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RESEARCH ARTICLE

GENDER EFFECTS ON THE PRODUCTION OF PHARYNGEALIZED VOWELS IN YEMENI ARABIC DIALECTS: AN ACOUSTIC ANALYSIS

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Abstract

This study investigated the acoustic effects of gender on the production of pharyngealized vowel formant frequencies (F1 and F2) and vowel duration in three Yemeni Arabic dialects (YADs): Abyani (AD), Hadhrami (HD), and Ta'izzi (TD). Previous research has reported inconsistent findings. Some studies suggest that male speakers produce vowels with a greater degree of pharyngealization than female speakers (Ahmed, 1979; Khan, 1975; Khattab et al., 2006; Lehn, 1963; Wahba, 1993), whereas other studies indicate that female speakers exhibit more pronounced pharyngealization (Al-Masri & Jongman, 2004; Almbark, 2008; Royal, 1985). To address this inconsistency, an acoustic experiment was conducted involving three male and three female native speakers from each dialect. Stimuli consisted of pharyngealized consonants and their non-pharyngealized counterparts containing both long and short vowels, recorded in controlled carrier sentences. Formant frequencies were measured at three vowel positions: onset, midpoint, and offset. Vowel durations were also recorded. The results showed that gender systematically influenced the degree of pharyngealization. The female speakers exhibited higher F1 and lower F2 values compared to the male ones across all dialects, indicating that pharyngealization is more pronounced in the female speech. In contrast, vowel duration did not differ significantly between pharyngealized and non-pharyngealized contexts for either gender, although the females produced slightly longer vowels overall. These findings demonstrate that gender affects the acoustic realization of pharyngealization primarily through vowel quality rather than duration. This study contributes to the understanding of sociophonetic and dialectal variation in Yemeni Arabic and provides empirical evidence for gender-based differences in phonetic realization.

Keywords: Pharyngealization; Gender differences; Acoustic analysis; Formant frequencies; Yemeni arabic dialects.

1. Introduction:

Pharyngealization is a distinctive feature in Semitic languages such as Arabic and Hebrew. The term *pharyngealization* refers to consonants produced with a secondary constriction in the back of the vocal tract in addition to a primary constriction in the dental or alveolar region. All Yemeni Arabic dialects (YADs) have minimal word pairs that differ only in the presence of a pharyngealized versus a non-pharyngealized consonant. This study focuses on three YADs: Abyani (AD), Hadhrami (HD), and Ta'izzi (TD), spoken in different regions of Yemen.

Previous research has shown that gender influences the production of pharyngealized vowels, particularly through changes in vowel formant values. Some studies suggested that male speakers produce vowels with a higher degree of pharyngealization than female speakers (Ahmed, 1979; Khan, 1975; Khattab et al., 2006; Lehn, 1963; Wahba, 1993), whereas others reported that female speakers produce a greater degree of pharyngealization than males (Al-Masri & Jongman, 2004; Almbark, 2008; Royal, 1985). This inconsistency

in the literature motivates the current investigation into Yemeni Arabic dialects, which have received less attention in this specific area of sociophonetician research.

2. Literature Review:

Regarding the production of emphasis by male speakers compared to female speakers, Lehn (1963) examined the effect of gender on the production of emphasis in Cairene Arabic. The results showed that the male speakers exhibited more emphasis than the female speakers in terms of F1 and F2 of adjacent vowels, although no experimental analysis was conducted. Khan (1975) investigated the acoustic effects of gender on pharyngealization in Cairene Arabic. She found that the male speakers showed greater F2 lowering in vowels following pharyngealized consonants compared to the female ones. A follow-up study by Khan on non-Arabic speakers of American English showed no significant gender differences, indicating that these differences are dialect-specific. Similar findings were reported for other dialects. Wahba (1993) observed

a greater degree of emphasis in in male speakers of Alexandrian Arabic, although the acoustic distinction between pharyngealized and non-pharyngealized vowels was less pronounced in female speech. For Ahmed (1979), he examined Egyptian Arabic and found higher F2 lowering in the male speakers compared to the female speakers. Khattab et al. (2006) studied Jordanian Arabic and observed greater overlap of pharyngealized and non-pharyngealized vowels in the female speech than the male speech.

Another study on the male and female productions in Jordanian Arabic was conducted by Al-Masri & Jongman (2004). The results revealed that the female speakers exhibited a higher degree of F2 lowering in pharyngealized contexts compared to the male speakers. Regarding Syrian dialect, Almbark (2008) investigated Syrian Arabic and found that pharyngealization was more salient in the female speech for stops, but more salient in the male speech for fricatives, indicating nuanced gender effects. Royal (1985) reported that the Cairene female speakers generally produced less pharyngealization than the males, though social class and age influenced these patterns.

Collectively, most studies (Ahmed, 1979; Khan, 1975; Khattab et al., 2006; Lehn, 1963; Mujdey, 2011; Wahba, 1993) suggested that male speakers produce a higher degree of pharyngealization than female speakers, while a few studies (Al-Masri & Jongman, 2004; Almbark, 2008) reported the opposite pattern. These discrepancies highlight the need to examine whether similar patterns occur in YADs.

Regarding vowel duration, Al-Masri & Jongman (2004) reported mixed results on differences between pharyngealized and non-pharyngealized vowels, with durations reported in milliseconds (ms). Mujdey (2011) found that pharyngealized vowels were slightly longer than non-pharyngealized vowels, but no significant gender interaction was observed. The inconsistent findings regarding both formant frequencies and duration necessitate further investigation, particularly in under-researched dialectal contexts like Yemeni Arabic.

3. Study Significance:

This study is significant because it addresses gaps in the literature regarding gender effects on pharyngealized vowel production in YADs. While previous studies have focused on Egyptian, Jordanian and Syrian Arabic, little is known about Yemeni varieties. Examining both vowel formant frequencies and duration across the male and the female speakers in three YADs provides new insights into the sociophonetic and dialectal variation of Arabic. By focusing on YADs, this study contributes to a more comprehensive understanding of the phonetic realization of pharyngealization across the Arabic-speaking world, offering empirical data from a region often overlooked in phonetic studies.

4. Research Questions:

Based on prior literature on gender effects on the production of pharyngealization (Ahmed, 1979; Al-Masri & Jongman, 2004; Almbark, 2008; Khan, 1975; Khattab et al., 2006; Lehn, 1963; Mujdey, 2011; Royal, 1985; Wahba, 1993), the study aims to address the following research questions:

1. Does the degree of pharyngealization differ in the male and the female speech in terms of formant frequencies (F1-F2) at the three vowel positions across the three YADs?
2. Does the degree of pharyngealization differ in the male and the female speech in terms of vowel duration across the three YADs?

5. Research Hypotheses:

In addition to the research questions, the following hypotheses are proposed for testing:

1. Pharyngealization is more pronounced in the male speech than in the female speech in terms of F1 and F2 formant frequencies at the three vowel positions across the three YADs.
2. The duration of pharyngealized vowels is greater in the male speech than in the female speech across the three YADs.

6. Methodology:

This section of the study provides detailed information about the participants, stimulus materials, procedures, acoustic measurements, statistical analyses, and research questions. The methodology ensures reproducibility and clarity of the experimental design.

6.1. Participants:

Eighteen native speakers of Yemeni Arabic participated in the production experiment. The sample included three females and three males from each of the three YADs: AD, HD and TD. The participants' ages ranged from 20 to 40 years. None reported any speech, hearing, or visual impairments. Most participants were students in the English and Foreign Languages Department/College at Osmania University, India.

6.2. Stimulus Materials:

The stimuli consisted of 28 disyllabic minimal pairs containing pharyngealized and non-pharyngealized consonants. The target pharyngealized consonants were /tˤ, dˤ, sˤ, ðˤ/, and their plain counterparts were /t, d, s, ð/. In all tokens, the target consonant occurred either word-initially or word-medially, immediately followed by one of the long and short vowels /i:/, /u:/, /a:/, /i/, /u/, and /a/. Both real words and nonce (nonsense) words were included.

Each word was embedded in the carrier sentence: ***katab thalaath maraat*** (he wrote three times) and displayed on a 14-inch laptop screen for the speakers to read aloud.

6.3. Procedures:

Recordings were conducted in the phonetics laboratory at the English and Foreign Languages College, Osmania University, using a CSL 4200 with a Shure SM48 condenser microphone. The participants were instructed to read each target sentence three times at a normal speech rate. The recordings were stored on a 14-inch Sony laptop for subsequent analysis.

6.4. Acoustic Measurements:

The recordings were analyzed using Praat speech analysis software (version 5.4.04; Boersma & Weenink, 2014). The beginning and end of each target word were manually segmented and labeled. An automated script measured the F1 and F2 formant frequencies of the pharyngealized vowels and their plain counterparts at three

vowel positions: onset, midpoint, and offset. Another automated script measured the duration of both pharyngealized and non-pharyngealized vowels. Formant values (F1-F2) and vowel durations were plotted using the ggplot2 package (Wickham, 2009) to examine gender effects on vowel quality and duration.

6.5. Statistical Analysis:

All statistical analyses were carried out using R (version 3.2.3; R Core Team, 2015). A one-way ANOVA was conducted to examine the effect of pharyngealization on mean vowel durations. Additional ANOVAs tested the effect of gender on F1 and F2 formant frequencies at onset, midpoint, and offset, comparing pharyngealized vowels with their plain counterparts across the three YADs.

7. Results and Discussion:

This section presents the results of the analysis of gender differences in the production of pharyngealization in YADs. Specifically, it reports on F1 and F2 formant values as well as vowel duration in pharyngealized and non-pharyngealized environments, with the target consonants occurring either word-initially or word-medially.

A one-way analysis of variance (ANOVA) was conducted to examine the effect of gender on the formant values (F1–F2) of pharyngealized and non-pharyngealized vowels at three measurement points (onset, midpoint, offset) for each dialect separately. The same test was also applied to measure the effect of gender on the duration of pharyngealized and non-pharyngealized vowels. This allowed for a systematic comparison of both acoustic parameters across male and female speakers.

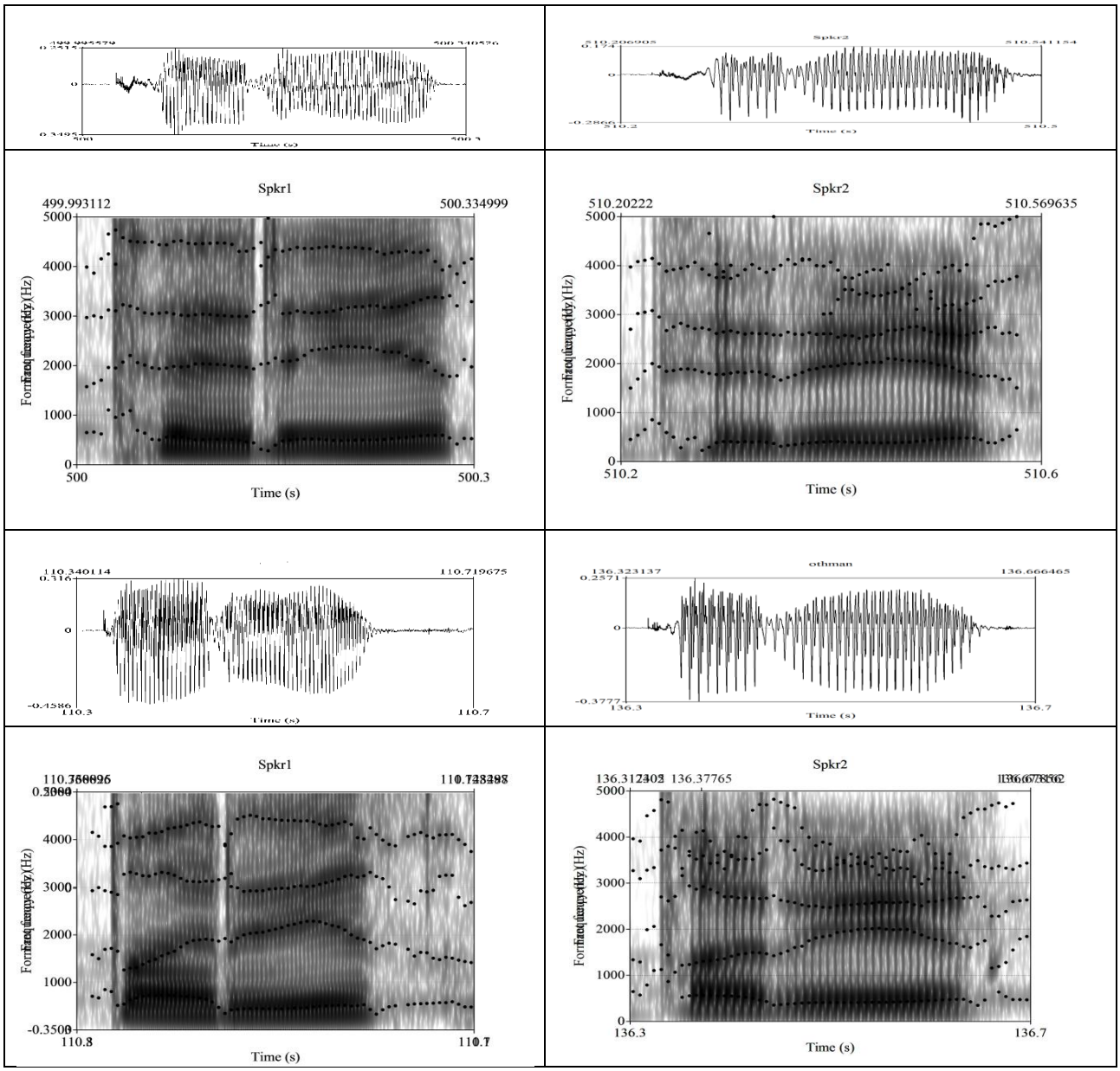
7.1. The Effect of Gender on F1 and F2 Formant Frequencies in AD:

A sample waveform and spectrogram of words starting with pharyngealized and non-pharyngealized stops are shown in Figure 1. The results revealed a clear main effect of pharyngealization on the F1 and F2 formant frequencies of the target vowel. Specifically. Pharyngealized vowels in the word *[tˤariiq]* exhibited higher F1 and lower F2 values compared to their non-pharyngealized counterparts in *[tariːq]*, which showed lower F1 and higher F2 values.

To test the effect of gender, sample waveforms and spectrograms were extracted from one female and one male native speaker of AD producing the target words *[tariiq]* and *[tˤariiq]* within the carrier sentence: ***"katab thalaath maraat"***

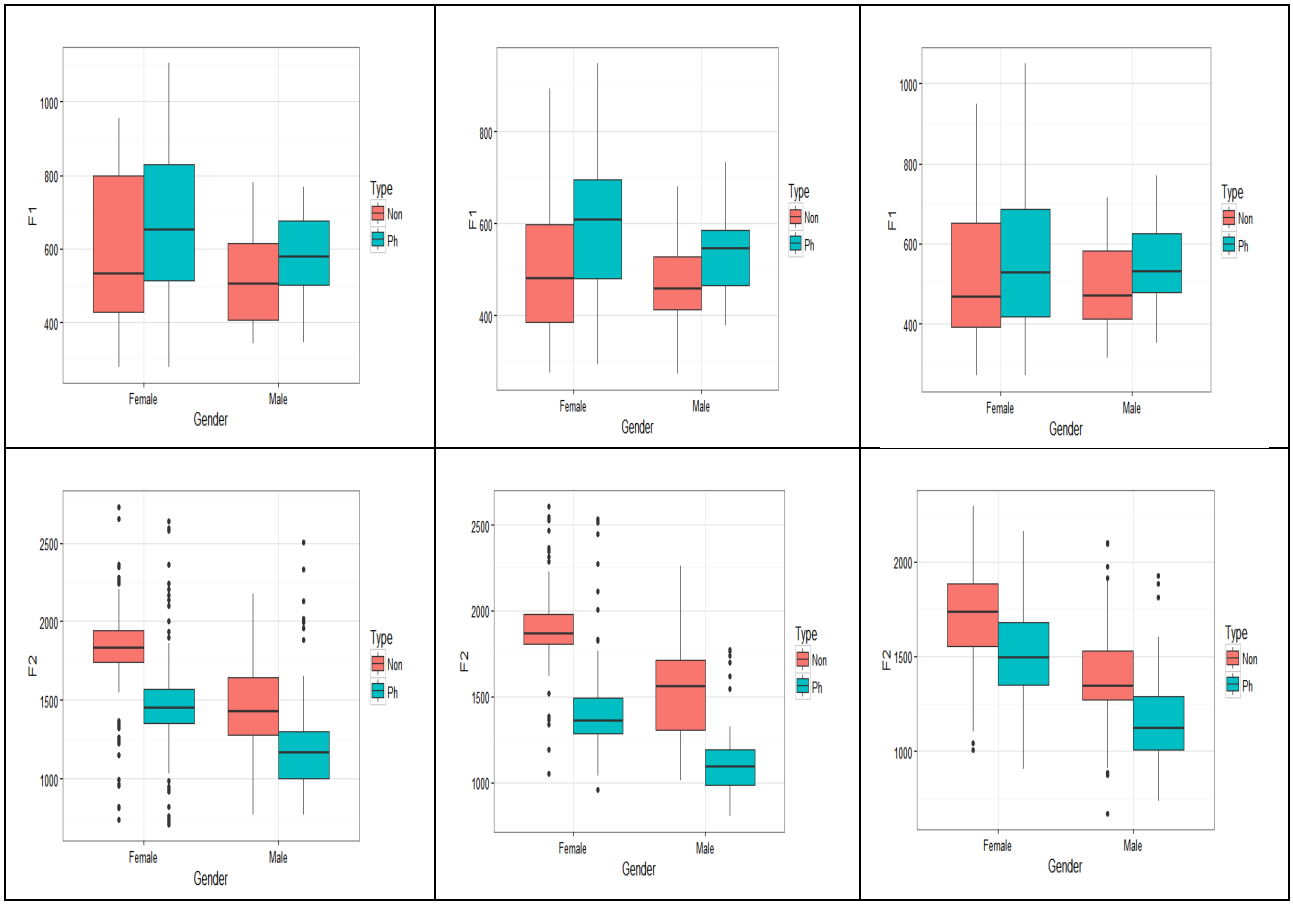
These data are presented in Figure 1 below. The analysis showed that the male speakers generally exhibited slightly higher F1 values and lower F2 values for pharyngealized vowels than the female speakers, consistent with findings in other Arabic dialect studies (e.g., Al-Masri & Jongman, 2004; Khattab et al., 2006). These results suggest that gender influences the acoustic realization of pharyngealization in AD, particularly in the vocalic formant structure.

Fig. 1: Waveforms and spectrograms of a female and a male native speaker of AD producing [tariiq] and [tˤariiq] respectively



A ggplot2 package (Wickham, 2009) was used to visualize the effect of gender on the formant values of pharyngealized vowels compared to their non-pharyngealized counterparts in AD. Figure 2 illustrates the F1 and F2 values at the onset, midpoint, and offset of the vowels in both pharyngealized and non-pharyngealized environments. The plots demonstrate that pharyngealized consonants increase F1 formant values and decrease F2 formant values of the vowels compared to non-pharyngealized consonants at all three vowel positions (onset, midpoint, and offset) for both male and female speakers. Moreover, the plots indicate gender-based variation in the production of pharyngealization: the female speakers exhibited higher F1 values and lower F2 values than the male speakers, suggesting that pharyngealization is more pronounced in the female speech.

Fig. 2: F1 and F2 formant frequencies of the male and female pharyngealized and non-pharyngealized vowels at the three vowel positions (onset, midpoint, and offset) in AD



The mean F1 and F2 values in Table 1 below show that the difference between F2 values of vowels following pharyngealized versus non-pharyngealized consonants was greater in the female speakers (e.g., 347 Hz at vowel midpoint) than in the male speakers (246 Hz), providing strong evidence that female speakers pharyngealize more than male speakers in AD.

Table 1: Mean F1 and F2 formant values for the male and female speakers of AD at three vowel positions

Vowel position	Pharyngealized vowels				Non-pharyngealized Vowels			
	Female		Male		Female		Male	
	F1	F2	F1	F2	F1	F2	F1	F2
Midpoint	671	1475	573	1219	594	1822	518	1465
Onset	590	1424	531	1127	507	1891	467	1552
Offset	557	1511	544	1152	519	1723	496	1395

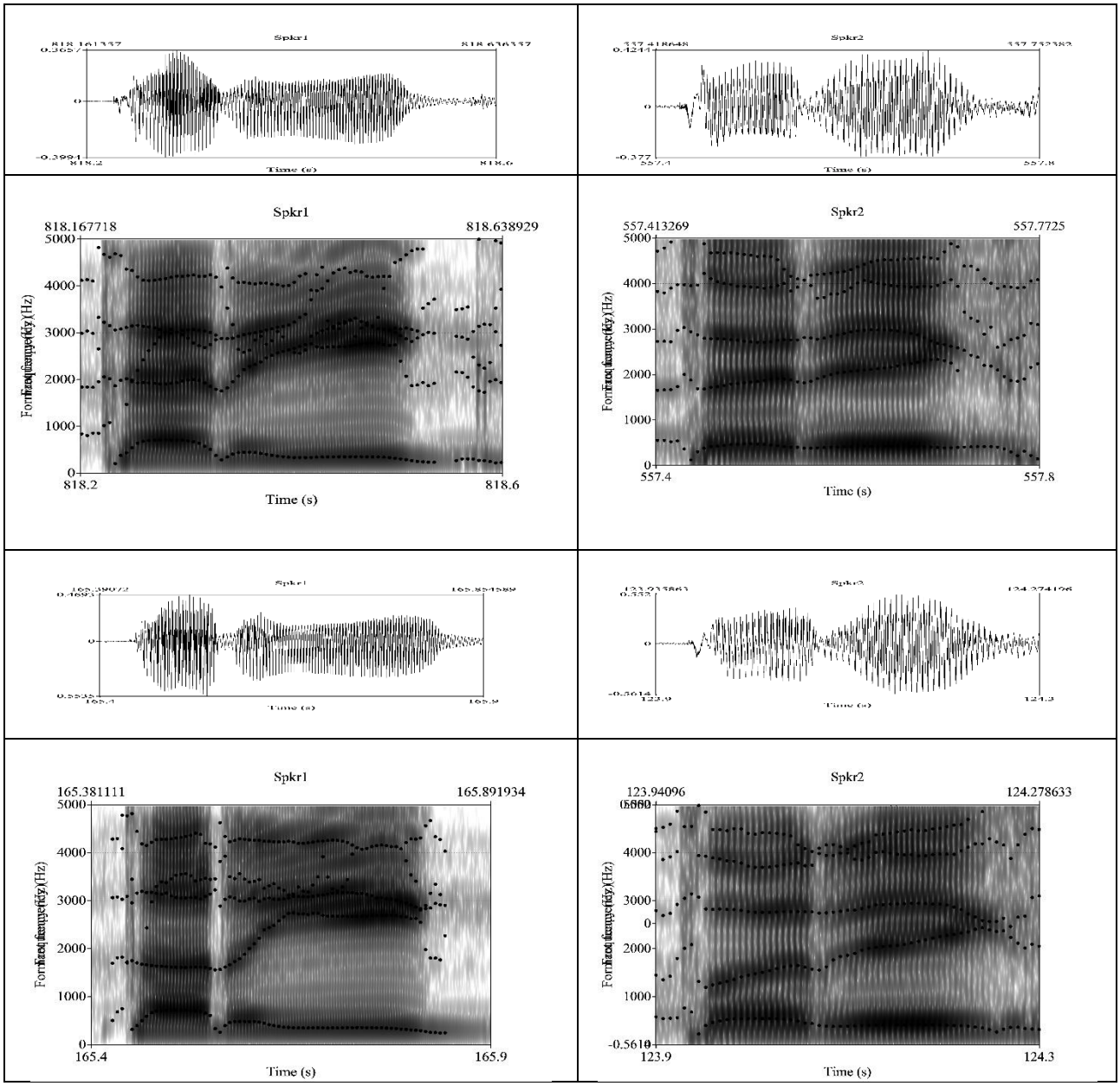
A one-way ANOVA confirmed these observations. The results indicated a significant main effect of gender on F1 at the vowel midpoint [$F(1, 250) = 22.64$, $p < .001$] and onset [$F(1, 250) = 17.10$, $p < .001$], but not at the offset [$F(1, 250) = 0.61$, $p = .44$]. For F2, gender had a significant effect at all three vowel positions: midpoint [$F(1, 250) = 37.93$, $p < .001$], onset [$F(1, 250) = 86.57$, $p < .001$], and offset [$F(1, 250) = 131.30$, $p < .001$].

7.2. The Effect of Gender on F1 and F2 Formant Frequencies in HD:

To examine the effect of gender on the formant frequencies of pharyngealized and non-pharyngealized vowels, sample waveforms and spectrograms were obtained from one male and one female speaker of HD producing the target words ***[tariiq] and [tˁariiq]*** in the carrier sentence 'katab ***<target word> thalaath maraat'***, as shown in Figure 3 below. The results revealed a clear effect of pharyngealization on the formant structure

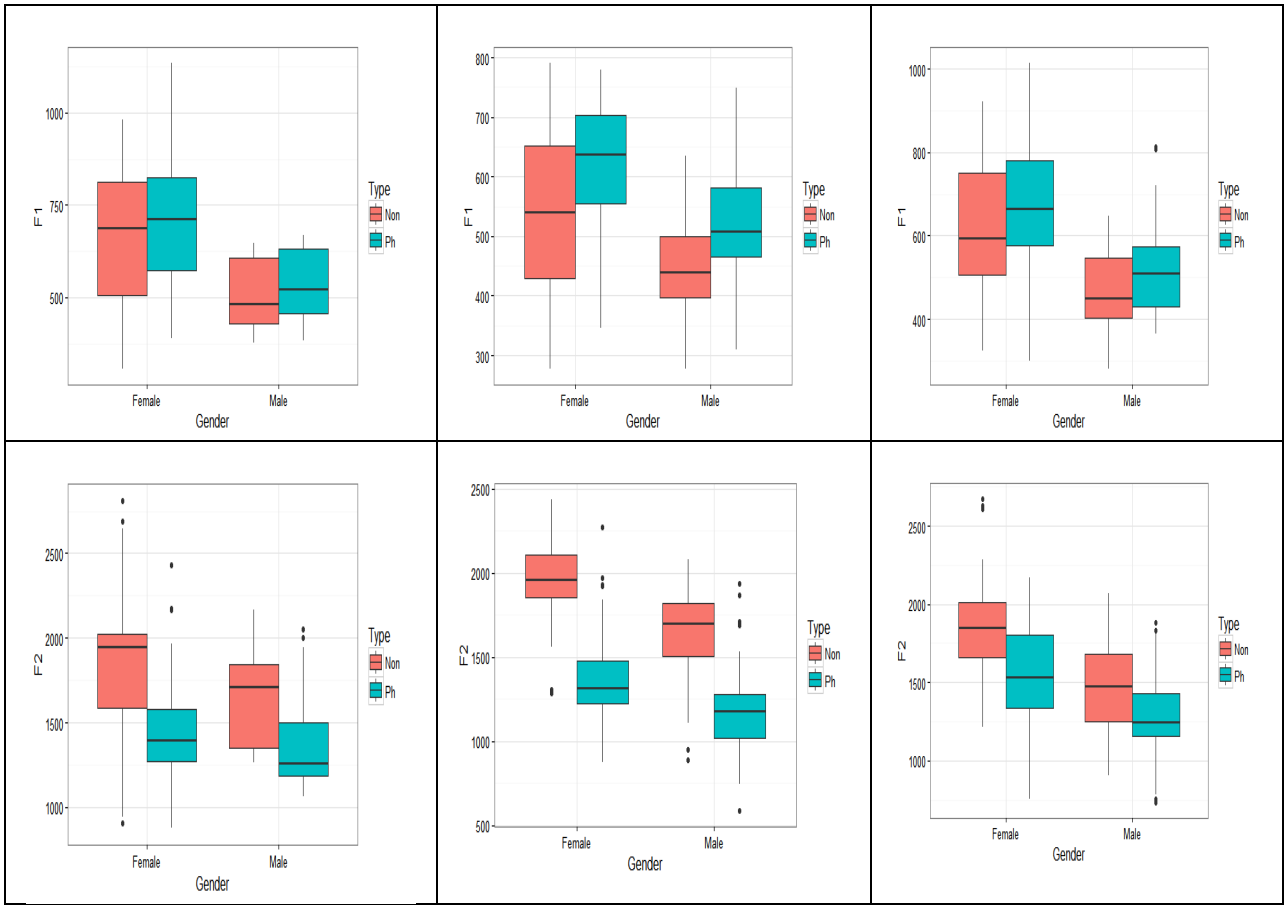
of the target vowels. In [tˤariiq], pharyngealization produced higher F1 and lower F2 values compared to the corresponding non-pharyngealized vowel in [tariiq], which exhibited lower F1 and higher F2 values. These results provide further evidence of the influence of gender on the acoustic realization of pharyngealization. The female speakers consistently produced vowels with higher F1 and lower F2 values than the male ones, confirming that pharyngealization is more pronounced in female speech in HD.

Fig. 3: Waveforms and spectrograms of a female and a male native speaker of HD producing [tariiq] and [tˤariiq] respectively



The boxplots in Figure 4 below illustrate the effect of gender on F1 and F2 formant values of the vowels in pharyngealized and non-pharyngealized environments. The results show that pharyngealized consonants consistently increase F1 and decrease F2 compared to their non-pharyngealized counterparts across all vowel positions for both genders. Similar to AD, the female speakers produced pharyngealized vowels with higher F1 and lower F2 values than the male speakers, indicating that pharyngealization is more pronounced in the female speech in HD. This supports the view that gender functions as a cue for pharyngealization in this dialect.

Fig. 4: F1 and F2 formant frequencies of the male and female pharyngealized and non-pharyngealized vowels at the three vowel positions (onset, midpoint, and offset) in HD



The one-way ANOVA test in Table 2 below summarized the mean F1 and F2 formant values for pharyngealized and non-pharyngealized vowels, showing significant differences between genders. The difference between F1 and F2 values was considerably greater for the female speakers than for the male speakers. For instance, at the vowel midpoint, the F2 difference between pharyngealized and non-pharyngealized vowels was 443 Hz for females compared to 308 Hz for males, providing strong evidence that the female speakers pharyngealize more than the male speakers.

Table 2: Mean F1 and F2 formant values for the male and female speakers of HD at three vowel positions

Vowel position	Pharyngealized vowels				Non-pharyngealized Vowels			
	Female		Male		Female		Male	
	F1	F2	F1	F2	F1	F2	F1	F2
Midpoint	699	1411	533	1349	655	1854	505	1657
Onset	614	1358	521	1168	538	1967	455	1650
Offset	675	1537	516	1292	604	1821	476	1471

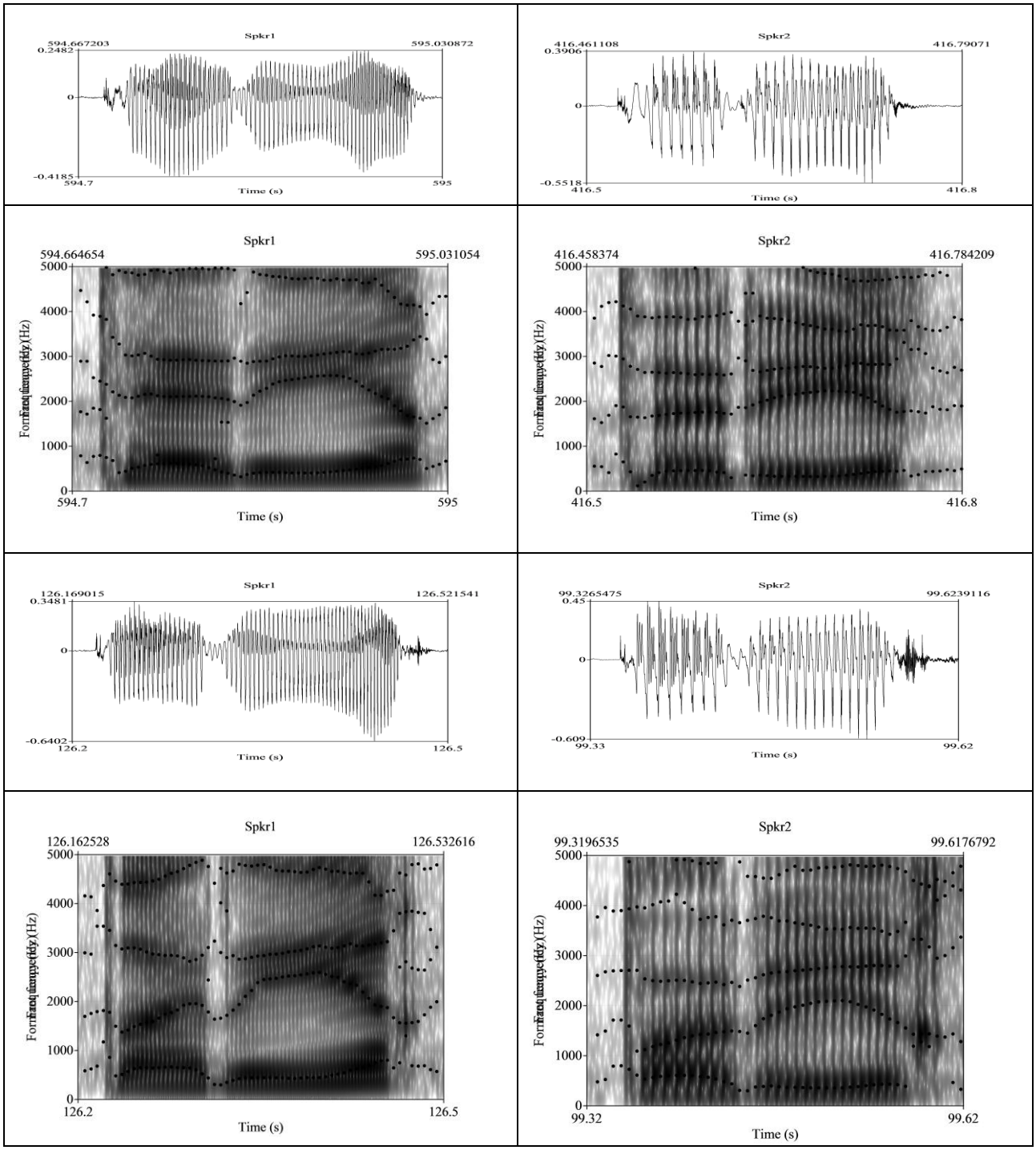
The ANOVA results indicated a significant main effect of gender on F1 at all three vowel positions: midpoint [$F(1, 250) = 109.40$, $p < .001$], onset [$F(1, 250) = 52.78$, $p < .001$], and offset [$F(1, 250) = 88.73$, $p < .001$]. Similarly, F2 values showed significant gender effects at the midpoint [$F(1, 250) = 3.92$, $p = .04$], onset [$F(1, 250) = 35.49$, $p < .001$], and offset [$F(1, 250) = 52.53$, $p < .001$]. These results confirm that the female speakers produce a higher degree of pharyngealization than the male speakers in HD.

7.3. The Effect of Gender on F1 and F2 Formant Frequencies in TD:

Sample waveforms and spectrograms illustrate the effect of pharyngealization on F1 and F2 formant frequencies of the target vowel in [tˤariiq]. Specifically, pharyngealization resulted in higher F1 values and

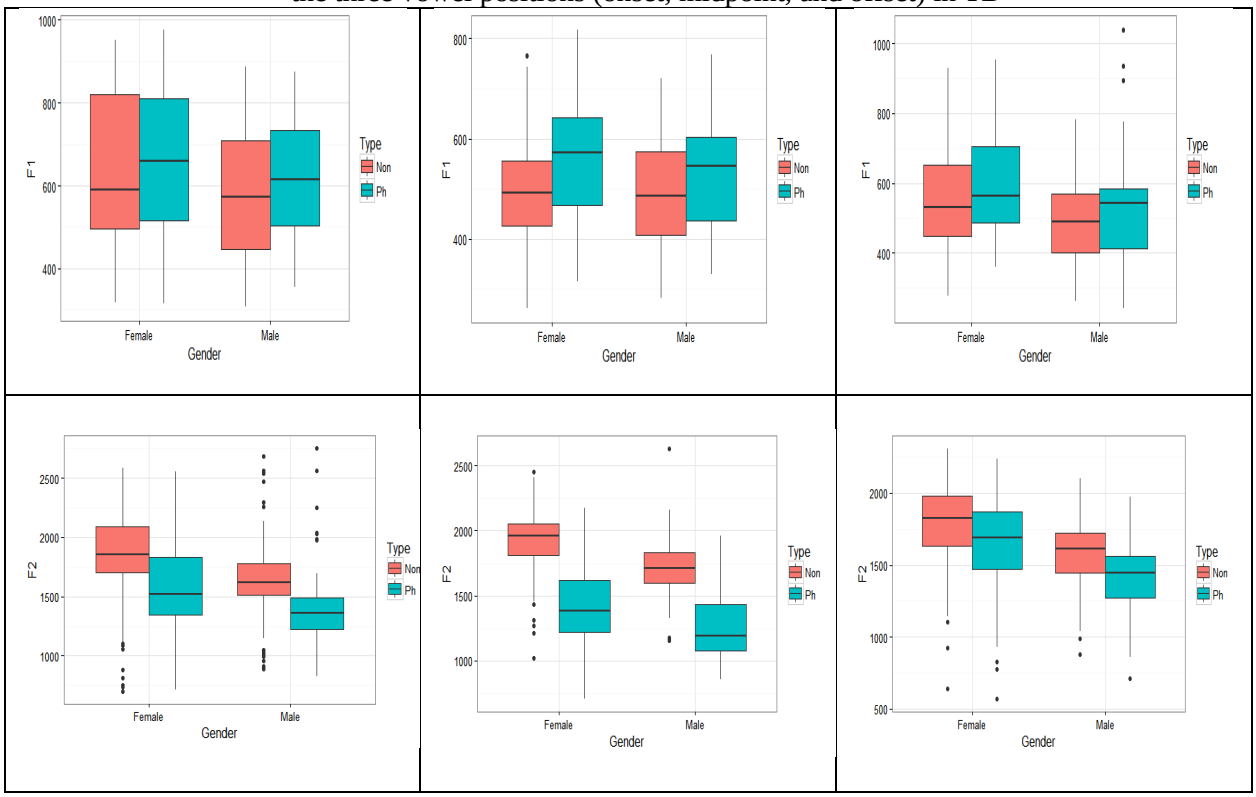
lower F2 values compared to the non-pharyngealized counterpart [tariiq], which exhibited lower F1 and higher F2 values. To assess the effect of gender, sample waveforms and spectrograms were taken from one male and one female native speaker of TD producing [tariiq] and [tˤariiq] in the carrier sentence 'katab thalaath maraat'.

Fig. 5: Waveforms and spectrograms of one female and one male native speaker of TD saying [tariiq] and [tˤariiq] respectively



Boxplots in Figure 6 below depict the effect of gender on F1 and F2 formant values. The plots show that pharyngealized consonants consistently increase F1 and decrease F2 compared with their non-pharyngealized counterparts across all vowel positions for both male and female speakers. The female speakers produced pharyngealized vowels with higher F1 values and lower F2 values than the male speakers, demonstrating that pharyngealization is more pronounced in the female speech. This indicates that gender is a significant cue for pharyngealization in TD.

Fig. 6: F1 and F2 formant frequencies of male and female pharyngealized and non-pharyngealized vowels at the three vowel positions (onset, midpoint, and offset) in TD



The results of the one-way ANOVA test summarized in Table 3 below show the mean F1 and F2 formant values of vowels in pharyngealized and non-pharyngealized environments, along with significant differences between genders. The differences between F1 of vowels following pharyngealized consonants and F2 of vowels following non-pharyngealized consonants were larger in the female speakers than in the male ones. For example, at the vowel midpoint, the F2 difference between pharyngealized and non-pharyngealized vowels was 347 Hz in the female speech compared to 246 Hz in males' speech. These findings indicate that the degree of pharyngealization, reflected in F1 raising and F2 lowering, is significantly greater in the female speech.

Table 3: Mean F1 and F2 formant values for the male and female speakers of TD at three vowel positions

Vowel position	Pharyngealized vowels				Non-pharyngealized Vowels			
	Female		Male		Female		Male	
	F1	F2	F1	F2	F1	F2	F1	F2
Midpoint	658	1575	619	1365	627	1831	581	1635
Onset	560	1428	529	1259	429	1709	497	1926
Offset	595	1650	521	1414	561	1777	495	1564

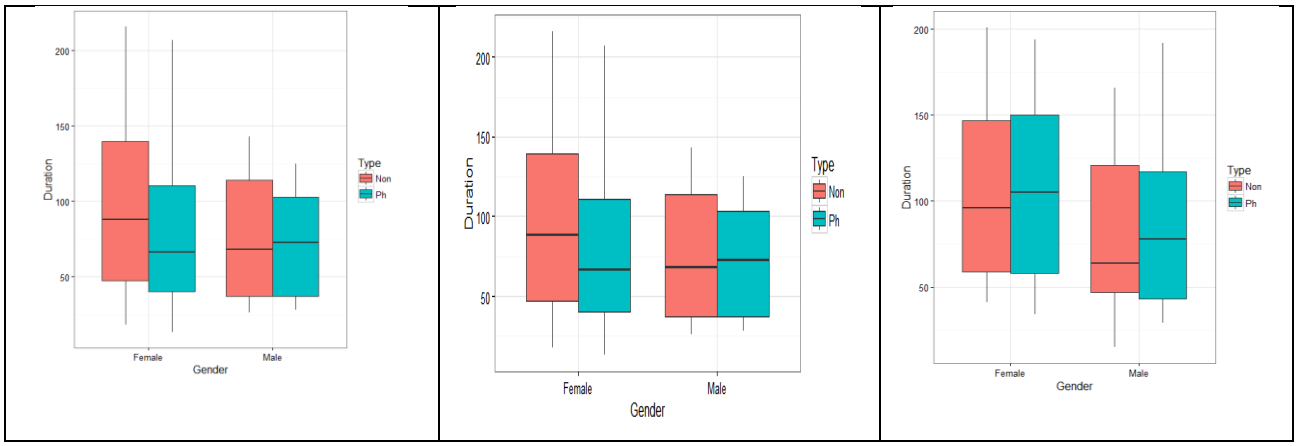
The ANOVA results indicated a significant main effect of gender on F1 at the midpoint [F (1, 250) = 4.25, p = .04], onset [F (1, 250) = 5.53, p = .01], but not at the offset [F (1, 250) = 0.61, p = .44]. Gender effects on F2 were significant at the midpoint [F (1, 250) = 21.26, p < .001], onset [F (1, 250) = 23.47, p < .001], and offset [F(1, 250) = 49.44, p < .001]. These results confirm that the female speakers pharyngealize more than the male speakers across all vowel positions in TD.

7.4. The Effect of Gender on the Duration of Pharyngealized and Non-Pharyngealized Vowels in the Three YADs:

Boxplots in Figure 7 illustrate the effect of gender on the duration of pharyngealized vowels compared to their non-pharyngealized counterparts across the three YAD. In AD and HD dialects, the female speakers exhibited shorter durations for pharyngealized vowels than non-pharyngealized vowels, whereas the male

speakers showed the opposite pattern. In contrast, in TD, both male and female speakers produced longer pharyngealized vowels than non-pharyngealized vowels. Overall, no consistent or systematic pattern emerged across the three YADs.

Fig. 7: Duration of pharyngealized and non-pharyngealized vowels in the male and female speech across the three YADs: AD, HD, and TD respectively



A two-way ANOVA was conducted for each dialect to examine the mean vowel duration in pharyngealized versus non-pharyngealized environments. The results indicated no significant interaction between gender and pharyngealization on vowel duration in AD [F (1, 500) = 0.142, p = .707], HD [F (1, 500) = 3.33, p = .068], or TD [F (1, 500) = 0.027, p = .870]. These findings suggest that vowel duration is not reliably affected by pharyngealization and that gender does not significantly modulate this effect.

Table 4: Mean vowel duration (ms) for the male and female speakers in pharyngealized and non-pharyngealized environments across the three YADs.

Dialect	Pharyngealized	Nonpharyngealized	Pharyngealized	Nonpharyngealized
	Female	Female	Male	Male
AD	88 ms	87 ms	84 ms	80 ms
HD	80 ms	99 ms	73 ms	76 ms
TD	105 ms	105 ms	83 ms	83 ms

The data indicate that in the female speech, there is negligible difference in vowel duration between pharyngealized and non-pharyngealized vowels in AD and TD, with minor differences in HD. For the male speakers, durations are largely similar in TD, but slight differences are observed in AD and HD. Notably, in HD, non-pharyngealized vowels were significantly longer than pharyngealized vowels for both male and female speakers.

8. Answering the Research Questions:

The findings of the present study provide clear answers to the research questions concerning the acoustic effects of gender on the production of pharyngealized vowels in the three YADs examined. The results demonstrate that gender significantly influences the acoustic realization of pharyngealization, particularly through changes in vowel formant frequencies. The female speakers consistently produced higher F1 and lower F2 values compared to the male speakers across AD, HD and TD, which indicates a greater degree of pharyngealization in the female speech. These results confirm that vowel quality, as reflected in formant frequencies, plays a crucial role in signaling pharyngealization. In contrast, vowel duration did not show a statistically significant difference between pharyngealized and non-pharyngealized contexts for either gender, although the females tended to produce slightly longer vowels overall. Therefore, the research questions are answered by demonstrating that gender affects the acoustic realization of pharyngealization primarily through vowel quality rather than vowel duration.

9. Testing the Research Hypotheses:

The results of the acoustic analysis provide partial support for the research hypotheses. The hypothesis that gender influences the acoustic realization of pharyngealization is supported by the formant frequency data, which show systematic differences between the male and female speakers. The female speakers exhibited higher F1 and lower F2 values, indicating a stronger degree of pharyngealization compared to the males across the three YADs studied. These findings align with previous studies that reported greater pharyngealization in female speech (Al-Masri & Jongman, 2004; Almbark, 2008; Royal, 1985). However, the hypothesis that vowel duration would differ significantly between pharyngealized and non-pharyngealized contexts was not supported, as no statistically significant differences were observed for either gender. Consequently, the results suggest that gender-based variation in pharyngealization is primarily reflected in vowel quality rather than temporal characteristics.

10. Comparison with Previous Studies:

The findings of the present study contribute to the ongoing debate in the literature regarding gender differences in the production of pharyngealized vowels. Previous studies have reported conflicting results. Some researchers have argued that male speakers produce a greater degree of pharyngealization than female speakers (Ahmed, 1979; Khan, 1975; Khattab et al., 2006; Lehn, 1963; Wahba, 1993), while other studies have suggested that female speakers exhibit stronger pharyngealization (Al-Masri & Jongman, 2004; Almbark, 2008; Royal, 1985). The findings of the current study support the latter group of findings, as the female speakers consistently produced higher F1 and lower F2 values than the male speakers across the three YADs. These acoustic patterns indicate a greater degree of pharyngealization in female speech.

One possible explanation for this pattern may be related to physiological and sociophonetic factors that influence vowel production. Female speakers often exhibit greater articulatory precision and clearer vowel articulation, which may lead to stronger acoustic cues associated with pharyngealization. In addition, sociophonetic variation across dialects may also play a role in shaping gender-based differences in pronunciation. Despite the clear differences observed in vowel quality, the results did not reveal significant gender-related differences in vowel duration between pharyngealized and non-pharyngealized contexts. This suggests that the acoustic realization of pharyngealization in Yemeni Arabic dialects is primarily manifested through changes in vowel formant structure rather than temporal duration.

Generally, these findings provide further empirical evidence that gender can play an important role in shaping the phonetic realization of pharyngealization, while also highlighting the importance of considering dialectal variation in sociophonetic studies of Arabic.

11. Conclusion:

This study examined the effect of gender on the production of pharyngealized and non-pharyngealized vowels across three Yemeni Arabic dialects. The findings have revealed that pharyngealization consistently raised F1 and lowered F2 values, confirming its strong influence on vowel quality across the examined dialects. The female speakers exhibited greater degrees of pharyngealization than the male speakers, suggesting that gender functions as an important sociophonetic cue in the realization of pharyngealization. In contrast, vowel duration did not show systematic or statistically significant differences between pharyngealized and non-pharyngealized contexts, indicating that duration is not a reliable acoustic correlate of pharyngealization in the three dialects studied. Furthermore, these findings have demonstrated that gender influences the acoustic realization of pharyngealization primarily through vowel quality rather than temporal duration. The study therefore contributes to a better understanding of the interaction between sociophonetic and dialectal variation in Yemeni Arabic.

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مقالة بحثية

تأثير جنس المتكلم على إنتاج الصوائت المفخمة في اللهجات العربية اليمنية: تحليل أكوستيكي

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المُلخّص

تهدف هذه الدراسة إلى استقصاء التأثيرات الأكوستيكية لجنس المتكلم على إنتاج ترددات المكونين الصوتيين الأول (F1) والثاني (F2) للصوائت المفخمة، إضافة إلى مدة الصائت، في ثلاث لهجات عربية يمنية هي: الأبينية، والحضرمية، والتعزية. وقد أظهرت الدراسات السابقة نتائج غير متسقة؛ إذ يرى أحمد (1979) و خان (1975) و خطاب و آخرون (2006) و ليهن (1963) و وهبة (1993) أن الذكور ينتجون درجة أعلى من التفخيم مقارنة بالإناث، في حين تشير دراسات أخرى إلى أن الإناث يُظهرن تفخيماً أكثر وضوحاً من الناحية الأكوستيكية (المصري وجونجمان، 2004؛ المبارك، 2008؛ رويال، 1985). ولمعالجة هذا التباين، أُجريت تجربة أكوستيكية شملت ثلاثة متحدثين وثلاث متحدثات من كل لهجة. وتكوّنت المادة اللغوية من صوامت مفخمة ونظائرها غير المفخمة متضمنة صوائت قصيرة وطويلة، سُجلت داخل جمل حاملة مضبوطة. وقد تم قياس قيم تردد المكونين الصوتيين عند ثلاث نقاط من الصائت: البداية، والمنتصف، والنهاية، كما تم تسجيل مدة الصائت. وأظهرت النتائج أن جنس المتكلم يؤثر بصورة منتظمة في درجة التفخيم؛ إذ أظهرت المتحدثات الإناث قيماً أعلى للمكون الصوتي الأول (F1) وانخفاضاً أكبر في قيم المكون الصوتي الثاني(F2) مقارنة بالذكور في جميع اللهجات، مما يشير إلى أن التفخيم كان أكثر بروزاً في كلام الإناث. أما مدة الصائت فلم تُظهر فروقاً ذات دلالة إحصائية بين السياقات المفخمة وغير المفخمة لدى كلا الجنسين، مع إنتاج الإناث لصوائت أطول قليلاً بشكل عام. وتوضح هذه النتائج أن تأثير جنس المتكلم في التحقيق الأكوستيكي للتفخيم يظهر أساساً في جودة الصائت (قيم التردد) أكثر من مدته. كما تسهم هذه الدراسة في توضيح التباين الاجتماعي الصوتي واللهجي في العربية اليمنية، وتقدم دليلاً تجريبياً على الفروق القائمة على جنس المتكلم في التحقيق الصوتي للأصوات المفخمة.

الكلمات المفتاحية: التفخيم؛ الفروق بين الجنسين؛ التحليل الأكوستيكي؛ المكون الصوتي الأول؛ المكون الصوتي الثاني؛ اللهجات العربية اليمنية.

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