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Do F_0 Peak Alignment and F_0 Peak location Differ Across Different Foci Types in Iraqi Arabic?

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Abstract

This study investigates the prosodic realization of focus in Iraqi Arabic by analyzing F_0 peak alignment and F_0 peak location across neutral, information, and contrastive focus conditions in diverse syntactic positions (initial, penultimate, and final). Adopting a question-answer paradigm, the study elicited focus in a controlled experimental setting and analyzed the alignment and location of F_0 peaks within the stressed syllables of focused words, as well as their influence on post-focus and pre-focus words. The findings reveal no statistically significant differences in F_0 peak alignment or location across focus types in any syntactic position, suggesting that Iraqi Arabic does not systematically encode focus through these prosodic cues alone. While minor trends suggest that contrastive focus may exhibit slightly later peak alignment and higher intensity values compared to information focus, these effects do not reach statistical significance. The absence of consistent prosodic differentiation in alignment and location raises important questions about the role of other phonetic correlates—such as duration, intensity, and phrasing—in marking focus in Iraqi Arabic. These findings contribute to the broader understanding of prosodic focus realization in Arabic dialects, underscoring the need for further research into alternative acoustic and perceptual cues that may serve as primary focus markers in Iraqi Arabic.

Keywords: Iraqi Arabic; F_0 peak alignment; F_0 peak location; Prosodic focus realization.

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هل تختلف محاذاة الذروة F_0 وموقع الذروة F_0 عبر أنواع البؤر المختلفة في اللهجة العراقية؟

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المستخلص

تبحث هذه الدراسة في الإدراك الفوقطعي للتركيز الكلامي في العربية العراقية من خلال تحليل محاذاة ذروة F_0 وموقعها عبر ظروف التركيز المحايدة، والمعلوماتية، والتباينية في مواضع نحوية مختلفة (الابتدائي، قبل الأخير، والنهائي). باستخدام نموذج سؤال وجواب، استخرجت الدراسة التركيز في بيئة تجريبية مُحكمة، وحللت محاذاة وموقع قمم F_0 داخل المقاطع المشددة للكلمات المُركزة، بالإضافة إلى تأثيرها على كلمات ما بعد التركيز وما قبله. تكشف النتائج عن عدم وجود فروق ذات دلالة إحصائية في محاذاة ذروة F_0 أو موقعها بين أنواع التركيز في أي موضع نحوي، مما يشير إلى أن العربية العراقية لا تُرمّز التركيز بشكل منهجي من خلال هذه الإشارات الفوقطعية وحدها. في حين أن الاتجاهات الطفيفة تشير إلى أن التركيز التباينيي قد يُظهر محاذاة ذروة متأخرة قليلاً وقيم شدة أعلى مقارنةً بتركيز المعلومات، إلا أن هذه التأثيرات لا تصل إلى دلالة إحصائية. يثير غياب التمايز الفوقطعي المتسق في المحاذاة والموضع تساؤلات مهمة حول دور العوامل الصوتية الأخرى – مثل المدة والشدة والصياغة – في تحديد التركيز في اللهجة العراقية. تُسهم هذه النتائج في فهم أوسع لإدراك التركيز الفوقطعي في اللهجات العربية، مما يُؤكد الحاجة إلى مزيد من البحث في الإشارات الصوتية والإدراكية البديلة التي قد تُمثل علامات تركيز رئيسية في اللهجة العراقية.

الكلمات المفتاحية: اللهجة العراقية؛ محاذاة ذروة F_0؛ موقع ذروة F_0؛ إدراك التركيز الفوقطعي.

1. INTRODUCTION

Information and contrastive focus are key components of information structure, each serving distinct communicative functions (Halliday, 1967; Chafe, 1976; Vallduví, 1993). Information focus highlights elements that introduce new information into the discourse, while contrastive focus signals a correction or contrast with previously mentioned alternatives. The examples in (1-3) illustrate these distinctions:

(1) a. What happened? → Neutral focus
b. Peter visited Mary

(2) a. Whom did Peter visit? → Information focus
b. Peter visited [Mary].

(3) a. Whom did Peter visit? Sarah? → Contrastive focus
b. Peter visited [Mary].

Analyzing these responses within an information-structural framework, the answer in (1a) constitutes neutral focus, where the entire utterance presents discourse-new information in response to the open-ended question "What happened?". From a prosodic perspective, utterances in neutral focus contexts are typically assumed to exhibit a language's default intonational pattern (Bruce, 1982; Eady et al., 1986; Xu, 1999; Xu & Xu, 2005; Gussenhoven, 2007; Alzaidi et al., 2019).

In contrast, (2b) demonstrates narrow information focus, where Mary is the focal element replacing the wh-phrase in the preceding question (Whom did Peter visit?). Here, Mary conveys the only new information in the utterance, while the remaining components (Peter visited) are given, having been explicitly stated in the question.

The answer in (3b) also places Mary under focus; however, it serves a contrastive or corrective function, distinguishing Mary from an alternative (Sarah), which was presented as a competing referent in the discourse. This corrective function differentiates contrastive focus from information focus, reinforcing its role in pragmatic opposition.

The phonetic realization of focus varies across languages, with differences observed in F_0 peak alignment (the temporal positioning of the pitch peak relative to the stressed syllable) and F_0 peak location (the proportion of the stressed syllable at which the peak occurs). These prosodic parameters are central to the identification of pitch accent types and are fundamental to tune-text association in the Autosegmental-Metrical (AM) framework (Pierrehumbert, 1980; Ladd, 2008).

Cross-linguistic studies show that focus influences peak alignment and peak location in diverse ways. For example, in Spanish, the F_0 peak of a focused word is aligned earlier than in neutral focus (Face, 2002), whereas in European Portuguese, the peak is aligned later in focus contexts compared to neutral utterances (Frota, 2000). Similarly, in English, Xu & Xu (2005) found that peak location shifts earlier within the stressed syllable of focused words. These findings highlight the importance of investigating how focus modulates peak alignment and location in different languages.

Arabic remains underexplored in this regard. Among the few relevant studies, Hellmuth (2006a) found that in Egyptian Arabic, words following contrastive focus exhibit earlier peak alignment compared to those following information focus.

Additionally, Cangemi et al. (2016) observed that peak and valley alignment within focused words occurred earlier in contrastive focus contexts than in topic-comment structures. However, no research has systematically examined the effect of focus on F_0 peak alignment and location in Iraqi Arabic.

Given this gap, the present study aims to investigate whether and how focus (neutral, information, and contrastive) affects F_0 peak alignment and location in Iraqi Arabic. By examining these prosodic features across different sentence structures and lexical items, this study contributes to our understanding of the way focus is phonetically programmed in Arabic varieties.

2. IRAQI ARABIC DIALECT

Iraqi Arabic, spoken throughout Iraq, is a dialect situated at a linguistic crossroads due to the country's geographical positioning. Iraq shares borders with Saudi Arabia and Kuwait to the south, Syria and Jordan to the west, Iran to the east, and Turkey to the north, placing Iraqi Arabic in direct contact with a variety of linguistic influences (Khidhir Sallo, 2008). While language contact often results in structural convergence, no systematic studies have explored the extent to which such interactions shape the grammar or phonetic patterns of Iraqi Arabic. Given the absence of empirical research on this topic, the present study does not address potential contact-induced influences on Iraqi Arabic but instead focuses on its prosodic encoding of focus.

Iraqi Arabic exhibits considerable internal variation, particularly in the well-documented /gelet/ and /qeltu/ dialectal division, named after their respective realizations of the verb 'I said' (Blanc, 1964; Jastrow, 2007). The distinction between the velar [g] and uvular [q] serves as a primary phonological isogloss demarcating these varieties. Despite the extensive linguistic research on Iraqi Arabic, which has examined its phonology, morphology, and syntax (Rahim, 1980; Hassan, 1981; Abu-Haidar, 1991; Masliyah, 1997; Erwin, 2004; Jastrow, 2007; Butcher & Ahmad, 2009; Saaed, 2010; Saaed, 2013; Tucker, 2010; Albuarabi, 2019; Bani Younes, 2020; Al-bazzaz & Ali, 2020; Abed, 2022), there remains a critical gap concerning its detailed analyses of prosodic realization of focus with regard to F_0 peak alignment and F_0 peak location (see Alzaidi, et all. 2025).

As focus realization can be either syntactically or prosodically encoded, it is essential to determine whether word order plays a role in marking focus in Iraqi Arabic. In Modern Standard Arabic (MSA), focus is frequently marked through syntactic reordering (Moutaouakil, 1989; Ouhalla, 1997; Alzaidi, 2022, 2024; Alzaidi et al., 2019, 2023). However, modern spoken Arabic dialects, including Iraqi Arabic, tend to maintain focus in situ rather than repositioning it syntactically. Iraqi Arabic allows multiple word order variations, including SVO, VSO, VOS, and SOV (Albuarabi, 2019). These orders are exemplified as follows:

(4)
a. *Līn katbat d-dars.* (SVO)
→ Lin wrote the lesson.
b. *katbat Līn d-dars.* (VSO)
→ Lin wrote the lesson.
c. *katbat d-dars Līn.* (VOS)
→ Lin wrote the lesson.
d. *Līn d-dars katbat.* (SOV)
→ Lin wrote the lesson.

While SVO and VSO appear frequently in neutral contexts, the felicity of VOS and SOV is largely determined by discourse-pragmatic factors. Unlike MSA, where case markings explicitly indicate grammatical relations (Ryding, 2005), Iraqi Arabic lacks overt nominative and accusative markers, as demonstrated in the contrast between (5a) and (5b):

(5) a. *qābala ʿali-un Saʿīd-an.* (MSA)
→ Ali met Saeed. *(nominative and accusative case markings present)*
b. *qābl ʿali Saʿīd.* (Iraqi Arabic)
→ Ali met Saeed. *(no case markings, interpretation dependent on context)*

Given the absence of morphological case marking, word order plays a crucial role in interpretation. Iraqi Arabic exhibits a preference for SVO as the default word order (Al-Janabi, 2019). Notably, Al-Janabi (2019) observed that an SVO structure is the most natural response to an open-ended broad focus question such as *shunu ṣār?* 'What happened?', reinforcing its role as the unmarked sentence structure.

The interaction between focus and word order in Iraqi Arabic remains largely unexplored, but preliminary observations suggest that focus remains **in situ**, regardless of syntactic function. This is illustrated in examples (6)–(8), where focus is realized on subjects, direct objects, and indirect objects without necessitating word order changes.

(6)a. *minu ḥamāt Luma min Muna?*
→ Who protected Luma from Muna?
b. **[Līn]NF** *ḥamāt Luma min Muna.*
→ *Lin* protected Luma from Muna.

(7) a. *minu ḥamāt Luma min Muna Layān?*
→ Who protected Luma from Muna, Layan?
b. **[Līn]CF** *ḥamāt Luma min Muna.*
→ *Lin* protected Luma from Muna. *(contrastive focus)*

(8) a. *Līn ḥamāt minu min Muna?*
→ Whom did Lin protect from Muna?

b. *Līn* ***[Luma]NF*** *ḥamāt min Muna.*
→ Lin protected *Luma* from Muna.

The phonetic realization of focus in Iraqi Arabic must be considered within the broader context of its prosodic system, particularly in relation to stress assignment. Like many Arabic dialects, pitch accents in Iraqi Arabic are anchored to the stressed syllable (Alzaidi et al., 2019; Bani Younes, 2020; Alzaidi, 2022). A proper understanding of stress patterns is therefore essential to interpreting prosodic focus cues. Hassan (1981) confirms that nine syllablic structures exist in Iraqi Arabic; these are listed in (9):

(9) a. CV → */la/ 'not'
b. CVV → */lō/ 'if'
c. CVC → */bas/ 'enough'
d. CVVC → */bāb/ 'door'
e. CVCC → */fard/ 'individual'
f. CVVCC → */mārr/ 'pass by'
g. CCVV → */šfā/ 'cured him'
h. CCVVC → */ktāb/ 'book'
i. CCVCC → */šbint/ 'dillweed'

Stress assignment in Iraqi Arabic is largely determined by syllable weight. Superheavy syllables receive stress by default. If no superheavy syllable is present, stress falls on the penultimate syllable if it is heavy. Otherwise, stress shifts to the antepenultimate syllable if the final and penultimate syllables are both light. The systematic correlation between stress and pitch accent placement is central to understanding how focus is realized in this dialect.

Alzaidi et all. (2025) investigate the prosodic realization of focus in Iraqi Arabic by analyzing F_0 maximum, F_0 minimum, intensity, duration, and excursion size across different focus conditions. The findings reveal a complex interplay between focus type (neutral, information, and contrastive), focus position (initial, penultimate, and final), and their corresponding prosodic effects. This is shown visually in Figure 1 below. Compared to neutral focus, both information and contrastive focus exhibit distinct prosodic patterns, with contrastive focus showing a stronger effect on intensity, particularly in sentence-final positions. In sentence-initial positions, no significant differences among focus types were found, a pattern consistent with other Arabic dialects such as Emirati Arabic (Alzaidi et al., 2023). Notably, focus also influences post-focus elements, with contrastive focus in sentence-initial position lowering the minimum F_0 of subsequent words more significantly than information focus. Additionally, pre-focus words exhibit varied effects depending on focus type and position, with F_0 and duration reductions being more pronounced for sentence-penultimate focus, particularly when contrastive focus occurs sentence-finally. The study underscores the differential prosodic encoding of information

and contrastive focus, demonstrating that contrastive focus consistently exerts a stronger influence on F_0 and intensity. While contrastive focus is marked by on-focus enhancement, post-focus compression, and pre-focus compression, these distinctions may partly stem from the incredulity effect introduced by the experimental design (Alzaidi et al., 2019). Overall, this research contributes to the understanding of how focus is signaled prosodically in Iraqi Arabic and highlights the need for further investigation into the role of prosody in Arabic dialects, particularly concerning the fine-grained distinctions between information and contrastive focus.

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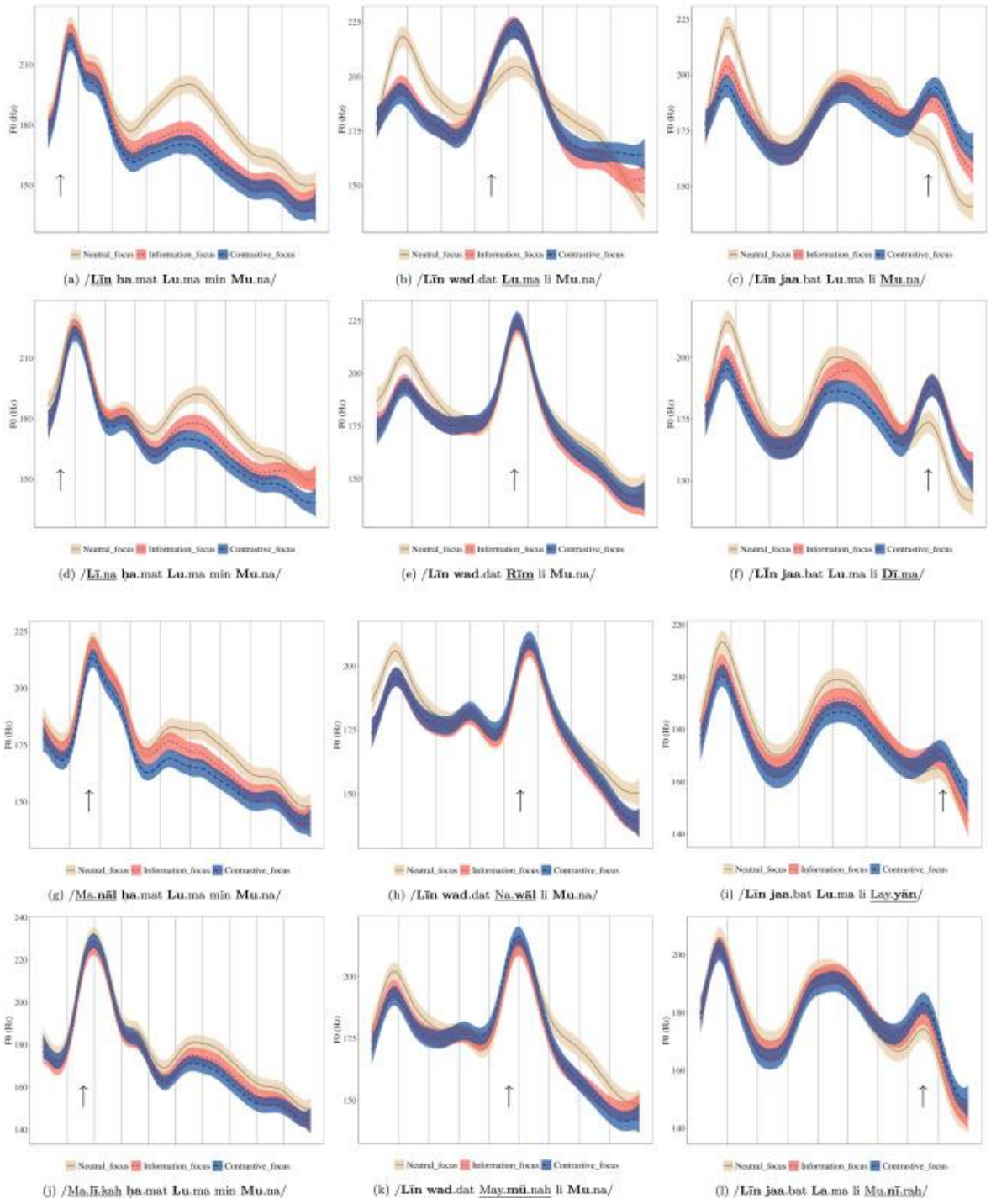

Figure 1. SS-ANOVA plots of time-normalized F₀ contours (categorized by focus and sentence position). The lines represent F₀ means, while the surrounding ribbons show 95% confidence intervals. Non-overlapping ribbons indicate statistical significance. Vertical lines denote syllable boundaries, with stressed syllables in bold. The focused

words are underlined, and the stressed syllables of the focused words are indicated with an upward arrow in the plots. Adopted from Alzaidi et all. (2025, p. 6).

The empirical investigation of F_0 peak alignment and peak location in Iraqi Arabic is essential for determining whether prosodic cues alone suffice to differentiate information and contrastive focus. Given the absence of syntactic reordering, the expectation is that focus marking will be primarily encoded through modifications in F_0 contours, as demonstrated empirically by Alzaidi et all. (2025). The findings of this study will thus contribute to broader discussions on prosodic focus realization in Arabic and inform theoretical models of intonation and information structure in spoken varieties of Arabic.

3. METHODOLOGY

3.1 Dataset and Experimental Design

The dataset used in this study originates from Alzaidi et al. (2025), which systematically examined the prosodic realization of focus in Iraqi Arabic. This prior study employed a widely established empirical approach (Cooper et al., 1985; Xu, 1999; Alzaidi et al., 2019; Alzaidi, 2022), utilizing a question-answer paradigm to elicit neutral focus, information focus, and contrastive focus across three syntactic positions: sentence-initial, penultimate, and final. The materials consisted of three sentence groups, where the target words were rotated to ensure positional control. These sentences were embedded in short, contextually rich anecdotes, designed to naturally evoke the intended focus type (following Alzaidi et al., 2019, 2022, 2023). A native Iraqi Arabic speaker (male, 34 years old) recorded the prompt questions to maintain dialectal authenticity. Iraqi Arabic lexicon and spelling conventions were strictly adhered to in the test materials.

3.2 Participants

The study involved ten native Iraqi Arabic speakers (five males, five females) with a mean age of 27 years. All participants were monolingual speakers of Iraqi Arabic, reporting no speech or hearing impairments. The participants were all educated and volunteered to participate in the study.

3.3 Procedure

Data collection was conducted in a language laboratory at the Department of English Language, University of Duhok, Iraq. The test materials were presented on a MacBook Pro laptop, and all recordings were made using a Countryman unidirectional head-worn dynamic microphone connected via a MicPort Pro compact USB preamplifier (24-bit/96 kHz, 48V Phantom Power). The recordings were captured using Audacity (version 3.2.3) with a sampling rate of 44,100 Hz and 16-bit resolution.

Participants were presented with short anecdotes via PowerPoint slides, followed by a prompt question-answer pair. They were instructed to read the target sentences naturally and at a normal speech rate. The test materials were randomized across trials, ensuring no fixed order effects. Each recording session lasted no more than 35 minutes per participant.

3.4 Acoustic Analysis of F_0 Peak Alignment and Location

The analysis of F_0 peak alignment and F_0 peak location was conducted using ProsodyPro (Xu, 2013) within PRAAT (Boersma & Weenink, 1992). The following definitions were applied:

A. F_0 Peak Alignment (ms): The temporal position of the F_0 peak relative to the onset of the stressed syllable, measured in milliseconds.
B. F_0 Peak Location (ratio): The relative position of the F_0 peak within the stressed syllable, expressed as a proportion of the syllable's total duration.

Acoustic measurements were extracted from the stressed syllable of each target word. The onset of the syllable was defined as the beginning of consonant closure, while the end of the syllable was marked at the release of the coda or, in cases where no coda was present, the offset of the vowel. This approach ensured precise measurement of prosodic variation across different focus conditions.

3.5 Statistical Analysis

The extracted acoustic parameters (F_0 peak alignment and F_0 peak location) were analyzed using linear mixed-effects models in R. The models incorporated focus type (neutral, information, contrastive) and focus position (initial, penultimate, final) as fixed effects, while speaker and sentence variation were treated as random effects. Likelihood ratio tests were conducted to evaluate statistical significance, and post-hoc comparisons were performed where necessary.

4. ANALYSIS AND DISCUSSION

The current study investigates the prosodic realization of focus in Iraqi Arabic by examining F_0 peak alignment and location across three focus positions (initial, penultimate, final) and three focus conditions (neutral focus, information focus, contrastive focus). The analyses focus on on-focus, post-focus, and pre-focus regions to determine whether prosodic cues systematically differentiate focus types and positions.

The results, presented in Table 1, indicate no statistically significant differences across conditions (all p-values > 0.1), suggesting a relatively stable prosodic pattern across focus types. Below, we provide a detailed analysis of these findings.

Table 1. Mean scores of F_0 peak alignment and it relative F_0 peak location under the effect of focus, together with results of Linear Mixed Models.

Focus Region	Measurements	Neutral Focus	Information Focus	Contrastive Focus	P-values
	Initial Focus				
On Focus	**Alignment (ms)**	M= 128.43, SD= 23.46	M= 123.78, SD= 26.37	M= 129.30, SD= 32.19	P= 0.1
	Location (ratio)	M= 0.52, SD= 0.2	M= 0.60, SD= 0.13	M= 0.74, SD= 0.26	P= 01
Post Focus	**Alignment (ms)**	M= 110.43, SD= 23.46	M= 99.18, SD= 26.37	M= 112.20, SD= 24.9	P= 0.1
	Location (ratio)	M= 0.54, SD= 0.24	M= 0.62, SD= 0.2	M= 0.50, SD= 0.24	P= 01
	Penultimate Focus				
On Focus	**Alignment (ms)**	M = 129.11, SD = 22.11	M = 129.27, SD = 21.45	M = 126.39, SD = 25.1	P = 0.25
	Location (ratio)	M = 0.47, SD = 0.12	M = 0.52, SD = 0.11	M = 0.75, SD = 0.24	P = 0.12
Post Focus	**Alignment (ms)**	M = 125.85, SD = 22.74	M = 126.64, SD = 20.04	M = 130.08, SD = 27.19	P = 0.19
	Location (ratio)	M = 0.52, SD = 0.19	M = 0.54, SD = 0.05	M = 0.7, SD = 0.2	P = 0.14
Pre Focus	**Alignment (ms)**	M = 123.64, SD = 23.66	M = 136.57, SD = 28.73	M = 138.94, SD = 22.03	P = 0.22
	Location (ratio)	M = 0.5, SD = 0.14	M = 0.61, SD = 0.17	M = 0.73, SD = 0.22	P = 0.16
	Final Focus				
On Focus	**Alignment (ms)**	M = 128.6, SD = 21.27	M = 127.04, SD = 17.42	M = 132.75, SD = 25.72	P = 0.21
	Location (ratio)	M = 0.47, SD = 0.15	M = 0.55, SD = 0.17	M = 0.73, SD = 0.2	P = 0.15
Pre Focus	**Alignment (ms)**	M = 122.0, SD = 18.11	M = 126.15, SD = 23.72	M = 131.91, SD = 25.96	P = 0.18
	Location (ratio)	M = 0.46, SD = 0.15	M = 0.55, SD = 0.18	M = 0.64, SD = 0.25	P = 0.13

When the focused word appears in sentence-initial position, both on-focus alignment and post-focus alignment do not exhibit significant differences across focus types ($p = 0.1$ for both). Specifically, on-focus alignment remains stable across conditions, with neutral focus ($M = 128.43$ ms, $SD = 23.46$ ms), information focus ($M = 123.78$ ms, $SD = 26.37$ ms), and contrastive focus ($M = 129.30$ ms, $SD = 32.19$ ms) showing no systematic shifts. A similar pattern is observed in post-focus alignment, where values fluctuate slightly but do not reach statistical significance (neutral focus: $M = 110.43$ ms, $SD = 23.46$ ms; information focus: $M = 99.18$ ms, $SD = 26.37$ ms; contrastive focus: $M = 112.20$ ms, $SD = 24.9$ ms).

In terms of F_0 peak location, the findings similarly indicate no significant differences. On-focus location shows minor variation, with contrastive focus displaying a slightly later peak ($M = 0.74$, $SD = 0.26$) compared to information focus ($M = 0.60$, $SD = 0.13$) and neutral focus ($M = 0.52$, $SD = 0.2$), though the effect does not reach significance ($p = 0.1$). Post-focus location measurements remain stable across focus types, reinforcing the absence of a systematic effect ($p = 0.1$).

When focus is placed in the penultimate position, the on-focus alignment remains relatively consistent across focus types (neutral focus: $M = 129.11$ ms, $SD = 22.11$ ms; information focus: $M = 129.27$ ms, $SD = 21.45$ ms; contrastive focus: $M = 126.39$ ms, $SD = 25.1$ ms; $p = 0.25$). Post-focus alignment also exhibits no statistically significant differences, with values remaining stable across conditions ($p = 0.19$).

Interestingly, pre-focus alignment shows a slight trend towards longer alignment durations in focused words (information focus: $M = 136.57$ ms, $SD = 28.73$ ms; contrastive focus: $M = 138.94$ ms, $SD = 22.03$ ms) compared to neutral focus ($M = 123.64$ ms, $SD = 23.66$ ms), but the lack of statistical significance ($p = 0.22$) suggests that this trend may be incidental rather than functionally meaningful.

Similarly, on-focus location values display a slight trend toward later alignment for contrastive focus ($M = 0.75$, $SD = 0.24$) compared to information focus ($M = 0.52$, $SD = 0.11$) and neutral focus ($M = 0.47$, $SD = 0.12$), but the effect remains non-significant ($p = 0.12$). Pre-focus location values, while slightly elevated for contrastive focus ($M = 0.73$, $SD = 0.22$), do not deviate significantly from information focus ($M = 0.61$, $SD = 0.17$) or neutral focus ($M = 0.50$, $SD = 0.14$) ($p = 0.16$).

For sentence-final focus, the on-focus alignment values indicate no substantial differentiation across focus conditions ($p = 0.21$). Neutral focus aligns at $M = 128.6$ ms, $SD = 21.27$ ms, whereas information focus and contrastive focus show slight variation ($M = 127.04$ ms, $SD = 17.42$ ms; $M = 132.75$ ms, $SD = 25.72$ ms, respectively), but none of these differences are statistically significant.

Pre-focus alignment, however, shows a minor trend toward later alignment for contrastive focus (M = 131.91 ms, SD = 25.96 ms) compared to information focus (M = 126.15 ms, SD = 23.72 ms) and neutral focus (M = 122.0 ms, SD = 18.11 ms), though again, no statistically significant effect emerges ($p = 0.18$).

Regarding on-focus location, the same trend of slightly later alignment in contrastive focus (M = 0.73, SD = 0.2) compared to information focus (M = 0.55, SD = 0.17) and neutral focus (M = 0.47, SD = 0.15) is observed, but without reaching significance ($p = 0.15$). Pre-focus location measurements follow a similar pattern, with no substantial deviations across conditions ($p = 0.13$).

The results indicate no statistically significant differences in F_0 peak alignment or location across focus types in Iraqi Arabic, suggesting that prosodic cues alone may not be the primary markers of focus in this dialect. While some minor trends were observed—such as contrastive focus displaying slightly later alignment in sentence-final and penultimate positions—none of these reached statistical significance, reinforcing the idea that other phonetic or syntactic mechanisms may be at play in marking focus.

One possible explanation for the absence of significant prosodic variation is that Iraqi Arabic may rely on additional cues beyond alignment and location to signal focus. For instance, duration, intensity, or phrase-level pitch movements may contribute more prominently to focus realization as demonstrated empirically by Alzaidi et all. (2025). Alternatively, focus marking may be more context-dependent, with speakers adjusting prosodic prominence based on pragmatic factors rather than exhibiting rigid, categorical prosodic distinctions.

Another important consideration is the possibility of speaker-specific variability. Given that the dataset comprised ten speakers, individual differences in prosodic realization could have contributed to the lack of statistical significance. Future studies could benefit from larger sample sizes or the application of more fine-grained acoustic analyses, such as examining tonal alignment at the phoneme level or measuring pitch span variations across focus conditions.

The findings suggest that while focus may exert a subtle influence on F_0 peak alignment and location, these cues alone do not provide robust phonetic evidence for focus marking in Iraqi Arabic. The lack of statistical significance across on-focus, post-focus, and pre-focus measurements underscores the need for further investigation into alternative prosodic markers. Future research should explore whether duration, intensity, and phrasing cues provide stronger signals for focus distinction and whether focus realization in Iraqi Arabic aligns more closely with regional Arabic dialects that utilize post-focus compression or pitch range expansion as primary prosodic correlates.

5. CONCLUSION

This study examined the effect of focus type (neutral, information, and contrastive) on F_0 peak alignment and F_0 peak location in Iraqi Arabic, with the aim of determining whether these prosodic parameters reliably distinguish focus conditions. Our findings indicate that neither alignment nor location exhibited statistically significant differences across focus types, regardless of syntactic position (sentence-initial, penultimate, or final). This suggests that Iraqi Arabic does not rely on these prosodic features as primary focus-marking strategies.

Despite the lack of significant effects, some trends were observed. Contrastive focus exhibited slightly later peak alignment and higher intensity values than information focus, particularly in sentence-final position. Additionally, post-focus compression effects were noted, with contrastive focus lowering the minimum F_0 of subsequent words more than information focus in some contexts. However, these differences did not reach statistical significance, suggesting that other phonetic cues, such as duration, intensity, or phrase-level pitch patterns, may play a more prominent role in focus marking in Iraqi Arabic.

The absence of systematic prosodic differentiation aligns with findings from other Arabic dialects that show weak phonetic encoding of focus compared to languages that employ robust post-focus compression (e.g., Mandarin Chinese). Given this, future research should explore whether alternative acoustic cues, such as intensity contours, syllable duration, or voice quality changes, serve as stronger indicators of focus in Iraqi Arabic. Furthermore, perception studies are needed to investigate whether Iraqi Arabic speakers rely on non-prosodic cues—such as syntactic or discourse-based strategies—for focus interpretation.

Overall, this study provides empirical evidence that Iraqi Arabic does not employ F_0 peak alignment and location as strong, categorical focus markers. These findings contribute to the growing body of research on prosodic focus realization in Arabic dialects and highlight the importance of exploring alternative phonetic and perceptual dimensions in future studies.

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