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ORIGINAL RESEARCH

Music and Caffeine Intake Effects on Gait, and Its Relationship with Psychological Parameters, in Middle-Aged Women

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Purpose: This study aimed to explore the combined effects of caffeine intake and listening to music on walking parameters, and its relationship with psychological variables (fatigue and exercise enjoyment) in middle-aged women.

Patients and Methods: Sixteen healthy middle-aged women, aged between 50 and 60 years old, participated in this study. Their walking parameters (distance, number of steps, steps number/minute, cadence and walking speed) were assessed using the 6-minute walking test (6MWT) in four task conditions: in no-music/no-caffeine, no-music/with caffeine, with music/no-caffeine, and with music/with caffeine conditions. Besides, exercise enjoyment and fatigue were evaluated using the Physical Activity Enjoyment Scale (PACES-8) and rating of perceived exertion (RPE) questionnaires, respectively.

Results: As a result, we found that 100 mg of caffeine intake significantly ($p < 0.05$) improved walking parameters such as distance, cadence and number of steps during both simple ($p < 0.05$) and dual-task, while listening to preferred music, where optimal results were found ($p < 0.01$) with a large effect size ($\eta 2p > 0.14$). Listening to music was sufficient to significantly improve the distance ($p < 0.001$), cadence ($p < 0.001$), and walking speed ($p < 0.05$) values. Besides, both caffeine intake and/or listening to music significantly ($p < 0.05$ with large effect size ($\eta 2p > 0.14$)) decreased the feeling of fatigue and increased exercise enjoyment while walking in healthy middle-aged women.

Conclusion: In conclusion, caffeine intake seems to positively influence gait capacities, and its combined effects with listening to music, mainly preferred ones, would boost these beneficial effects in middle-aged women.

Keywords: supplements, auditory stimulus, fatigue, exercise enjoyment, walking parameters, aging

Introduction

Gait has been commonly used to assess and monitor overall health and functional capability.[1] Adequate gait is crucial to function independently within a community. Various gait parameters serve as prognostic indicators for hospitalization and deteriorating health in older adults,[2] with reduced walking speed serving as a key indicator for identifying frail individuals.[3] Various studies have demonstrated that as individuals age, their gait tends to deteriorate,[4,5] and this is expected to be more pronounced as life-expectancy increases. Particularly, at the age of 40, the beginning of middle-age, motor functions start to significantly be altered.[6] With age, individuals to meet the neuromuscular demands of a walking condition may need to recruit a larger number of motor units. Such gait alteration was explained by reduced muscle strength[7] and ability to detect and process sensory information.[8] Notably, muscle mass declines by 1 to 2% per years after the age of 50 with women experiencing greater loss in muscle mass density compared to men.[9]

Women at this period, faced the onset of menopause and various signs of aging, encounter a myriad of physical, cognitive, and psychological changes.[10] For that, these women tend to have poorer functional mobility, strength, flexibility, gait capacity, and postural control in comparison to premenopausal ones.[11] These alterations significantly

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increase the risk of falls. Statistics indicate that falls rank as the third leading cause of unintentional injury deaths among individuals aged 45 to 64,[12,13] with women having the most serious fall-related injuries compared to men.[14]

Nevertheless, women often find themselves constrained by caregiving responsibilities, health issues, and a lack of motivation to engage in physical activity during leisure time, resulting in limited time available. Yet, there are strategies proposed to address these challenges. Notably, nutritional ergogenic aids like caffeine have been suggested as a means to enhance performance in daily tasks and promote psychological well-being among middle-aged women,[15] as well as older adults.[16] Caffeine is a well-known central nervous system stimulant. It blocks adenosine receptors, particularly A1 and A2A receptors, leading to increased neuronal firing and the release of neurotransmitters like dopamine, serotonin and norepinephrine.[17–19] The positive impact of increasing these neurotransmitters positively impacts the motor unit recruitment and reduces pain responses.[20] In this context, previous studies indicated that caffeine improved locomotor function and the ability to perform daily living activities in the elderly.[21,22] Particularly, in middle-aged women, recent study has found that caffeine intake effectively enhances functional performances, including postural balance, cognitive abilities, and dual-task performance while standing and walking.[23]

In combination, music holds significant importance in the daily lives of women and serves as a vital component of leisure activities, recognized universally as one of the most enjoyable and satisfying pursuits.[24,25] Previous research demonstrates the effectiveness of musical interventions in enhancing mood, neuromotor function, and cognitive abilities.[26,27] Music has substantial effects on psychological responses within the central nervous system (CNS).[28] Indeed, it has been suggested that the mechanism for its effects involves the release of excitatory neurotransmitters (eg, serotonin and endorphins) during exercise, which potentially reduce pain and fatigue, leading to improved physical performance.[29,30] Furthermore, various investigations have consistently shown that listening to music can improve posture control, enhance movement symmetry, and increase self-awareness in individuals, particularly patients, by activating motor-related brain structures such as the lateral premotor, supplementary motor, and somatomotor areas.[31,32] A recent study specifically focused on middle-aged women revealed that listening to preferred music significantly improved dynamic balance, as assessed through a timed up-and-go task.[33] It has been revealed that positive effects of music not only reflected in improved exercise performance but also in greater exercise enjoyment.[34]

Psychological variables (like perceived enjoyment and feeling of fatigue) are widely considered as key motivators for exercise.[35,36] In particular, fatigue, commonly experienced in daily life, has been widely described as a sense of tiredness and weakness, influenced by various physiological and psychological factors.[37,38] Numerous studies have observed fatigue significantly altered balance performance among healthy adults and athletes after different forms of exercise,[39,40] including occupational activities such as walking in challenging conditions.[41] Besides, perceived exertion, which encompasses the overall sensation of exertion incorporating feelings of physical stress, effort, and fatigue following training sessions, is crucial. Caffeine has been demonstrated to reduce rating of perceived exertion (RPE) during exercise.[42,43]

Although the effectiveness of caffeine intake and musical interventions as separate entities on exercise performance is well-documented, the literature lacks studies exploring their combined impact. Existing research primarily focuses on either caffeine or music alone, without considering their potential synergistic effects. Additionally, most studies have concentrated on younger populations, leaving a gap in understanding the effects on middle-aged women. Furthermore, while gait analysis has been extensively studied in older adults, there remains a significant gap in understanding gait performance in middle-aged women. Thus, the purpose of this study was to explore the combined effects of caffeine and listening to preferred music on walking parameters, and its relationship between the psychological parameters (fatigue, RPE and exercise enjoyment).

Material and Methods

Participants

To estimate the required sample size, the G * power software (version 3.1.9.2; Kiel University, Kiel, Germany)[44] was used. Parameters such as a large effect size, alpha, power, correlation among repeated measures, and non-sphericity correction (ε) were set at 0.4, 0.05, 0.95, 0.50, and 1, respectively. Consequently, the resulting sample size for this study was computed as a minimum of 10 participants.

Considering an estimated drop out of 30%, sixteen volunteers' middle-aged women (57 ± 1.8 years; height 156 ± 4.3 cm; body mass 74.2 ± 13.6 kg) participated in this study.

Prior to the experiment, each participant completed several questionnaires: (i) a caffeine consumption questionnaire,[45] to determine their daily caffeine intake, (ii) a medical history questionnaire[46] to verify their health status, and (iii) the International Physical Activity Questionnaire[47] to assess their level of physical activity. All participants were healthy, low habitual consumers of caffeine (CC = 120.4 ± 1.42 mg/day), and had been post-menopausal for a minimum of four years. They reported no use of medications, nicotine, or treatments that could interfere with the effects of caffeine. Additionally, none of the participants exhibited sensitivity to caffeine.

Prior to the experiment, each participant completed several questionnaires: (i) a caffeine consumption questionnaire,[45] to determine their daily caffeine intake, (ii) a medical history questionnaire[46] to verify their health status, (iii) the Kupperman menopausal index to estimate their menopause degree, (iv) the Self-Rated Fall Risk[48] to verify their falls risk, and (v) the International Physical Activity Questionnaire[47] to assess their level of physical activity. All participants were healthy, had a normal healthy resting heart rate (60–80 bpm), had normal blood pressure (systolic blood pressure of 110–130 mmHg), were physically independent with a mild risk for falling (3.1 ± 0.7), were low habitual consumers of caffeine (CC = 120.4 ± 1.42 mg/day), and had been post-menopausal for a minimum of four years with mild menopause degree. They reported no use of medications, nicotine, or treatments that could interfere with the effects of caffeine. Additionally, none of the participants exhibited sensitivity to caffeine. Women with vestibular or visual disturbances, history of injury over the past 12 months, musculoskeletal or neurological disease were excluded.

Study Design

This study is a single-blind, counterbalanced, crossover study aiming to investigate the acute effects of caffeine intake combined with listening to music on walking performance in middle-aged women. It complied with the ethical standards of the Declaration of Helsinki and was approved by the Ethics Committee of the Tunisian Protection of Person Sub (NB: CPP/SUD: 0174/2024). Informed consent was obtained from each participant.

Participants were invited to visit the laboratory in three sessions, 2 days apart. The first visit was the familiarization session, where participants were familiarized with the testing procedure and anthropometric characteristic measurements were conducted. For the two testing sessions, women were asked to perform the walking test (6-minute walk test (6MWT)) in four experimental conditions (no-caffeine/no-music condition, caffeine/no-music condition, no-caffeine/with music condition and caffeine/with music condition), using the headphones connected to the participants' personal mobile phone in a randomized counterbalanced order (Figure 1). The randomness was performed using a computerized random

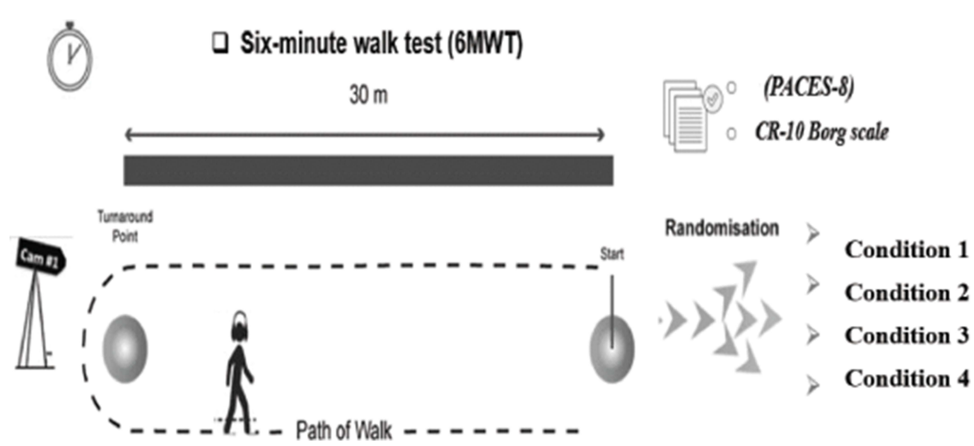

Figure 1 Study design illustration.

Abbreviations: PACES-8, Physical Activity Enjoyment Scale; condition 1, no-music/no-caffeine; condition 2, music/no-caffeine; condition 3, no-music/caffeine; condition 4, music/caffeine.

number generator, which assigned participants to each experimental condition in a random order to avoid any potential order effect or biases. Specifically, in each testing session, two experimental conditions were randomly performed (for example; in session 1: no-caffeine/no-music condition and caffeine/no-music condition, and in session 2: no-caffeine/music condition, caffeine/music condition) with a 1 h rest in between, to avoid potential carryover effects.

In a double-blind fashion, women consume, 30 minutes before performing the 6MWT, a capsule that contain 100 mg of pure caffeine or placebo (0 mg of caffeine). These capsules (with caffeine or placebo) were prepared by an independent researcher with the same color and size and then placed in envelopes according to the allocation orders. Both participants and experimenters were blinded to capsules-allocated.

Participants were instructed not to perform strenuous exercise and to maintain a normal diet for 48 hours preceding each test session and to not consume caffeine after 6:00 pm the night before testing in order to control for the effects of caffeine already consumed.[49] In each testing session, participants rated their Physical Activity Enjoyment Scale (PACES-8) and rating of perceived exertion (RPE) (Figure 1).

The preferred music was identified during the first visit to the laboratory, in which each woman was instructed to select her favorite music. The Brunel Music Rating Inventory-2 was used to control the motivational quotient of the selected music, and only music with a tempo ≥120 bpm was accepted to be considered as during the measurements. The mean tempo of the selected music from all participants was 153 ± 9.5 bpm (Table 1).

Measurements

Six-Minute Walk Test (6MWT)

A 6MWT was used to evaluate gait variability. This test measures an individual's functional capacity by determining the distance they can walk in six minutes at their maximum speed while wearing their usual footwear.[50] Participants were instructed to walk back and forth along a 30-meter straight pathway, turning 180° at each end, aiming to cover the greatest possible distance within the allotted time (ie, 6 minutes). To ensure familiarity with the protocol, participants completed the test three times with 20-minute rest intervals between each trial. Consistency was maintained by having the same two investigators oversee all tests.

Before each 6MWT, participants listened to taped standardized instructions (adapted from Sciurba and Slivka[51]) guiding them to "walk as quickly as possible for six minutes to cover as much ground as possible". They were reassured that they could slow down or rest if necessary. Throughout the test, participants received feedback on the elapsed time and standardized encouragement, including statements like "you're doing well, keep it up" and "do your best", provided at the end of each minute. Three trials were conducted with an hour interval between each to minimize fatigue and ensure accurate results. Additionally, the number of steps taken by each participant was manually counted using a hand counter while observing video recordings.

The parameters analyzed were the walking distance within 6 minutes (meters), walking speed (meters/seconds), steps number during the 6-minute period, number of steps per meter (steps/meter), and cadence (step/minute), by manually counting the number of steps and dividing this by the amount of time recorded.

Rating of Perceived Exertion (RPE)

Perceived exertion was assessed using the CR-10 Borg scale.[52] The Borg RPE is a widely used standardized measure to evaluate perceived intensity of exertion, effort and fatigue during physical exercise. This is a scale ranging from "0" to

Table 1 List of the Preferred Music Selected by Participants

	Title	Owner of the Music	Type	Tempo	Energy	Duration	Number of Participants
Self-selected music	Zarny Fe El Doha	Warda Al-Jazairia	Classical	158 BPM	Average energy	6:59	4
	Ki Jitina	Amina Fakhet	Folk	143 BPM	High energy	5:07	4
	Aléch	Nabiha Karaouli	Folk	148 BPM	Average energy	5:28	2
	Toba	Mayada El Hennawy	Classical	164 BPM	High energy	4:43	6

"10", with corresponding verbal expressions, which gradually increases with the intensity of perceived sensation (0 = nothing at all; 1 = Very week; 2 = week; 3–4 = Moderate; 5–6 = strong; 7–9 = very strong; and 10 = extremely strong). Higher ratings on the scale indicate greater overall body exertion.

The Physical Activity Enjoyment Scale (PACES-8)

The Physical Activity Enjoyment Scale (PACES-8) was employed to determine the level of pleasure and enjoyment experienced by participants during exercise 45. This scale comprises eight items, such as "It is fun", designed to assess the individual's agreement with statements regarding their exercise enjoyment. Participants were asked to rate their current feelings about exercising using a 7-point bipolar scale, ranging from 1 (Totally disagree) to 7 (Totally agree).

Statistical Analysis

Statistical tests were performed using STATISTICA Software (StatSoft, France). Data values were expressed as means (standard deviations (SD)). We verified assumptions of data normality distribution, homogeneity and sphericity using the Shapiro–Wilk W, Leven and Mauchly's tests, respectively. The 6MWT, RPE and PACES scores were analyzed using a one-way analysis of variance (ANOVA) with repeated-measures (4 task conditions). The task factor had 4 levels: 1 ST and 2 DT. When significant differences were observed, a post-hoc analysis was then performed with a Bonferroni significance test. The alpha level of statistical significance was set as $P < 0.05$. Effect sizes were calculated using partial eta squared $\eta 2p$ (small effect: $0.01 < \eta 2p < 0.06$; medium effect: $0.06 < \eta 2p < 0.14$; large effect: $\eta 2p > 0.14$) to assess the practical significance of our findings.[53,54]

Furthermore, Pearson's correlation coefficient was performed to determine the relationship between gait parameters and explanatory factors (exercise enjoyment and RPE). Correlation coefficients were interpreted as small (<0.3), moderate (0.3–0.5) and large (>0.5).[55]

Results

The one-way repeated measures ANOVA showed significant main effects ($p < 0.05$) of the condition factor on the walking parameters' values (distance ($p = 0.00$), number of steps ($p = 0.00$), walking speed ($p = 0.04$) and cadence ($p = 0.00$)) with large effect size ($\eta 2p > 0.14$) (Table 2). The post-hoc analysis showed that the distance, number of steps and cadence values significantly increased ($p < 0.05$) in both caffeine conditions (in the no-music/caffeine condition; distance: $p = 0.018$, 95% CI [0.013, 0.18], number of steps: $p = 0.00$, 95% CI [0.10, 0.31], cadence: $p = 0.00$, 95% CI [0.16, 0.42] and in the music/caffeine condition; distance: $p = 0.002$, 95% CI [15.91, 97.08], number of steps: $p = 0.00$, 95% CI [0.14, 0.34], cadence: $p = 0.00$, 95% CI [0.32, 0.57]) compared to no-music/no-caffeine conditions. These values were significantly better ($p < 0.001$) in the music/

Table 2 Summary of ANOVA Results of the Walking Parameters [6 Minutes Walking Test (6MWT): Distance, Cadence, Number of Steps and Walking Speed], Physical Activity Enjoyment Scale (PACES-8) and Rating of Perceived Exertion (RPE) Variables Statistics Values (F, p, η2p) in Middle-Aged Women

6MWT	F	p-value	η2p
Distance (m)	8.81	<0.001	0.37
Steps	16.90	<0.001	0.52
Walking speed (m/s)	2.940	<0.05	0.66
Cadence (step/minute)	34.18	<0.001	0.69
PACES-8 (scores)	243.90	<0.001	0.94
RPE (scores)	73.64	<0.001	0.83

Abbreviations: 6MWT, 6 minutes walking test; PACES-8, Physical ACtivity Enjoyment Scale; RPE, rating of perceived exertion.

caffeine condition (Table 3). Besides, listening to music significantly ($p < 0.001$) improved the distance ($p = 0.00$, 95% CI [31.04, 112.21]), cadence ($p = 0.00$, 95% CI [0.12, 0.37]), and walking speed ($p = 0.03$, 95% CI [1.76, 91.85]) values compered to no-caffeine/no-music condition. However, no significant changes in the music/no-caffeine condition compared to no-music/no-caffeine were found in terms of distance scores (Table 3).

Besides, the ANOVA results showed a significant main effect ($p < 0.001$) of the task on the PACES-8 ($p = 0.00$) and RPE ($p = 0.00$) scores with large effect size (η2p >0.14) (Table 2). The post-hoc analysis showed that the PACES-8 values significantly increased ($p < 0.001$) in all caffeine or/and music conditions (no-music/caffeine ($p = 0.00$, 95% CI [−8.79, −5.45]), music/no-caffeine ($p = 0.00$, 95% CI [−13.16, −9.83]) and music/caffeine ($p = 0.00$, 95% CI [−17.29, −13.95]) conditions) compared to the no-music/no-caffeine condition. These PACES-8 values were significantly better in the music/caffeine condition (Table 3). However, the RPE values significantly increased only in both music conditions (music/caffeine ($p = 0.00$, 95% CI [1.85, 3.14]) and music/no-caffeine ($p = 0.00$, 95% CI [1.79, 3.07]) conditions) (Table 3).

The Pearson's correlation coefficient revealed moderate positive correlations between the exercise enjoyment (PACES scores) and gait variables; distance ($r = 0.496$, $p < 0.001$), speed ($r = 0.496$, $p < 0.001$), as well as high negative correlations between the exercise enjoyment (PACES scores) and both the number of steps/meter ($r = −0.734$, $p < 0.001$) and the RPE scores ($r = −0.754$, $p < 0.001$). Furthermore, we found significant moderate correlations between the RPE scores and gait variables [distance ($r = −345$, $p = 0.005$), speed ($r = −0.345$, $p = 0.005$)], and with the PACES scores ($r = −0.750$, $p < 0.001$), as well as a small positive correlation with both the steps number, and cadence scores ($r = 0.247$, $p = 0.048$).

Discussion

This study investigated the combining effects of listening to preferred music and caffeine intake on walking performance in middle-aged women. Our findings indicated that listening to preferred music positively impacts their walking variability. Likewise, previous studies demonstrated that music listening enhanced dynamic balance, evaluated by the TUGT, in middle-aged women,[33] and were explained by the possible auditory-balance system interactions between occurring in the peripheral receptors of the inner ear or in the central areas.[56,57] Besides, music also triggers the lateral premotor and supplementary motor areas,[32] which in turn boost postural performance and gait velocity.[58] Besides, these gains may also be explained by reducing the fatigue level (RPE). Indeed, listening to music significantly improved the RPE scores. One potential explication is that while listening to preferred music, participants may have anticipated the upcoming motivational segments of the music that they selected, and this may have "psyched up" or energized participants,[34] which reduce their feeling of fatigue, increasing their work output while performing the 6MWT. Furthermore, it has been evidenced that listening to self-selected music has been shown to induce positive mood responses,[59] high levels of self-esteem, and more confident and arousal feelings,[60] which in turn improve the energy and motivation to exercise.[61] One potential explanation is that listening to music stimulates the brain areas (ie, limbic system and frontal lobes) mainly associated with high emotional and cognitive processes.[62,63] Similarly, it has been

Table 3 Means (SD) of the Walking Parameters [6 Minutes Walking Test (6MWT): Distance, Number of Steps, Cadence and Walking Speed], Physical Activity Enjoyment Scale (PACES-8) and Rating of Perceived Exertion (RPE) in Four Conditions (No-Music/No Caffeine Condition, No-Music/with Caffeine Condition, Music/No-Caffeine Condition and with Music/with Caffeine Condition) in Middle-Aged Women

6MWT	No-Music/No-Caffeine	Music/No-Caffeine	No-Music/Caffeine	Music/Caffeine
Distance (m)	377.02 (30.94)	390.71 (21.43)***	419.47 (36.85)*	464.57 (50.51)***#
STEPS	661.12 (51.37)	601.81 (33.40)	627.75 (38.54)***	616.93 (52.97)***#
Walking speed (m/s)	1.04 (0.09)	1.08 (0.05)*	1.16 (0.10)	1.29 (0.14)
Cadence (step/minute)	1.79 (0.14)	1.54 (0.08)***	1.50 (0.08)***	1.33 (0.15)***£#
PACES-8 (scores)	19.62 (1.74)	28.00 (2.00)***	26.75 (1.23)***	35.25 (1.80)***£#
RPE (scores)	5.93 (0.68)	3.5 (0.51)***	5.87 (0.80)	3.43 (0.51)***

Notes: *Significant difference (p< 0.05) compared to the no-music/no-caffeine condition at p< 0.05 and *** at p< 0.001; #Significant difference (p< 0.001) between caffeine and music/caffeine conditions; £Significant difference (p< 0.001) between music and music/caffeine conditions.
Abbreviations: 6MWT, 6 minutes walking test; PACES-8, Physical ACtivity Enjoyment Scale; RPE, rating of perceived exertion.

demonstrated that exposure to music has positive effects on the brain, particularly in terms of improved neurogenesis, synaptic plasticity and the levels of neurotropes and neurotransmitters (eg, dopamine) levels.[64,65] These brainstem stimulations have been found to mediate sensory and motor functions thanks to serotonin, epinephrine and norepinephrine.[66] Even the tempo of music was found to influence central neurotransmission underlying cardiovascular and respiratory control, motor function, as well as cognitive functions, which may explain our positive effects of music found in our study.[26]

In combination, our findings showed that caffeine boosts these musical benefits on different walking parameters, and even only 100 mg of caffeine intake was sufficient to significantly improve these parameters in middle-aged women. To the best of our knowledge, this is the first study that investigates the combining effects of caffeine and listening to music on walking performance in middle-aged women. Recently, caffeine has been found to be effective in enhancing postural balance under dual-task conditions among middle-aged women.[23] One explanation for its beneficial effect is that caffeine intake stimulates the sympathetic nervous system, releasing dopamine, which in turn induces high feelings of well-being, and good physical performance.[67,68]

Our results proved that after caffeine intake, walking performance improved in both single and dual-task, while listening to music conditions. We suggested that improved walking after caffeine intake might be achieved due to improvement not only motor abilities but also cognitive functions like attention as well as the ability to conduct dual-task. It is well known that a complex movement such as walking, involving different motion phases and actions, requires increased use of cognitive resources (ie, executive function, attention, memory).[69] In fact, areas of walking speed control appear to be linked to higher-level cognitive function networks.[70] On the other hand, caffeine consumption has been shown to improve cognitive performance, in terms of attention, reaction time, vigilance, working memory and alertness.[71–74] It may therefore explain the observed walking improvements in our study. Following these results, middle-aged women are encouraged to consume 100 mg of caffeine (equivalent to one cup of instant coffee) while listening to their preferred music to instantly enhance their walking performance and their feeling of exercise enjoyment. This walking improvement would potentially have a greater impact on daily functioning and prevent falls related injuries in the middle-aged women.

This study has some limitations that should be taken into account in future investigations. First, the participants' number was relatively small due to several difficulties in the recruitment of middle-aged women meeting the inclusion criteria. Second, since our sample was limited to only healthy middle-aged women, the generalization of the findings is difficult for other populations, ie, older adults or individuals with mobility issues. Further research is needed to confirm the positive effects, found in our study, in broader populations. Besides, given that the type of participants' preferred music was folk and classical, it would be interesting to consider different types of music, such as rock, rap and pop. Finally, only a low dose (100 mg) of pure caffeine was used to determine its effects on walking performance. Thus, it would be interesting to consider different doses of caffeine.

Conclusion

Findings of this study are clearly in favor of the hypothesis that caffeine intake influences gait performance, and its combining effects with listening to music, mainly preferred music, would boost these beneficial effects in middle-aged women. Indeed, our results showed that 100 mg of caffeine intake music significantly improved walking parameters such as walking speed, distance and number of steps during both simple task and dual-task while listening to preferred music where optimal results were found. Listening to preferred music seems to be an attention-demanding activity that boosts gait capacities among middle-aged women. These women are therefore recommended to consume 100 mg of caffeine and listen to their preferred music in order to promote their walking performance, by reducing their feeling of fatigue and increasing their exercise enjoyments, offering better functioning during their daily life activities. However, it is important to note that these findings are specific to middle-aged women, and for more generalized results, future research is needed to confirm and expand on these findings, especially in different age groups, genders, or individuals with mobility issues or different health conditions.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

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