



Phonetic Investigation of the Yingtan Variety of Gan Chinese: A Comparative Analysis Based on Single-Speaker Data

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Abstract. This study investigated the speech data from a young speaker (23 years old) of Gan Chinese in Yingtan, Jiangxi Province, China. By comparing the phonemic inventory and tone systems, this study finds over all consistency in the inventory except for /ɣ/ devoicing into /x/, and a potential signal of /e/ and /ie/ merger. The study also finds the tone system revealed by data to be systematically inconsistent with previous study on Gan spoken in Yingtan and two surrounding areas in Yingtan city. Other than that, cues for perceiving entering tones are further discussed in terms of vowel duration, rather than relying only on the presence of the coda stop. In addition, this study founds several alternations potentially attributes to language contacts especially from Mandarin, notes limitations in sample size and data scope, and raises questions for future research with more focused experimental designs.

Keywords: Gan Chinese, Phonetic Description, Tone and Syllable Structure, Single-Speaker Corpus

1 Introduction

Gan Chinese (赣语) is one of the seven Sinitic language groups, primarily spoken in Jiangxi Province, China. It boasts approximately 48 million speakers nationwide, with roughly 29 million residing in Jiangxi, the language's main stronghold. Although Gan Chinese shares the same writing system with Mandarin Chinese, the two languages are not mutually intelligible. The term “Gan” generally denotes the geographical area roughly corresponding to modern-day Jiangxi, which is also the historical core of Gan's cultural and ethnic development. From a linguistic standpoint, Not only does Gan Chinese and Mandarin differ in phonological systems, certain varieties within the Gan group (traditionally referred to as “piàn (片)” or branches) may also share limited mutual intelligibility with the other. In comparison with Mandarin, Wu, Hakka, and Cantonese, Gan Chinese has attracted relatively little research attention, and comprehensive corpora, phonetic records, and descriptive materials remain scarce. Existing research on Gan is important for the study of Sinitic Languages, the reconstruction of Middle

Chinese features, as well as the analysis of sound changes. Thus, this study collects speech data from a female speaker of Yingtan Gan, Speaker Q, consisting of a total of 270 tokens of utterance. By examining these data alongside prior descriptions, it becomes evident that Speaker Q's speech differs in certain respects from that of earlier middle-aged speakers, reflecting both generational changes and possible influences from the promotion of Mandarin. Accordingly, this study seeks to create a preliminary but systematically organized phonetic dataset, with fully annotated .TextGrid files, to serve as a foundational resource for Gan research. In addition, this study investigates the realization of two phonological features in Yingtan Gan, namely entering tones, corresponding to syllables with coda stops, and sequences with a zero consonant onset. Through the analysis of these features, new empirical insights into Gan Chinese phonology is generated, supporting further comparative and historical studies.

2 Literature Review

2.1 Onset Consonant Features and Dialectal Differences

Nine major varieties of Gan Chinese are defined by previous dialectological investigations, usually named according to the regions in which they are spoken. Earlier studies categorized the Yingtan Gan examined in this study under the Yugan branch (余干片). However, recent studies, particularly Yang and Li, place it in the Yingyi branch (鹰弋片), and this study adopts the same view [1-3]. In this paper, Yingtan Gan (鹰潭话), considered a Yingyi variety of Gan Chinese, is examined. As a result, the Yingtan Gan dialect exhibits some unique features in its consonant system while showing differences from previous records of neighboring areas.

To understand these features in detail, it is useful to consider Chen Changyi's Dialect Records of Jiangxi Province, which laid the foundation for the study of Gan Chinese [1]. His research involved large-scale data collection in 79 areas of Jiangxi Province, but it did not include Yuehu, the urban area of Yingtan City, where the speaker identifies as belonging to. Yang's report fills this gap, allowing for a comparison of data from different Yingtan Gan speakers from Yuehu area, and this study relies largely on that report [2].

Based on Yang's research, the Yingtan Gan includes 18 consonants in the inventory, not including the zero consonant onset, as presented in Table 1 [2]. Although the exclusion of zero onset from the phonemic inventory is now a common practice in analysing Sinitic Languages, the treatment of it had been a topic of discussion among linguistics trained by the conventional Chinese phonology framework. The historical background of a zero onset often involves categorical reduction of a consonant onset, example being the “/ə/-/j/” merger in Midde Chinese [4]. Not only is it a historical event, similar tendency are also reported as ongoing sound changes in another Gan dialect [5]. In production, zero onset are often not realized as none. In a descriptive analyse of Yichun Gan, Li observed that [ʔ] always surfaces in onset position in /əa/, /əo/, /əe/ sequeces and [w], [j] typically realize in /əu/, /əy/ sequences [3]. This suggest that the realized zero onset is potentially associated with conditioned context rather than mere

absence of segment. Therefore, while the categorization of zero onset is no longer under debate, reserving its position in a /øV(C)/ sequence potentially benefits the convenience of phonological analysis. In following paragraphs, the term“zero onset” is used interchangeably with zero consonant onset.

Table 1. Consonant inventory of Yingtan Gan

	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Velar
Plosive	p ^h p		t ^h t			k ^h k
Nasal	m		n			ŋ
Fricative		f	s ɕ			ʃ
Affricate			ts ^h ts	te ^h te		
Lateral Approximant			l			

Like many Sinitic languages, the plosives and affricates of Yingtan Gan do not phonologically contrast voicing but aspiration, reflecting historical sound change from Middle Chinese. Nasals contrast places of articulation at the bilabial, alveolar, and velar all are potentially capable to form lexical syllables on their own. In addition, Yang also reports a voiced velar fricative /ɣ/, a sound not uncommon in southern Chinese dialects, though its precise phonetic realization is worth investigating, as the common sound change trend in Sinitic languages as well as the Jiangxi region involves a shift from [+voice] to [-voice] [2,4,5]. Thus, the Yingtan Gan exhibits distinct regional features in its consonant system while differing in certain ways from surrounding varieties such as Guixi and Yujiang. For example, the Guixi Gan lacks syllabic nasals, and in the Yujiang Gan only /m/ and /n/ can be syllabic. In addition, both Guixi and Yujiang appear to have a voiced labiodental fricative /v/, which is absent in Yingtan Gan.

2.2 Vowel Distribution Patterns and Dialectal Comparison

The Yingtan Gan permits monophthongs, diphthongs, triphthongs, /VN/ and /Vʔ/rhymes, forming the basis for its phonological analysis. In the following sections, the vowels and rhymes are examined and compared with neighboring dialects.

Features of the Vowel System. The Yingtan Gan vowel system exhibits regular patterns while also showing distinctive features at different vowel positions. Overall, the back vowels are rounded, whereas the [-back] vowels are unrounded, with the high front vowel being the only exception showing a contrast in roundness. The apical vowel /ɿ/ is commonly seen in Sinitic Languages; in Yingtan Gan, it occurs only after apical fricatives or affricates. Its phonetic nature remains as some degree of debate in the literature [6-9]. While recent acoustic and ultrasound studies observed non-typical pattern for a vowel due to unusual apical target, some proposed to consider that an approximant /ɹ/ [6,7,9]. Since Yang considered /ɿ/ as a vowel and compiled his wordlist accordingly, this study follows the same approach, treating /ɿ/ as a separate vowel [2].

Other vowels such as /ɛ/ and /ə/ mainly occur in specific diphthong or triphthong sequences, and are therefore treated as allophones of other phonemes in this study. Table 2 presents the vowel inventory of Yingtan Gan, providing a clear view of the distribution patterns of vowels in the front, central, and back positions.

Table 2. Vowel Inventory of Yingtan Gan

	Front	Central	Back
Close	i y	ɿ	u
Cloee-mid	e		o
Open	a		

Rhyme System and Dialectal Comparison. Syllables in Sinitic Languages are conventionally analyzed as consisting of an onset plus a rhyme, rather than as simple /(C)V(C)/ sequences. Its rhyme system includes monophthongs, diphthongs, triphthongs, and /VN/ sequences with nasal codas /n/ or /ŋ/. /Vʔ/ sequences with distinct tone quality are to be discussed later. The monophthongs are typical in distribution over the places, and are productive in forming diphthongs and triphthongs, resulting in a relatively rich variety of rhyme types [2]. Besides, the nasal coda in /VN/ sequences can combine with the preceding vowel to form an independent rhyme. As such, Yingtan Gan has 7 monophthongs, 12 diphthongs, and 2 triphthongs, as shown in Table 3. Such an inventory are fairly typical in the area, while also showing some of the regional differences. For example, the Guixi and Yujiang dialects do not feature the high front rounded vowel /y/ or the diphthong /yu/. These characteristics provide a foundation for the comparison and analysis of fieldwork data.

Table 3. Rhyme System of Yingtan Gan Chinese

Rhyme Type	Examples
Monophthongs	/i/, /y/, /ɿ/, /e/, /a/, /o/, /u/
Diphthongs	/ai/, /au/, /ei/, /ia/, /ie/, /iu/, /io/, /ua/, /uo/, /ui/, /ue/, /yu/
Triphthongs	/iau/, /uai/
/VN/ sequences	/Vn/, /Vŋ/

2.3 Tone Types Analysis and Phonological Study

Like the most members of the Sinitic group, Yingtan Gan is tonal, tones are marked by the system developed by Chao Yuen Ren for suprasegmental notation. According to Yang, the tonal system of Yingtan Gan consists of six tones, comprising one level tone, three contour tones, and two entering tones [2]. The entering tones refers to a distinct tone group occurs specifically with coda stop syllables. The origin of which could, as well, be traced back to middle Chinese [3]. The realization of entering tones has been widely investigated in multiple Sinitic languages. Typically, entering tones are realized with shortened vowel duration, and the coda stops are often reduced and unreleased

[10-12]. In the case of Yingtang Gan, all entering tone syllables are /Vʔ/ sequences, considered as a “reduction” from middle Chinese entering tone syllables [2,3]. Such tendency is not uncommon as it is also found as an ongoing change in mainstream American English known as t-glottalization [13]. Furthermore, recent study of the production of entering tone of Min speaker with Mandarin influence observed deletion of coda stop and lengthening of the vowel, revealed further reduction of coda stop sequences in another Sinitic language under the influence of language contact with Mandarin, which prohibits such pattern [14].

Studies of Cantonese report clear F0 patterns for entering tones, suggesting that their pitch quality is distinct from that of plain level tones. Considering that this distinction is also the norm in phonological analyses of Sinitic languages, the present study treats entering tones and their associated segmental sequences as part of the tonal system. For comparison, this study also refers to the tonal characteristics of the Gan dialects in Guixi and Yujiang, as shown in Table 4. It shows that dialects from different regions differ notably in tone values, contour types, and the realization of entering tones.

Table 4. Tone Qualities in Three Areas of Yingtang City

Tone	Yingtang	Guixi	Yujiang
1	/44/	/33/	/24/
2	/24/	/14/	/453/
3	/341/	/215/	/31/
4	/41/	/41/	/22/
5	/ʔ5/	/ʔ5/	/ʔ4/
6	/ʔ2/	/ʔ2/	/ʔ1/

3 Methodology

3.1 Speaker Profile and Linguistic Competence

The data for this study were provided by a female participant, hereafter referred to as Speaker Q. And the purpose and procedures of the study were fully explained to her prior to data collection. Born in the 2000s in Yingtang, Jiangxi Province, Speaker Q is a native speaker of the Yingtang variety of Gan Chinese. She acquired Gan Chinese as her first language in the family environment and has continued to use it regularly in interactions with family members, close friends, and the local community. Despite exposure to Standard Mandarin from elementary school, she maintains a high level of fluency in Yingtang Gan, thus demonstrating stable phonological and lexical competence appropriate for phonetic analysis. Her linguistic background provides a reliable basis for the study, as the continuous use of Yingtang Gan across different social contexts allows the recordings to capture representative features of the dialect. This combination ensures that the collected data accurately reflect natural usage and provide a reliable basis for analysis.

3.2 Data Acquisition and Recording Procedures

The speaker recorded the material independently, following instructions provided in advance via a remote meeting. She was instructed to optimize the recording environment by turning off desktops and air conditioning and by addressing other potential sources of noise. In addition, she was instructed to position herself close to a wall and to place a cushion against it to minimize echo. Once the “recording studio” was prepared, the speaker positioned the recording device, an iPhone 14, between herself and the wall, and left it in place for the duration of the session. The recording was conducted using the X Recorder software, with the channel set to mono and a sampling frequency of 48,000 Hz.

The final output is a 13-minute .wav file featuring 80 monosyllabic lexical items repeated three times each, six sentences repeated three times each, and twelve disyllabic phrases presented a single time. The wordlist for the 80 lexical items was derived from Chen’s illustration and subsequently utilized in Yang’s investigation. Although occasional bursts and background noise were present due to the omnidirectional recording feature of the iPhone, the audio quality was adequate for the purposes of this study. All utterances were clearly intelligible, and segment boundaries were readily identifiable in the spectrogram.

3.3 Analytical Approach and Data Processing

The data is imported into Praat for further annotation. Segmentation is two tier and by word, with the first tier labeling the English meaning and underlying representation according to Yang’s illustration, and second tier being the IPA transcription for utterance. The transcription is based on transcriber’s auditory perception. In cases where auditory cues are subtle, the transcriber also inspect the spectrogram and extract information such as duration, formant and pitch to determine the surface form. The transcription was then made into a chart in the order they appear in the wordlist, and compared the result with Yang’s illustration.

4 Results and Analysis

4.1 Tonal Characteristics and Individual Variation Analysis

The tonal system of Yingtan Gan as observed in the current dataset exhibits both systematic patterns and individual variation when compared with the illustrations provided by Yang for Yingtan and Chen for nearby areas.

Tone 1 /44/ is realized as a markedly lower level tone than reported in previous studies. While a few occurrences of modal particles preserve [44], most tokens are consistently realized as [22], thus indicating a shift in pitch height in actual speech production. Tone 2 /24/ shows variation between [24] and [213], which may reflect in-word phonetic alternation. The data reveal that [24] typically occurs in the first repetition of a word, whereas [213] emerges in later repetitions, implying that articulation precision influences tonal production. Tone 3 /341/ has lost its original falling contour in most

monosyllabic lexical items, being realized as [34]. However, the full contour [341] remains detectable at prosodic end boundaries, exhibiting that tonal variation interacts with speech prosody. For instance, the phrase “Zhang’s daughter, son, stepson” (小张的女儿, 儿子, 继子) /ɛiau341 taŋ44 koʔ2 ny341 ə24 tsai341 jaŋ341 tsai341/ is realized as [ɛiau34 taŋ22 kə nie24 tsai341 jaŋ34 tsai341], illustrating this systematic reduction in pitch contour.

Tone 4 /41/ is generally realised as [41], the falling destination, however, does not always sound as extreme, but rather somewhere close to [42]. The entering tones /ʔ5/ and /ʔ2/ are both realised as [ʔ5] with no /ʔ2/ attested. According to Table 5, which compares the observed tonal realizations with Yang’s Yingtian data and Chen’s data from neighboring areas, the tonal patterns in this study do not closely match any previously reported system. This discrepancy may be attributed to generational differences, regional variation, language contact, or a combination of these factors.

Table 5. Realization of Tones Compared with Underlying Pitch

Tone	Yingtian	Guixi	Yujiang	Data
1	/44/	/33/	/24/	[22]
2	/24/	/14/	/453/	[24]~[213]
3	/341/	/215/	/31/	[34]
4	/41/	/41/	/22/	[41]~[42]
5	/ʔ5/	/ʔ5/	/ʔ4/	[ʔ5]
6	/ʔ2/	/ʔ2/	/ʔ1/	[ʔ5]

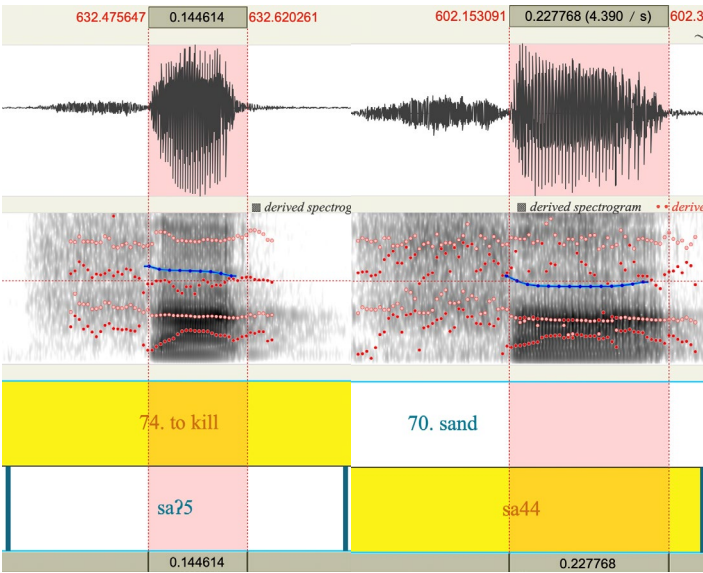


Fig. 1. Vowel duration of saʔ5 and sa44

Entering tones, as noted in the introduction, are a conventional Chinese phonological category realized with stop-coda syllables. Examples from Cantonese include /jat/

“one” and /ʌk/ “six,” where the stops are often unreleased. In Yingtan Gan, all entering tone syllables have a /ʔ/ coda, which is often unrealized or reduced to creaky voice quality, rendering the glottal stop inaudible. Such variation is not unexpected since studies on other languages widely report /ʔ/ to be altered and, in many occasions, reduced [15]. However, these tones remain perceptible. According to Figure 1, which presents a timing comparison of a tonal minimal pair, the vowel in the /_ ʔ/ word [saʔ5] “to kill” has a significantly shorter duration than [sa44] “sand,” indicating that vowel duration, together with pitch height, may serve as a more stable predictor for entering tones than the presence of clear acoustic signal of a glottal stop-release dynamic.

Common across many tonal languages, prosodic information in Yingtan Gan is not solely revealed by pitch accent but by a combination of stress and timing. Two sentences below are used for testing prosodic intonation.

79 [ˈna34 (“which”).sɿ42.ɕiau34.taŋ22.kə.nie24] “Who is Zhang’s daughter?”

80 [ˈko34 (“this”).sɿ42.ɕiau34.taŋ22.kə.nie24] “This is Zhang’s daughter,”

The speaker produced distinctively higher volume, longer duration, and, hence, exaggerated tonal contour for both word in focus [na34] and [ko34], illustrating how tonal hyperarticulation and timing cues signal focus in natural speech.

4.2 The Consonant System and Its Dialectal Differences

In the data collected, this study observed the same onset consonant inventory as Yang’s illustration with one exception being the voiced velar fricative /ɣ/, which was never realized in the data. Table 6 presents the outcomes of a speech production test for /ɣ__/ sequences, showing that /ɣ/ is systematically devoiced to [x] in the speaker’s productions. The vowel /o/ showed some backing effect on /x/ in some tokens for examples 29 and 98, such alternation could potentially be attributed to anticipatory coarticulation, and the occurrence is probabilistic, therefore not categorical.

Table 6. Realization of /ɣ/

Word	Definition	Repetition 1	2	3
29. 和 /o24/	“peace”	[xo24]	[χo24]	[χo24]
94. 瞎 /ɣa44/	“blind”	[xaʔ5]		
95. 鞋 /ɣai24/	“shoe”	[xai24]	[xai24]	[xai213]
96. 憨 /ɣan44/	“dumb”	[xoŋ44]	[xoŋ44]	[xoŋ22]
97. 好 /ɣau341/	“nice”	[xau341]	[xau341]	[xau34]
98. 河 /ɣo24/	“river”	[χo24]		

The realizations of syllabic nasal words /m44/, /n24/, and /ŋ341/ are summarized in Table 7. Among these, /ŋ341/ “five” was realized frontedly as [ɲ34], whereas the other potential syllabic nasals did not occur in the data. Attempts to elicit additional syllabic nasal words were unsuccessful despite consultation with the speaker. These observations suggest two characteristics of Yingtan Gan. First, the scarcity of syllabic nasal words indicates that this class is marginally productive and limited in lexical distribution. Second, the difference in syllabic nasal realization between the current speaker and those documented by Yang may reflect an ongoing sound change in Yingtan Gan.

Table 7. Realization of Syllabic Nasal Words

Word	Meaning	
19. 吗 /m44/	“modal particle”	[mɛ44]
20. 你 /ŋ24/	“2nd SG pronoun”	[ni24]
21. 五 /ŋ341/	“five”	[ŋ34] *Check POA

Moreover, Table 8 illustrates the realizations of nasal codas following various vowels, revealing a complementary distribution in which /n/ occurs after front vowels and /ŋ/ after back vowels. The speaker consistently generalizes this pattern, though different elements may be manipulated to conform to the distribution. For instance, in articulating /piŋ44/ “the guest,” the nasal coda was altered to yield [pin22], whereas in /paŋ44/ “to help,” the vowel was modified, resulting in [paŋ22]. This reflects both systematic phonotactics and flexible articulation.

Table 8. Nasal Coda Rhymes

Rhymes	Word	Definition	Transcription 1	2	3
/an/	/pan44/	班 “class”	[pan22]		
/uan/	/uan44/	弯 “bended”	[βʷan22]		
/on/	/pon44/	搬 “to lift”	[poŋ22]		
/uon/	/uon24/	完 “finished”	[βoŋ24]		
/yn/	/kyn41/	棍 “stick”	[kyn42]	[kyn42]	[kʰyn42]
/ien/	/pien44/	边 “the edge”	[pien22]		
/aŋ/	/paŋ44/	帮 “to help”	[paŋ22]		
/iaŋ/	/iaŋ44/	秧 “plant”	[jaŋ44]		
/uaŋ/	/uaŋ24/	王 “surname”	[βaŋ24]		
/əŋ/	/pəŋ44/	奔 “to run”	[pən22]		
/iŋ/	/piŋ44/	宾 “the guest”	[pin22]		
/iuŋ/	/iuŋ41/	用 “too use”	[joŋ42]		
/uŋ/	/tuŋ44/	东 “east”	[toŋ22]		

4.3 Vowel Types and the Distribution of Zero Onsets

The dataset exhibits a vowel inventory largely consistent with Yang’s illustration, with the notable exception that [e] is not realized for the word with underlying vowel /ke24/ “to saw,” which is realized as [kie42]. This forms a minimal pair with /kʰie41/ “to go to,” realized as [kʰie42]. Although the dataset is too limited to claim a phonological merger, the speaker reported that the two rhymes are perceived as identical. Notably, the vowel duration for both words is approximately 27 ms, which is significantly shorter than the typical duration of diphthongs in this dataset (around 40 ms) but closer to that of monophthongs. However, the offglide is auditorily perceivable, and the trajectories of the first and second formants, as shown in Figure 2, support the realization of [ie]. While the /ie/ rhyme is realized as a higher [ie], [ɛ] appears in environments like /i_ n/ and /_ʔ/, in complementary distribution with [e].

Zero onset consonants vary with the following vowel. In /ØV/ sequences (except for /Øu/), a glottal stop is frequently realized, with a clearly observable burst on the spectrogram. In sequences preceding /u/ or /u_ / rhymes, the zero onset typically labializes

the vowel and may introduce frication. For example, /uai44/ “cooked” is realized as [βai22], [vai22], or [wai22]. In such /Øu_/_ sequences, [β] and [v] are the most stable realizations of the zero onset. Third, in /Øi_/_ sequences, the /i/ often becomes a glide [j], occasionally preceded by a glottal stop. For instance, /iau44/ “hip” is realized as [jau22] or [ʔiau22]. Figure 3 presents examples of glottal bursts preceding /Øi_/_ sequences, showing the acoustic characteristics of this zero onset pattern.

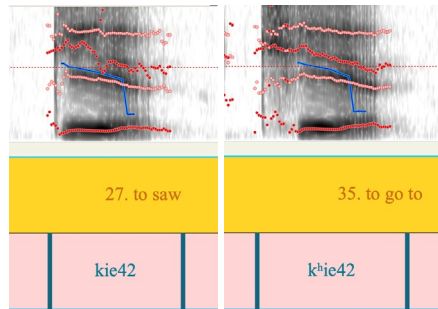


Fig. 2. Formants of kie42 and kʰie42

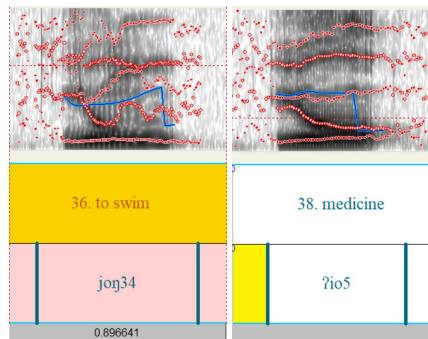


Fig. 3. Spectrogram of /Øi_/_ sequences

5 Conclusion

This study examined a remotely collected dataset of the Yingtan Gan Chinese spoken in Yuehu area, Jiangxi Province. Comparison with previous studies on the same variety revealed several differences. In the consonant system, the voiced velar fricative /ɣ/ is consistently devoiced to [x]. The vowel inventory largely aligns with Yang’s illustration, with a potential /e/~ie/ merger observed. Among three syllabic nasal words, two are realized as /NV/ sequences rather than true syllabic nasals. Tone quality differs most markedly from Yang’s description, yet the shift remains systematic. These differences may reflect regional variation, generational patterns, contact with other languages, or a combination of factors. Due to the limited sample size, the precise causes of these differences remain unclear. Future research should involve a larger number of speakers with both similar and varied demographic profiles to minimize individual effects and

to better identify underlying patterns. Such a dataset would enable quantitative analysis of realization of features such as vowel qualities, zero consonants and entering tones. Notably, some alternations in the speaker's productions suggest potential influence from Standard Mandarin, as in /saʔ2/ "explode" realized as [tsa42], and /ai41/ "outside" realized as [ɬai44]. It also finds that zero onsets are most frequently realized as glottal stops, with clearly observable bursts on the spectrogram. Entering tones do not always end with an audible glottal stop; however, the reduced vowel duration in entering-tone words may reflect the mental representation of a coda consonant in the speaker's articulatory plan. Confirmation of this hypothesis would require further testing with different eliciting form such as running speech.

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