THE EFFECT OF ROBUSTA COFFEE CONSUMPTION ON THE INCIDENT OF LOWER URINARY TRACT SYMPTOMS (LUTS) IN HEALTHY UNDERGRADUATE

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ABSTRACT

Introduction: *Lower urinary tract symptoms (LUTS) are common and may impair quality of life. Coffee consumption has been associated with LUTS, although evidence remains inconsistent.* ***Objective:*** *This study aimed to evaluate the effect of robusta coffee consumption on LUTS.* ***Material &Methods:*** *A quasi-experimental design was conducted with 20 medical students.The participants consumed robusta coffee once daily for 14 days as an intervention. LUTS were assessed before and after the intervention using the LURN SI-10 questionnaire, covering storage, voiding, and post-micturition symptom.* ***Results:*** *All 20 participants completed the study. Significant aggravation was observed in urinary urgency (P= 0.035) and nocturia (P= 0.046) after the intervention. However, no significant changes were noted in urinary frequency, incontinence, bladder pain, hesitancy, weak stream, and post-micturition dribble (P> 0.05).* ***Conclusion:*** *Robusta coffee consumption significantly aggravates urinary urgency and nocturia.*

Keywords: *LUTS, robusta coffee, healthy undergraduate.*

ABSTRAK

Pendahuluan: *Gejala saluran kemih bagian bawah (LUTS) merupakan kondisi yang umum terjadi dan dapat mengganggu kualitas hidup. Konsumsi kopi telah dikaitkan dengan LUTS, meskipun bukti yang ada masih belum konsisten.* ***Tujuan:*** *Penelitian ini bertujuan untuk mengevaluasi pengaruh konsumsi kopi robusta terhadap LUTS.* ***Bahan & Cara:*** *Sebuah penelitian dengan desain kuasi-eksperimental dilakukan pada 20 mahasiswa kedokteran. Para peserta mengonsumsi kopi robusta sehari sekali selama 14 hari sebagai intervensi. LUTS dinilai sebelum dan sesudah intervensi dengan menggunakan kuesioner LURN SI-10, yang meliputi gejala penampungan, pengosongan, dan pasca berkemih.* ***Hasil:*** *Dua puluh partisipan menyelesaikan penelitian ini. Perburukan gejala yang signifikan ditemukan pada gejala urgensi berkemih (P= 0,035) dan nokturia (P=0,036) pasca intervensi. Namun, tidak ada perubahan signifikan yang ditemukan pada frekuensi berkemih, inkontinensia, nyeri kandung kemih, hesitansi, pancaran lemah, dan menetes setelah berkemih.* ***Simpulan:*** *Konsumsi kopi robusta secara signifikan memperburuk urgensi berkemih dan nokturia.*

Kata Kunci: *LUTS, kopi robusta, mahasiswa sehat.*

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INTRODUCTION

Lower Urinary Tract Symptoms (LUTS) are a common condition that affects both men and women, include urgency, frequency, nocturia, incontinence, and more.[1] These symptoms can reduce quality of life and contribute to anxiety and depression. Coffee has long been considered as one of the beverages that can aggravate LUTS symptoms. However, previous findings remain inconsistent. Some observational studies show that coffee consumption is associated with LUTS, while others find no significant link.[2-3] Coffee has become an integral part of modern lifestyle, with consumption steadily increasing. Among college students, coffee is one of the most consumed beverages.[4]Therefore, avoiding coffee to prevent worsening LUTS can be challenging. Thus, experimental research is needed to assess its impact on LUTS.

OBJECTIVE

This study aims to evaluate the safety of regular coffee consumption on LUTS, focusing on medical students, a population with high coffee consumption levels.

MATERIAL&METHODS

This study was approved by the Ethics Committee of the Faculty of Medicine, Jember University. Twenty medical students aged 18-25 years participated, meeting inclusion criteria such as normal body mass index (18.5-24.9), normal blood pressure, and not using supplements or medications that can affect bladder function (e.g., diuretics, anticholinergics, or vitamin C). Exclusion criteria included caffeine intolerance, nephroulogical conditions (e.g., benign prostatic hyperplasia, recurrent urinary tract infections, or others), a history of urinary tract or pelvic surgery, alcohol consumption in the past three months, or smoking in the past two months. Participants were required to abstain from other caffeine-containing foods or beverages, smoking, and alcohol during the study.

Each participant consumed one cup of robusta coffee daily (approximately 240 mg of caffeine per serving) for 14 days. Consumption is scheduled to the afternoon. The coffee, prepared in consistent doses, was specially provided by the researchers.LUTS were assessed before and after the intervention using the LURN SI-10 questionnaire, which includes nine items evaluating urinary urgency, urgency incontinence, stress incontinence, bladder pain, hesitancy, weak stream, urinary frequency, and nocturia. Participants were monitored for adverse events and withdrawal effects throughout the study and for seven days afterward. Any research-induced side effects were fully covered by the researchers.

All data were analyzed using SPSS software version 26.0. Wilcoxon signed-rank test was used to compare pre- and post-intervention results. A P-value of less than 0.05 was considered statistically significant.

RESULTS

The effect of robusta coffee consumption on LUTS was evaluated in 20 healthy undergraduates (10 males and 10 females). As shown in Figure 1, most participants exhibited no change in LUTS symptoms, particularly in postmicturition dribble, weak stream, hesitancy, bladder pain, stress incontinence, and urgency incontinence. However, a notable increase in urinary urgency was observed in the majority of participants.

According to the Wilcoxon signed-rank test results (Table 1), two symptoms showed significant changes, urinary urgency (P= 0.035) and nocturia (P= 0.046), with both values <0.05, supporting the hypothesis (H1). In contrast, other symptoms, including urgency incontinence (P= 0.317), stress incontinence (P=0.317), bladder pain (P= 0.783), hesitancy (P= 0.066), weak stream (P= 0.317), postmicturition dribble (P= 0.665), and frequency

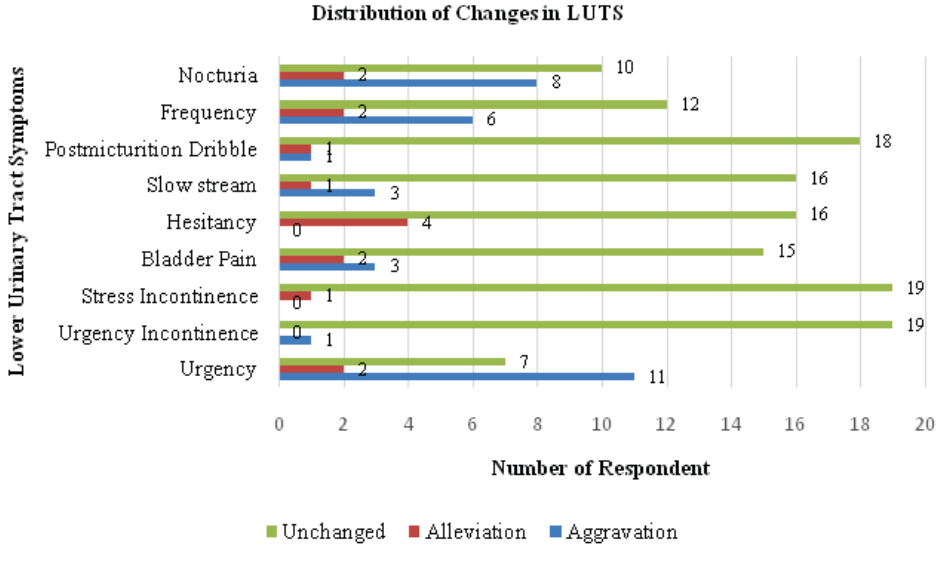

Figure 1. Distribution of Changes in LUTS.

(P= 0.366), showed no significant changes (P> 0.05), leading to the rejection of H1 for these variables. These findings indicate a significant aggravation of urinary urgency and nocturia after 14 days of robusta coffee consumption.

Table 1. Comparison of Pretest and Posttest Results Using Wilcoxon Signed-Rank Test.

Questionnaire Items	*Z*-score	*P*-value
Urgency	-2.112	0.035
Urgency incontinence	-1.000	0.317
Stress incontinence	-1.000	0.317
Bladder pain	-0.276	0.783
Hesitancy	-1.841	0.066
Weak stream	-1.000	0.317
Postmicturition dribble	-0.447	0.655
Frequency	-0.905	0.366
Nocturia	-1.999	0.046

DISCUSSION

This study found that robusta coffee consumption for 14 days significantly increased urinary urgency (P= 0.035), one of the symptoms of LUTS. This finding is in line with the observational study byMaserejian et al.[2],which linked coffee consumption to aggravated urinary urgency. Similarly, experimental research by Lohsiriwat et al.[5] demonstrated that caffeine intake at 4.5 mg/kg body weight or about 200-250 mg, can lower the urgency sensation threshold during bladder filling, making smaller urine volumes sufficient to trigger the urge to urinate. This condition can disrupt daily life, causing discomfort and anxiety.[5] Additionally, in vivo study by Cho et al.[6] showed that caffeine consumption for 14 days increased bladder smooth muscle contraction and elevated c-Fos and NGF expression in the micturition center. These changes indicate heightened neural activity, contributing to bladder instability and overactivity.[6]

Despite urinary urgency, this overactive condition can cause urgency incontinence, stress incontinence, frequency, and nocturia. However, in this study, only urgency and nocturia showed significant worsening. Nocturia has a significant value of 0.046. This finding align with Wells et al.[7] who reported that 14 days of caffeinated coffe consumption was significantly associated with nocturia. This effect is believed to involve caffeine's action on adenosine receptors, as caffeine structurally resembles adenosine. One cup of coffee contains enough caffeine to block adenosine A1 and A2A receptors significantly. In the kidneys, this blockade increases the glomerular filtration rate (GFR), resulting in greater urine production and more frequent micturition.[5]

In vivo research by Kitta et al.[8] further highlights the role of adenosine receptors in micturition control. Their findings show that A1 receptor inhibition increases micturition frequency, whereas A2A receptor inhibition has the opposite effect. Since A1 receptors are more prevalent in the brain, their blockade has a stronger impact. A1 adenosine receptors in the brain are part of neural pathways activated by C-fiber afferent impulses from the bladder. Under normal conditions, A1 receptor activation suppresses bladder hyperactivity caused by C-fiber hyperexcitability. However, caffeine inhibits this mechanism, thereby exacerbating bladder overactivity.[8]

Adenosine receptor blockade affects both the central nervous system and other organs like the kidneys and bladder. In the kidneys, blocking A1 adenosine receptors causes vasodilation in afferent arterioles and vasoconstriction in efferent arterioles, increasing the glomerular filtration rate (GFR). This elevated GFR promotes sodium and water excretion. The distinct effects of vasodilation and vasoconstriction are due to receptor distribution, with A1 receptors predominantly in afferent arterioles and A2A receptors in efferent arterioles.[9]

A1 receptor blockade increases adenylyl cyclase activity, elevating cAMP levels in smooth muscle. This rise in cAMP inhibits Ca^2 binding to myosin light chain kinase (MLCK), disrupting the actin-myosin bridge cycle and relaxing vascular smooth muscle. Conversely, A2A receptor blockade promotes smooth muscle contraction, particularly in efferent arterioles.[10]

In the bladder, activation of A2A adenosine receptors increases smooth muscle contraction. CAMP also regulates polarization in smooth muscle by activating protein kinase A (PKA), which opens K-ATP channels, allowing K to exit the cell and inducing hyperpolarization, leading to muscle relaxation.[11] However, caffeine inhibits this process, maintaining bladder smooth muscle contraction. Vasodilatation of renal afferent arterioles, vasoconstriction of renal efferent arterioles, and contraction of bladder smooth muscle, these processes can also increase urinary frequency.

Although some participants reported increased urinary frequency, the results were not statistically significant (P= 0.366). This aligns with the findings of Wells et al.[7], which showed no significant increase in urinary frequency after 14 days of caffeine consumption. Conversely, research by Lohsiriwat et al.[5] demonstrated significant changes in urine volume following caffeine consumption, potentially leading to increase urinary frequency.

The insignificant results in this study may be influenced by the participants' daily activities. Students often delay urination during busy academic schedules, which could mask changes in urinary frequency.[12] Additionally, the timing of coffee consumption in the afternoon may play a role. Caffeine has a half-life of around 5-6 hours, its effects on the urinary tract likely diminish after this period.[13]

Symptoms of urinary incontinence, including urgency incontinence (P= 0.317) and stress incontinence (P= 0.317), also showed no significant changes. Urinary incontinence, defined as involuntary urine leakage, has shown varying results in previous studies regarding its relationship with caffeine. Davis et al.[14] reported that consuming 250 mg/day of caffeine caused moderate to severe incontinence in men, while Jura et al.[15] found no association with consumption levels of 150-299 mg/day (RR 0.99; 95% CI 0.91-1.07). However, caffeine intake of ≥ 450 mg/day significantly increased the risk of urinary incontinence (RR 1.21; 95% CI 1.08-1.36). The non-significant effects of coffee consumption on urinary incontinence in this study may be due to insufficient caffeine levels to induce such symptoms.

The consumption of robusta coffee showed no significant effect on bladder pain (P= 0.783). In vivo research by Yeh et al.[16] found that low doses of chlorogenic acid (CGA), a compound present in coffee, can reduce bladder inflammation. CGA is known for its antioxidant, anti-inflammatory, and free radical-scavenging properties, which may protect the bladder from irritants.

Similarly, robusta coffee consumption had no significant impact on hesitancy, weak stream, or postmicturition dribble, with P-value more than 0.05. These findings align with Maserejian et al.[2] who reported that consuming 1–2 cups of coffee per day did not significantly worsen voiding symptoms in men or women. This is likely because these symptoms are categorized as underactive bladder conditions, whereas the effect of caffeine is more related to overactive bladder.

This study did not account for daily fluid intake, which could act as a confounding factor and influence the results. Additionally, not all participants adhered to the scheduled afternoon coffee consumption, due to academic commitments, leading to variations in consumption timing. Another limitation was the lack of examination of genetic factors affecting caffeine metabolism, which may have influenced individual responses.

CONCLUSION

This study on the impact of robusta coffee consumption on LUTS in healthy undergraduates found that consuming one cup of robusta coffee daily significantly increased symptoms of urgency and nocturia. However, no significant changes were observed in urinary frequency, urgency incontinence, stress incontinence, bladder pain, hesitancy, weak stream, or postmicturition dribble. Therefore, groups that prone to nocturia, urgency, or LUTS are advised to limit coffee consumption adjusting their consumption timing.

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