

THE DEVELOPMENT OF SUK SAI YAD REMEDY IN PILL DOSAGE FORM AND STABILITY STUDY OF ITS VARIOUS FORMS

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ABSTRACT

This study aimed to develop a pill dosage form of the Suk Sai Yad (SSY) remedy and to evaluate its stability in three dosage forms: powder, capsule, and pill. The SSY pill was successfully developed, with Formula 2 being identified as the most suitable formulation, consisting of 60.00% w/w SSY powder, 10.00% w/w glucose syrup, and 30.00% w/w distilled water. This formulation passed all physical tests and demonstrated the highest production yield at 71.39%. Subsequently, all three dosage forms of SSY were manufactured for further stability studies under both long-term and accelerated conditions. Comprehensive evaluations were conducted, including physical tests, chemical analysis, and microbial contamination testing. All samples passed the physical tests and met the microbial contamination criteria. For the chemical analysis, piperine remained stable for six months under both conditions in all dosage forms. In contrast, the gallic acid content decreased by more than 10% from its initial value only in the capsule dosage form under accelerated conditions at the six-month mark. Moreover, analysis of CBD and Δ^9 -THC revealed that only the SSY powder under long-term conditions maintained its content within $\pm 10\%$ of the initial levels throughout the six-month period. Therefore, it can be concluded that if piperine and gallic acid are used as markers in the accelerated stability study, a 2-year shelf life could be extrapolated for both the powder and pill forms. However, when considering all compounds, the long-term stability study shows that only the powder form has a shelf life of 6 months. Thus, it is necessary to investigate additional methods to slow the degradation of all four active compounds.

Keywords: Suk Sai Yad Remedy, Stability, Cannabis, Development of Pill Dosage Form

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INTRODUCTION

The Suk Sai Yad remedy (SSY) was recorded in the Phra Osot Phra Narai pharmacopeia dating back to the late Ayutthaya period (B.E. 1893-2310). Subsequently, the Narcotics Act B.E. 2522 (1979) classified cannabis as a Category 5 narcotic, making its cultivation, possession, and use illegal (Narcotics Act B.E. 2522 (1979)). As a result, traditional remedies containing cannabis, including the SSY, were excluded from clinical practice and research for more than 40 years. It was not until the Narcotics Act (No. 7), B.E. 2562 (2019), that the legal use of cannabis for medical purposes and research was permitted (Narcotics Act (No. 7) B.E. 2562 (2019)).

Thereafter, the 2022 Ministry of Public Health Notification regarding Category 5 narcotics stipulates that only cannabis extracts containing more than 0.2% w/w of delta-9-tetrahydrocannabinol (Δ^9 -THC) and seed-derived extracts are classified as narcotics (Narcotic Code Implementation Act B.E. 2564 (2021)). This regulatory change has paved the way for broader applications of cannabis in medicine, including the revival of the SSY.

In 2023, the SSY was officially included in the National List of Essential Herbal Medicines and classified as a Thai traditional medicine based on indigenous knowledge. Approved dosage forms include powders and capsules. According to the official monograph, each capsule should contain 500 milligrams of SSY powder. The remedy is indicated for promoting sleep and appetite. The recommended dosage is 0.5-2 grams per dose, taken 1-2 times daily. The recommended adjuvant is either raw honey or boiled water, and administration with honey may help alleviate heartburn symptoms (Drug Act B.E. 2510 (1967)). Later, in 2025, the pill dosage form of SSY was also added to the National List of Essential Medicines (Drug Act B.E. 2510 (1967)). However, no monograph has yet been established specifying the type and amount of binder used, or the size and weight of the SSY pills. In addition, the Thai Food and Drug Administration (FDA Thailand) allows Thai traditional medicines based on indigenous knowledge to have a shelf life of up to three years without the requirement of prior stability studies.

Previous research has explored the development of SSY in pill dosage form and analyzed its THC and cannabidiol (CBD) content. Quality control assessments have also been conducted, covering parameters such as physical tests, microbial contamination, heavy metals, and pesticide residues (Pathompak, 2021). However, these studies did not utilize industrial-scale pill manufacturing equipment, and more importantly, they did not assess the stability of the product.

Given the recent inclusion of SSY in the 2025 National List of Essential Herbal Medicines, with dosage forms including capsules, powders, and pill dosage form, there is a clear need to develop a standardized formulation using industrial-grade manufacturing processes. Additionally, comprehensive stability studies across all three dosage forms—physical, chemical, and microbiological—are necessary to support the industrial production and to provide data for determining the actual shelf life of the SSY remedy for submission to the FDA Thailand.

LITERATURE REVIEWS

Suk Sai Yad remedy (SSY)

The Suk Sai Yad remedy (SSY) is a traditional herbal formulation recorded during the Ayutthaya period (1893-2310 BE; 1350-1767 AD). The text describes the preparation as follows: "For Suk Sai Yad medicine, take 1 part camphor, 2 parts *Azadirachta indica* var. *siamensis* Valetton (leaves), 3 parts *Kleinhovia hospita* L. (stems), 4 parts *Cinnamomum bejolghota* (Buch.-Ham.) Sweet (bark), 5 parts *Nigella sativa* L. (seeds), 6 parts *Aucklandia lappa* Decne (roots), 7 parts *Myristica fragrans* Houtt. (seeds), 8 parts *Mesua ferrea* L. (flowers), 9 parts *Piper nigrum* L. (fruits), 10 parts *Zingiber officinale* Roscoe (rhizomes), 11 parts *Piper retrofractum* Vahl (fruits), and 12 parts *Cannabis sativa* L. (leaves). Grind all

ingredients into a powder and mix with honey. Before consuming, chant Sabbitiyo three times, then consume as appropriate. (Ministry of Public Health, 2012).

In the 2025 National List of Essential Herbal Medicines, the approved dosage forms of SSY include powder, capsule, and pill dosage forms. The indications of the SSY are specified as promoting sleep and appetite. The recommended dosage is 0.5-2 grams per dose, taken 1-2 times daily, with the adjuvant being either raw honey or boiled water. Contraindications include use in pregnant women, lactating women, and individuals with fever. Precautions are advised in patients with peptic ulcers or gastroesophageal reflux disease (GERD) due to the hot nature of the formulation. The remedy should be used with caution when co-administered with central nervous system depressants, such as sedatives, anticonvulsants, alcohol, or alcohol-containing products. For patients with diabetes mellitus, it is recommended to use boiled water as the adjuvant. Adverse effects may include dry mouth, dry throat, and facial flushing. Additionally, there is a noted correlation between dosage and the likelihood of adverse effects, with higher doses increasing the risk of such events. Administration with honey as an adjuvant may help alleviate heartburn symptoms (Drug Act B.E. 2510 (1967)).

An analysis of the SSY revealed that the formulation possesses hot properties, primarily derived from *Piper retrofractum* Vahl fruits, *Zingiber officinale* Roscoe rhizomes, *Piper nigrum* L. fruits, *Myristica fragrans* Houtt. seeds, *Nigella sativa* L. seeds, *Kleinhovia hospita* L. stems and camphor. In addition, the remedy contains *Cannabis sativa* L. leaves, which have nauseating effects. However, the formulation also includes medicinal herbs traditionally used to alleviate dizziness, faintness, and blurred vision, which help control the effect from *Cannabis sativa* L. leaves. These balancing ingredients include *Mesua ferrea* L. flowers, *Aucklandia lappa* Decne roots, and *Cinnamomum bejolghota* (Buch.-Ham.) Sweet bark.

Considering the indications, the primary ingredients that promote sleep are *Cannabis sativa* L. leaves and *Zingiber officinale* Roscoe rhizomes. The main ingredients that enhance appetite include *Cannabis sativa* L. leaves, *Piper retrofractum* Vahl fruits, *Piper nigrum* L. fruits and *Azadirachta indica* var. *siamensis* Valetton leaves. The supplementary ingredients serve carminative and digestive purposes and include *Myristica fragrans* Houtt. seeds, *Nigella sativa* L. seeds, *Kleinhovia hospita* L. stems and camphor.

Research related to the Suk Sai Yad remedy (SSY)

Clinical studies on the SSY have all shown positive results. However, there have been numerous reports of adverse effects associated with consuming SSY in powder dosage form, including gastrointestinal irritation, a burning sensation in the mouth, throat and stomach, heartburn, dizziness, dry mouth, and dry throat. These adverse effects were one of the reasons some participants withdrew from their studies. Interestingly, when SSY powder is mixed with honey, molded into pills, and consumed, the occurrence of adverse effects is significantly lower (Boontham et al., 2022; Jamparngernthaweeri et al., 2023; Tengtermwong, 2021; Tipratchadaporn, 2021).

Previously, research on the development and quality control of SSY pills was conducted. The formulation involved mixing SSY powder with the sodium starch glycolate in a ratio of 97:3, respectively. This mixture was then combined with honey and boiled water at a ratio of 35:65, respectively. The liquid gradually poured into the solid mixture while kneading until a cohesive herbal mass with the desired consistency was achieved. A 4-hun (11 mm diameter) brass tablet press was then used to compress the herbal mass into pills. The pills were manually rolled into a spherical shape and subsequently dried at 50°C for 24 hours. The final herbal pills exhibited a smooth surface, with an average weight of 470.01 ± 44.19 mg. The disintegration time was 19.61 minutes, and the average moisture content was $8.27 \pm 0.09\%$ (w/w). Additionally, the pills passed microbial, heavy metal, and pesticide contamination tests. Furthermore, an HPLC method was developed to quantify CBD and THC in the formulation (Pathompak, 2021).

Legally defined Δ^9 -THC and CBD levels

Currently, the use of *Cannabis sativa* L. in herbal medicines is permitted only in powder form, with no specific regulations governing the content of Δ^9 -THC and CBD. However, if a cannabis extract contains more than 0.2% w/w Δ^9 -THC, it is classified as a Category 5 narcotic under the Narcotic Code, according to the 2022 announcement by the Ministry of Public Health regarding the identification of Category 5 narcotic substances (Narcotic Code Implementation Act B.E. 2564 (2021)).

Standard requirements for herbal products

At present, the Herbal Product Division of the Thai Food and Drug Administration (FDA Thailand) has established specifications for each dosage form of herbal products, including testing parameters, testing methods, acceptance criteria, and microbiological limits (Herbal Product Act B.E. 2562 (2019)).

Stability testing of herbal products

Stability testing of herbal products is essential to ensure the quality, safety, and efficacy of a drug substance or product throughout its designated shelf life. Typically, there are two types of studies: long-term studies conducted under ambient conditions ($30^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and $75\% \text{RH} \pm 5\% \text{RH}$), and short-term studies conducted under accelerated conditions ($40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and $75\% \text{RH} \pm 5\% \text{RH}$) at elevated temperatures and relative humidity (Association of South East Asian Nations, 2013). According to World Health Organization (2009) guidelines, a provisional shelf life of 2 years can be granted if a product remains stable for at least six months under accelerated conditions (World Health organization, 2009).

RESEARCH METHODOLOGY

Preparation of SSY dosage forms

1) SSY powdered and capsule

The raw materials for the SSY formulation were sourced and processed into a fine powder by the Ayurved Siriraj Manufacturing Unit of Herbal Medicine & Products, which operates under Good Manufacturing Practice Pharmaceutical Inspection Co-Operation Scheme (GMP-PIC/S) standards. Five hundred mg of SSY powder was filled into the transparent gelatin capsule (No. 0) by capsule inserter and filler. SSY capsules were cleaned any excess powder on the outside of the capsules by linen cloth.

2) Preparation of SSY pill

The production of SSY pill was also manufactured by the Ayurved Siriraj Manufacturing Unit of Herbal Medicine & Products, which operates GMP-PIC/S standards. Three different formulations of SSY pill were developed, with the formulation details presented in Table 1. The formulations were evaluated based on physical test criteria, as shown in Table 2. The final selected formulation was chosen based on meeting the physical test standards and achieving the highest percentage yield.

Table 1 Composition of the three SSY pill formulations

No	Ingredients	Formulation 1 (%w/w)	Formulation 2 (%w/w)	Formulation 3 (%w/w)
1	SSY powder	54.55	60.00	54.5
2	Glucose syrup	9.09	10.00	-
3	Purified honey	-	-	11.36
4	Water (distilled)	36.36	30.00	34.09

3) SSY packaging

The study was conducted on all three dosage forms of SSY—powder, capsule, and pill. Three dosage forms of SSY were packed into High Density Polyethylene (HDPE) bottles.

Stability study

Stability testing was conducted under two storage conditions: long-term ($30^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and 75% RH \pm 5% RH) and accelerated ($40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and 75% RH \pm 5% RH) (Association of South East Asian Nations, 2013). Evaluations were performed at three timepoints: 0, 3, and 6 months. The tests included physical, chemical, and microbial contamination.

The physical testing of SSY in all three dosage forms—powder, capsule, and pill—includes the following parameters: appearance, diameter, weight variation, disintegration test, and loss on drying. The testing methods, specification, and equipment used (Herbal Product Act B.E. 2562 (2019)) are detailed in Table 2.

Table 2 Physical tests and criteria of each dosage forms

No	Tests	Method	Specification			Equipment
			Powder	Capsule	Pill	
1	Appearance	Consider by senses	Brown powder	Transparent capsule with brown powder	Brown round pills	-
2	Loss on drying	Take 2 grams of SSY each dosage form to test in moisture analyzer, record results and calculate	% Loss on drying (%LOD) must not exceed 10%			Moisture analyzer
			% LOD = $\frac{\text{Weigh before test} - \text{Weigh after test}}{\text{Weigh before test}} \times 100$			
3	Diameter	Take 20 pills for to test in thickness gauge, record results and calculate for average	-	-	No pill has a diameter exceeding $\pm 10\%$ of the average	Thickness gauges
4	Weight variation	Weigh 20 pills/capsules, record results and calculate for average	-	Not more than 2 pills/capsules deviate exceeding $\pm 10\%$ from the average weight and no pill/capsule has a weight deviation of more than $\pm 20\%$ from the average weight		Analytical balance 4 digits
5	Disintegration on test	Take 6 pills/capsules for disintegration test	-	All capsules disintegrate within 30 minutes	All pills disintegrate within 60 minutes	Disintegration apparatus

Chemical testing was performed using Ultra-Performance Liquid Chromatography (UPLC) to quantify gallic acid and piperine, and Gas Chromatography-Mass Spectrometry (GC-MS) to determine CBD and Δ^9 -THC levels. The analyses were conducted by the Siriraj Herbal Examination and Analysis Center (SiHAC). The acceptance criterion was that the content of each compound should remain within $\pm 10\%$ of the initial value.

Samples were submitted for microbial analysis at the Department of Microbiology, Faculty of Medicine, Siriraj Hospital, which is accredited under international standards ISO 15189 (Medical Laboratory Accreditation) and ISO/IEC 17025 (Testing and Calibration Laboratory Accreditation). The microbial parameters and acceptance criteria (Herbal Product Act B.E. 2562 (2019)) are presented in Table 3.

Table 3 Microbial parameters and acceptance criteria for SSY

No	List of microbial	Acceptance criteria
1	Total aerobic microbial count (TAMC)	Not more than 2×10^4 cfu/g
2	Total yeast and mold count (TYMC)	Not more than 2×10^2 cfu/g
3	Bile-tolerant gram negative bacteria	Not more than 10^2 cfu in 1 gram
4	<i>Salmonella</i> spp.	Not detected in 10 grams
5	<i>Escherichia coli</i>	Not detected in 1 gram
6	<i>Staphylococcus aureus</i>	Not detected in 1 gram
7	<i>Clostridium</i> spp.	Not detected in 1 gram

RESEARCH RESULTS

Development of SSY in pill dosage form

Three formulations of SSY in pill dosage form were developed. Each pill is specified to have a net weight of 180 mg of SSY powder. Each formulation was evaluated through physical tests according to the methods and criteria shown in Table 2, and all three formulations passed every parameter. The percentage yields were 43.50%, 71.39%, and 41.63%, respectively. Based on the physical test results and percentage yield, Formula 2 was selected for the production of SSY pills for subsequent stability studies. The detailed results of the physical tests are presented in Table 4.

Table 4 Physical test results of SSY pill formulation 2

No	Physical test parameters	Formulation 2
1	Appearance	Brown round pills
2	Diameter (average; mm)	6.84
3	Weight variation (average; mg)	183.6 (approximately 180 mg)
4	Disintegration test(minutes)	25
5	Loss on drying (average %LOD)	4.90 %

Stability test

From the six-month stability study, it was found that all three dosage forms under both storage conditions—long-term and accelerated—met the criteria for all physical tests and microbial contamination at every timepoint. The results of the physical tests are presented in Table 5, while the results of the microbial contamination tests are presented in Table 6.

Table 5 Physical properties of 3 dosage forms of SSY at 6 months long term (30 °C/ 75 %RH) and accelerated conditions (40 °C/ 75 %RH)

Dosage form	Long-term storage (30°C ± 2°C and 75% RH ± 5% RH)							
Powder	Timepoint (months)	Appearance		%LOD (n=3)				
		Shape	Color					
	0	Fine powder	Brown	6.78 %				
	3	Fine powder	Brown	7.30 %				
	6	Fine powder	Brown	7.44 %				
	Capsule	Accelerated storage (40°C ± 2°C and 75% RH ± 5% RH)						
		Timepoint (months)	Appearance		%LOD (n=3)			
			Shape	Color				
		0	Fine powder	Brown	6.78 %			
		3	Fine powder	Brown	7.74 %			
6		Fine powder	Brown	8.92 %				
Capsule		Long-term storage (30°C ± 2°C and 75% RH ± 5% RH)						
		Timepoint (months)	Appearance		%LOD (n=3)	Wight variation (mg) (n=20)		Disintegration time (minutes) (n=6)
			Shape	Color		Min-Max	Mean	
		0	Transparent capsule	brown powder	6.64 %	462.4-547.0	506.5	10
	3	Transparent capsule	brown powder	6.57 %	476.6-528.6	507.0	10	
	6	Transparent capsule	brown powder	6.77 %	465.7-545.2	505.4	10	
	Capsule	Accelerated storage (40°C ± 2°C and 75% RH ± 5% RH)						
		Timepoint (months)	Appearance		%LOD (n=3)	Wight variation (mg) (n=20)		Disintegration time (minutes) (n=6)
			Shape	Color		Min-Max	Mean	
		0	Transparent capsule	brown powder	6.64 %	462.4-547.0	506.5	10
3		Transparent capsule	brown powder	7.66 %	476.6-528.6	507.0	10	
6		Transparent capsule	brown powder	8.20 %	465.7-545.2	505.4	10	

Long-term storage (30°C ± 2°C and 75% RH ± 5% RH)								
Timepoint (months)	Appearance		%LOD (n=3)	Diameter (mm) (n=10)	Wight variation (mg) (n=20)		Disintegration time (minutes) (n=6)	
	Shape	Color		Mean	Min-Max	Mean		
Pill	0	Round pills	Brown	2.14 %	6.63	163.0-196.5	180.7	25
	3	Round pills	Brown	2.77 %	6.49	161.0-191.9	173.6	25
	6	Round pills	Brown	3.20 %	6.48	158.4-192.0	175.4	25
	Accelerated storage (40°C ± 2°C and 75% RH ± 5% RH)							
	Timepoint (months)	Appearance		%LOD (n=3)	Diameter (mm) (n=10)	Wight variation (mg) (n=20)		Disintegration time (minutes) (n=6)
		Shape	Color		Mean	Min-Max	Mean	
	0	Round pills	Brown	2.14 %	6.63	163.0-196.5	180.7	25
	3	Round pills	Brown	3.27 %	6.63	156.2-195.3	179.3	25
	6	Round pills	Brown	4.90 %	6.51	160.9-194.8	179.7	25

Table 6 Microbial contamination of three dosage forms of SSY after six months under long-term (30°C ± 2°C and 75% RH ± 5% RH) and accelerated (40°C ± 2°C and 75% RH ± 5% RH) storage conditions

Storage conditions	Dosage form	Timepoint (months)	List of microbial						
			Total Aerobic Microbial Count (TAMC) (cfu/g)	Total Yeast and Mold Count (TYMC) (cfu/g)	Bile-tolerant gram negative bacteria (cfu/g)	<i>Salmonella</i> spp. (cfu)	<i>Escherichia coli</i> (cfu)	<i>Staphylococcus aureus</i> (cfu)	<i>Clostridium</i> spp. (cfu)
Long-term storage	Powder	0	< 100	< 100	< 10	Absence	Absence	Absence	Absence
		3	< 100	< 100	< 10	Absence	Absence	Absence	Absence
		6	< 100	< 100	< 10	Absence	Absence	Absence	Absence
	Capsule	0	< 100	< 100	< 10	Absence	Absence	Absence	Absence
		3	< 100	< 100	< 10	Absence	Absence	Absence	Absence
		6	< 100	< 100	< 10	Absence	Absence	Absence	Absence
	Pill	0	< 100	< 100	< 10	Absence	Absence	Absence	Absence
		3	< 100	< 100	< 10	Absence	Absence	Absence	Absence
		6	< 100	< 100	< 10	Absence	Absence	Absence	Absence
Accelerated storage	Powder	0	< 100	< 100	< 10	Absence	Absence	Absence	Absence
		3	< 100	< 100	< 10	Absence	Absence	Absence	Absence
		6	< 100	< 100	< 10	Absence	Absence	Absence	Absence
	Capsule	0	< 100	< 100	< 10	Absence	Absence	Absence	Absence
		3	< 100	< 100	< 10	Absence	Absence	Absence	Absence
		6	< 100	< 100	< 10	Absence	Absence	Absence	Absence
	Pill	0	< 100	< 100	< 10	Absence	Absence	Absence	Absence
		3	< 100	< 100	< 10	Absence	Absence	Absence	Absence
		6	< 100	< 100	< 10	Absence	Absence	Absence	Absence

However, chemical testing revealed that UPLC analysis of gallic acid and piperine showed piperine content remained within ±10% of the initial value in all samples. In contrast, gallic acid content decreased by more than 10% from the initial value only in the capsule dosage form under accelerated conditions at six months. For CBD and Δ⁹-THC, GC-MS analysis indicated that only the SSY powder dosage form under long-term conditions maintained both compounds within ±10% of the initial values throughout the six-month period. Detailed results are presented in Figure 1.

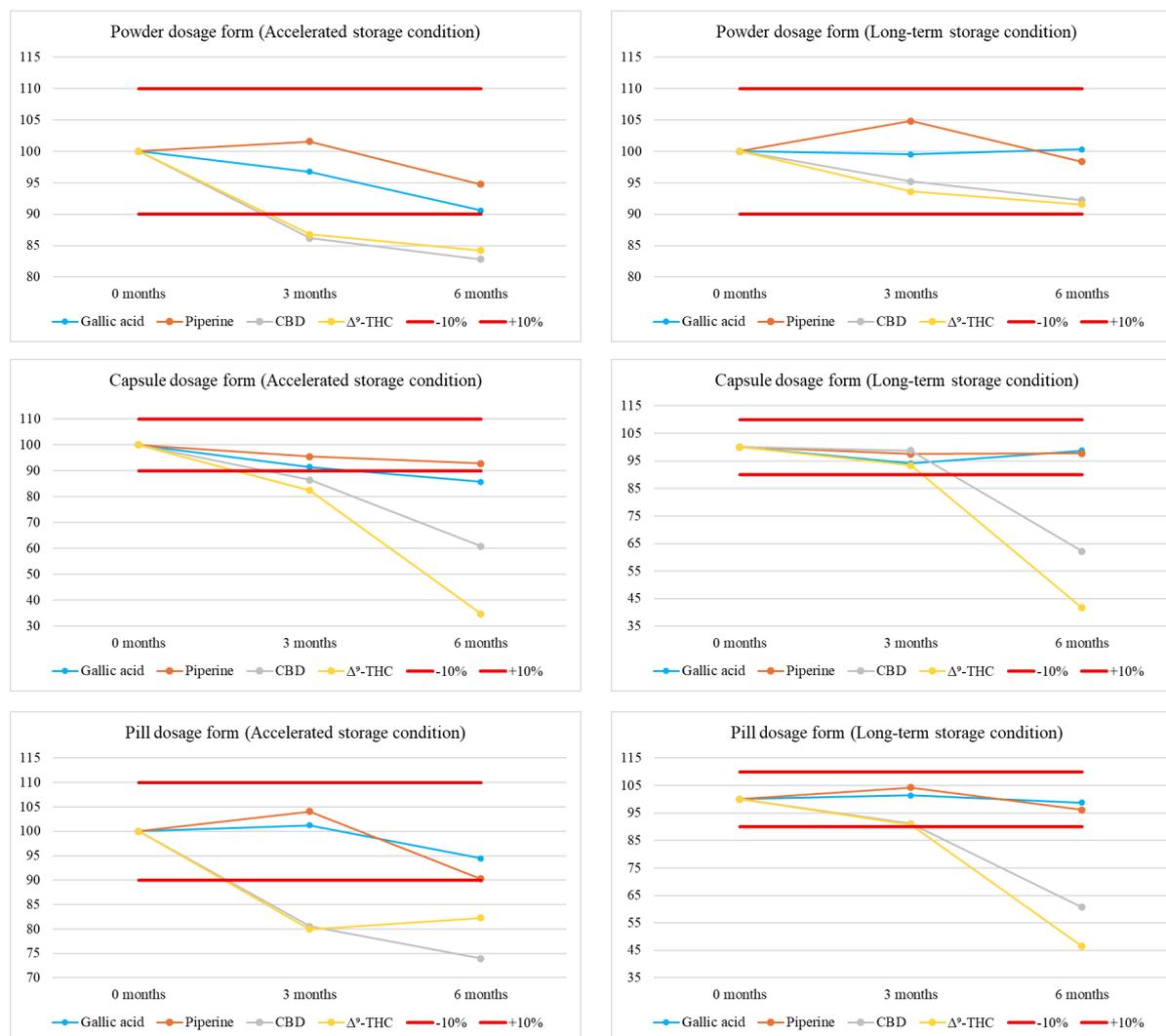


Figure 1 Percent remaining contents of gallic acid, piperine, CBD, and Δ^9 -THC in three SSY dosage forms (powder, capsule, and pill) under accelerated storage conditions ($40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and $75\% \text{RH} \pm 5\% \text{RH}$) and long-term storage conditions ($30^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and $75\% \text{RH} \pm 5\% \text{RH}$) over a six-month period.

DISCUSSION & CONCLUSION

From the development of SSY in pill dosage form, Formula 2 was identified as the most suitable, as it passed all physical test parameters and achieved the highest percentage yield. The average weight of SSY pill Formula 2 was approximately 180 mg, prepared from SSY powder (60%), glucose syrup (10%), and distilled water (30%). In addition, the pill manufacturing process included a honey-coating step, in which a total of 3 g of honey was used. Based on this calculation, each SSY pill (Formula 2) contained approximately 152.98 mg of SSY powder and 27.02 mg of binder. Compared with the recommended dosage of SSY in the National List of Essential Medicines (0.5-2 g/day), approximately 13 pills would be required to meet the daily intake specified in the National List (Drug Act B.E. 2510 (1967)). The stability study demonstrated that while all three SSY dosage forms passed physical tests and met microbial contamination criteria, their chemical stability was inconsistent. The content of marker compounds did not remain within acceptance limits under accelerated conditions. Therefore, the results from the accelerated stability study did not support a provisional 2-year shelf life, as the product failed to demonstrate the required six-month stability outlined by the World Health Organization (2009) (World Health organization, 2009). Considering marker

compounds, gallic acid and piperine appeared to be the most appropriate due to their relatively higher stability over six months, whereas CBD and Δ^9 -THC exhibited lower stability. This highlights the discrepancy between the two testing methods: The accelerated study, using only piperine and gallic acid as markers, suggested a 2-year shelf life for both powder and pill formulations. In stark contrast, the more comprehensive long-term study of all compounds revealed that only the powder form remained stable, and for merely six months.

Although SSY powder showed the highest stability in terms of chemical constituents in long term stability condition, previous clinical studies have reported several adverse effects associated with its ingestion, including heartburn, gastrointestinal irritation, burning sensations in the mouth, throat, and abdomen, as well as dryness of the mouth and throat (Boontham et al., 2022; Jamparngernthaweessri et al., 2023; Tengtermwong, 2021; Tipratchadaporn, 2021). These adverse effects are likely attributable to the inherently warm nature of the SSY formulation and the direct contact of the powdered medicine with the gastrointestinal tract. In contrast, SSY pills, with the addition of binders, exhibit a slower disintegration rate, potentially reducing the occurrence of such adverse effects.

If CBD and Δ^9 -THC are to be established as quality markers, the development of new formulations that enhance their stability is essential. Encapsulation techniques may provide protection against light, moisture, and oxygen, as factors such as increased humidity can accelerate hydrolysis reactions, while heat and light can further promote degradation of CBD and Δ^9 -THC. Improved packaging, such as Alu-Alu blister packs, should also be considered to provide better moisture protection.

Therefore, further human studies are required to compare the efficacy and adverse effects of SSY in all three dosage forms. In addition, investigations on pharmacokinetics, pharmacodynamics, and clinical trials are necessary to determine the minimum effective dose of SSY. Future research should also focus on the development of new formulations designed to improve the stability of active constituents.

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