8 g* | 63.9 g* | 68 g* | Customized | Depkes RI, 2014 |
| Wasted materials | 14 g (18%) | 11.6 g* (18%) | 31.7 g (46%) | <10% of initial weight | Depkes RI, 2014 |

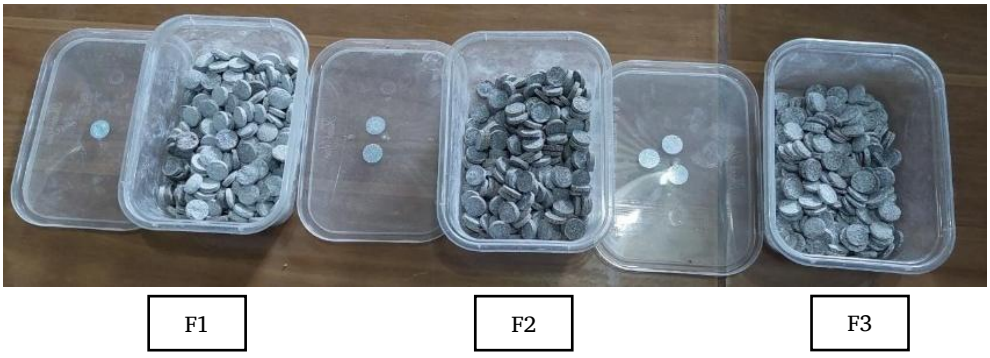


**Figure 2.** Betel, areca nut and gambier chewable tablets

From the results of the physical property evaluation test of chewable tablets, F2 had an evaluation of physical properties that met the requirements compared to other formulas. The chewable tablets that were produced are shown in **Figure 2**.

From the picture above and the results of the evaluation of the physical properties of chewable tablets, F2 is a formula that provides the best physical form compared to the other two formulas, resulting in tablets that are thin and not brittle or easily broken. After passing the quality testing, the chewable tablets are ready to be packed in appropriate packaging. Each package must include dosage information, expiry dates, and clear instructions before distribution to the market. Chewable tablet manufacturing

is a complex process that must be undertaken carefully to ensure a safe and effective product for consumers. At every stage, attention to detail is essential for producing high-quality tablets that conform to strict pharmaceutical standards (Rajput et al., 2019).

## 4. CONCLUSION

From the results and discussion, it can be concluded that the preparation of betel nut, areca nut, and gambier chewable tablets as a substitute for betel nut from the three formulas, F2, is the best formula to produce the best physical properties of granules and chewable tablets from other formulas. F2 contained active substances with the following composition: Betel leaf (Piper betle) symplisia at a concentration of 10%, Areca nut symplisia (Areca catechu) at a concentration of 7%, Gambir symplisia (Uncaria gambir) at a concentration of 7%, and calcium hydroxide at a concentration of 4%.

## 5. REFERENCES


Al-Hilal, T. A., & Al-Faqeer, H. S. (2020). Formulation and In vitro Evaluation of Chewable Tablets Containing Losartan Potassium. European Journal of Pharmaceutical and Medical Research, 7(1), 151-158.

Aisyah, D., Wuryaningsih, E. R., & Kamso, S. (2019). Sirih, Tembakau, dan Perilaku Kesehatan. *Jurnal Kesehatan Masyarakat*, *14*(1), 37-44.

Al-Hilal, T. A., & Al-Faqeer, H. S. (2020). Formulation and in vitro evaluation of chewable tablets containing losartan potassium. *European Journal of Pharmaceutical and Medical Research*, *7*(1), 151-158.

Arifin, Z. (2005). The habit of chewing betel and cigarettes and its impact on health. *Makara, Health*, *9*(2), 49-54.

Bhattacharya, S., & Roy, S. (2020). Design and evaluation of chewable tablets for pediatrics. *Journal of Pharmaceutical Research*, *19*(1), 15-21.

Choudhury, S. B., & Kishore, R. (2021). Formulation and evaluation of chewable tablets of cetirizine hydrochloride for pediatric use. *Journal of Drug Delivery and Therapeutics*, *11*(3), 146-151.

Kumar, A., & Tyagi, L. K. (2021). Formulation and evaluation of taste masked chewable tablets of pediatric antipyretic. *Research Journal of Pharmacy and Technology*, *14*(4), 2191-2196.

Lestari, U., Rahman, H., & Elisma, E. (2018a). Formulation and test of physical properties of activated charcoal tablets from palm shell waste (*Elaeis guenensis* Jacg) as an antidiarrhea medicine. *Jambi University Applied Sciences Scientific Journal*, *2*(1).

Lestari, U., Maharini, I., Utami, D., & Rahman, H. (2018b). Introduction of activated charcoal tablet technology from palm shell waste as an adsorbent for refrigerator odors at the PT SNP Association of Parit Village, Sungai Gelam. *Journal of Community Service*, *2*(1).

Lieberman, H. A., Lachman, L., & Schwartz, J. B. (1989). *Pharmaceutical dosage form: Tablet* (Vol. 1 & 2).

Marcel Dekker.

Marshall, K., & Rudnic, E. M. (1990). Tablet dosage form. In G. S. Banker & C. T. Rhodes (Eds.), *Modern pharmaceutics* (2nd ed.). Marcel Dekker.

Martin, A., Swarbrick, J., & Cammarata, A. (1993). *Farmasi fisik 2* (3rd ed.). UI Press.

Patel, D., Patel, M., & Patel, C. (2019). Development and evaluation of chewable tablets of antihypertensive drug. *International Journal of Applied Pharmaceutics*, *11*(6), 100-105.

Rajput, S. J., Yadav, K. S., & Bharadia, P. D. (2019). Formulation and evaluation of chewable tablets of cefixime. *International Journal of Research in Pharmaceutical Sciences*, *10*(1), 325-331.

Salama, A. H., Elsabawi, N. A., & Tadros, M. I. (2022). Formulation and evaluation of taste-masked chewable tablets of amoxicillin trihydrate. *International Journal of Pharmacy and Pharmaceutical Sciences*, *14*(3), 60-66.

Saleh, H. M., & Elsayed, I. (2019). Formulation and evaluation of chewable tablets of promethazine hydrochloride. *Journal of Pharmaceutical Sciences and Research*, *11*(5), 1458-1463.

Sinvo, P. (2005). *Martin physical pharmacy and pharmaceutical science* (5th ed.). Lippincott Williams & Wilkins.

Staniforth, J. N. (2000). The mechanical properties of compacts of microcrystalline cellulose and silicified microcrystalline cellulose. *Powder Technology*, *110*(1-2), 101-109.

Suparlan, Y. (2010). Menyirih di tengah kehidupan masyarakat Jawa. Universitas Negeri Yogyakarta.

Thakur, D. S., Rani, P. L., Rani, S., & Kumari, S. S. (2022). Formulation and evaluation of chewable tablets of antidiabetic drug. *Journal of Drug Delivery and Therapeutics*, *12*(1), 84-88.

Voight, R. (1994). *Buku pelajaran teknologi farmasi*. Gadjah Mada University Press.

Wells, J. I. (1988). *Pharmaceutical preformulation: The physicochemical properties of drug substances*. Ellis Horwood.

Zheng, W., Jia, L., Xie, Q., Wang, S., & Xie, R. (2020). Formulation and evaluation of chewable tablets: A review. *International Journal of Pharmaceutical Sciences and Research*, *11*(1), 1-11.



**Citation format:**

Lestari, U., Novra, A., Kurniadi, R. (2025). Chewable Tablet Formulation from Ethanol Extracts of Betel, Areca and Gambir as a Substitute for Betel. *Jurnal Jamu Indonesia*, *10*(1), 49–54. https://doi.org/10.29244/jji.v10i1.311