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Impact of wearing high heels shoes on pelvic floor muscle activity and incontinence

Wpływ noszenia butów na wysokim obcasie na aktywność mięśni dna miednicy i występowanie nietrzymania moczu

ABSTRACT

High-heeled shoes (so-called stilettos) are an important element of women's wardrobe. Unfortunately, wearing high heels forces the ankle joint into plantar flexion. The daily positioning of the foot in plantar flexion can lead to many abnormalities in the human body. This position is unnatural for the organism from the point of biomechanics.

The aim of the study was to present the effect of wearing high-heeled shoes (plantar position of the foot) on the activity of the pelvic floor muscles and the associated negative effects, such as urinary incontinence.

The authors on the basis of the research showed that the activity of the pelvic floor muscles is the lowest in the dorsiflexion position of the ankle joint. A weakening of the pelvic floor can be associated with urinary incontinence and thus a deterioration of the quality of life.

Keywords: high heels shoes, pelvic floor muscles, incontinence, ankle position

STRESZCZENIE

Buty na wysokim obcasie (tzw. szpilki) są ważnym elementem garderoby wielu kobiet. Niestety noszenie szpilek wymusza w stawie skokowym pozycję zgięcia podszwowego. Codzienne ustawianie stopy w zgięciu podszwowym może prowadzić do wielu nieprawidłowości w ludzkim ciele. Pozycja ta jest nie naturalna dla organizmu z perspektywy biomechaniki.

Celem pracy było przedstawienie wpływu noszenia butów na wysokim obcasie (pozycja ustawienia podszwowego stopy) na aktywność mięśni dna miednicy i związane z tym występowanie negatywnych skutków, takich jak nietrzymanie moczu.

Autorzy na podstawie badań wykazali, że aktywność mięśni dna miednicy jest najmniejsza w pozycji zgięcia grzbietowego stawu skokowego. Osłabienie dna miednicy może wiązać się z nietrzymaniem moczu, a co za tym idzie pogorszeniem jakości życia.

Słowa kluczowe: buty na wysokim obcasie, mięśnie dna miednicy, nietrzymanie moczu, ustawienie stawu skokowego

INTRODUCTION

Urinary incontinence, as defined by the International Continence Society (ICS), is a complaint of involuntary urination, including during sports activities, sneezing and coughing [1]. Urinary incontinence is a common condition in women, with a prevalence that varies from 8.5% to 38% dependent

on age, parity and definition [2, 3]. There are several types of incontinence.

- Stress urinary incontinence is the involuntary leakage of urine due to effort or exertion (e.g., sneezing or exercise), which raises the intra-abdominal pressure to

that higher than the pelvic floor and bladder sphincter pressures. The leakage is momentary and ceases once the episode of raised intra-abdominal pressure stops.

- Urge incontinence is involuntary leakage accompanied by a sudden powerful desire to urinate which cannot be deferred or is difficult to defer.
- Mixed urinary incontinence is associated with urgency and stress incontinence.
- Overflow incontinence is a complication of urinary retention. When a patient can not empty their bladder completely and it becomes over-distended.
- Reflex incontinence is urinary leakage due to neurological damage, disease or a congenital abnormality.
- Nocturnal enuresis is the involuntary leakage of urine at night [4].

As urethral support requires resting pelvic floor muscle activity, decreased resting contraction in plantar flexion indicates that women wearing high-heeled shoes with urinary incontinence might experience more leakage during exertion (e.g., sneezing or exercise) in a standing position. [5]. Pathogenetically, urinary incontinence is not a separate entity, but a symptom that occurs in the case of disorders of the lower urinary tract and the nervous system [6]. However, its frequency prompts us to take it seriously and promptly introduce treatment guidelines for doctors, midwives and physiotherapists, and establish clear recommendations. Stress urinary incontinence is caused by an increase in intra-abdominal pressure, which increases with exercise, sneezing or coughing. It affects physically active people of all ages. Runners are a frequent subject of research focused on the pelvic floor muscles and the effects of prolonged exercise on weakening of the pelvic floor muscles [7]. Pelvic floor muscle training is introduced to strengthen the weakened structures and restore normal muscle function. Urinary incontinence may be associated with weakening of the pelvic floor muscles, whose proper functioning determines physiological urination [8]. Their dysfunction may be aggravated by wearing high-heeled shoes, which cause a strong dorsiflexion in the ankle joint [9-11]. Different heights of heels can cause different stresses in the pelvic floor area [12]. Heels are a symbol for many women, so even despite the negative impact, not every woman will want to give them up. Statistically, more than 60% of women wear heels to work, which may have long-term and repeated effects on the pelvic floor muscles [13].

AIM OF ARTICLE

The primary goal of the article was to create an author's opinion based on 3 studies of the impact of wearing high heels on pelvic floor muscle activity. The authors assume that the position of the plantar flexion caused by wearing high heels will negatively impact the activity of the pelvic floor muscles. The authors pay attention to the negative ef-

fects and characteristic symptoms of urinary incontinence dysfunction as a result of decreased activity of the pelvic floor muscles. An important element is also the quality of life of patients with urinary incontinence.

ANKLE ANATOMY AND POSITION OF THE JOINT

The foot is an amazing part of our body that is the only one in contact with the ground. It serves in two essential roles: support-bearing and locomotive, through propulsions. Its complexity and complicated structure allow you to maintain incredible mobility and multi-directional action. It connects to the lower leg in the ankle joint. It is thanks to the foot that the foot can be in different positions [14]. From maximum plantar flexion to maximum dorsiflexion. It is formed by the distal part of the tibia and the fibula, which form the socket for the trochlea of talus, which is the head of the joint. Such connections ensure both high stability and unhindered possibility of movement in the sagittal plane. This allows the body position to be straight. Bone stabilization, due to the shape of the trochlea of talus, is different in both plantar and dorsiflexion. During dorsiflexion, the connecting ligaments tighten and create a strong stabilization for the joint. For plantar flexion, the posterior part of the trochlea of talus connects to the ankles in the plantar flexion and reduces stabilization, thereby increasing mobility. The ankle joint is secured by numerous ligaments, both from the lateral and medial sides, and by tibiofibular syndesmosis, lying at the front. On the lateral side there are the anterior talofibular ligament, posterior talofibular ligament, and the calcaneofibular ligament). From the medial side, the joint is protected by a deltoid ligament [15].

PELVIC FLOOR ANATOMY

The weakening of the pelvic floor muscles is increasingly becoming a problem for women. Their structure resembles a hammock. The muscles can be divided into three groups: the pelvic diaphragm, urogenital diaphragm, and urogenital triangle. The first group includes the levator ani, pubococcygneus and iliac-coccyx. The genitourinary diaphragm consists of the deep transverse perineal muscle and the superficial transverse perineal muscle. The urogenital triangle is ensured by the contracting muscles, i.e. external anal sphincter, e.g. external urethral sphinter, bulbospongiosus and ischiocavernosus. The pelvic floor muscles have two key functions. They fix the abdominal organs and prevent them from falling out thanks to supporting them from below, which is directly related to the specific and characteristic anatomical structure. Secondly, they control contracting activities through the end sections of the rectum and the genitourinary tract. It is the puncture of these areas by the genitals that leads to the mechanical weakening of these places [16].

IMPACT HIGH HEELS SHOES WEARING ON PELVIC FLOOR MUSCLES IN WOMEN

Research indicates that high-heeled shoes force the ankles into plantar flexion while standing and walking [17]. Analyzing scientific research, it can be concluded that wearing high heels and thus producing different ankle positions alter pelvic floor muscles activity [9-11].

Lee et al. (2018) assessed activation of pelvic floor muscles (PFM) during ankle posture change. Fifty healthy adults (24 men and 26 women) who underwent PFM contraction in ankle posture change (dorsiflexion, neutral, and plantar flexion) while standing were simultaneously measured using electromyography and motion capture systems. Muscle activity at the tibialis anterior and gastrocnemius muscles was measured by surface electromyography electrodes and PFMs were measured using an anal/vaginal probe. The results of this examination showed significantly greater pelvic floor muscles activities in ankle dorsiflexion. At the ankle dorsiflexion, pelvic floor muscles were activated and pelvic was tilted anteriorly, but there was no pelvic movement in ankle plantar flexion [9].

Cerruto et al. (2012) examined the effects of ankle position on pelvic floor muscle electromyographic activity in female stress urinary incontinence. Twenty women, with mild-moderate uncomplicated stress urinary incontinence, were enrolled. In this research an electromyographic (EMG) biofeedback instrument using surface electrodes was used to measure changes in PFM activity while each participant assumed the following different ankle inclinations in upright position: horizontal standing, dorsiflexion at 5, 10, 15 degrees and ankle plantar flexion at 5, 10, 15 degrees. The researchers did not find differences in EMG between horizontal standing and plantar flexion. Pelvic floor muscles tension in dorsiflexion, at whatever angle, was significantly greater than in both horizontal standing and plantar flexion. Moreover, there were no differences between 10 and 15 degrees of dorsiflexion in terms of resting pelvic floor muscles activity. Concerning maximal pelvic floor muscles activity, it was higher in 10 degrees than in 15 degrees of dorsiflexion [10].

Chen et al. (2005). The authors took into account the relationship between ankle position and pelvic floor muscle activity in female stress urinary incontinence. In research 1 a total of 39 women participated between the ages of 38 and 72 and 2 were clinically diagnosed with stress urinary incontinence. Pelvic floor muscle activity changes were tested during various pelvic tilt angles created by horizontal, dorsiflexed, and plantar flexed ankle positions. Pelvic floor muscles activity was measured by an intravaginal probe with surface electromyographic electrodes. An adjustable angle platform was used to set the ankle in each of the positions. The results of the research showed that standing with the ankles plantar flexed resulted in a pos-

terior pelvic tilt and a decrease in pelvic floor muscles activity in comparison to the ankles in a horizontal position. Subjects with ankle dorsiflexion had greater resting pelvic floor muscle activity than with plantar flexion. Patients also produced more mean maximal pelvic floor muscle activity while standing with the ankles dorsiflexed and in a neutral position than while standing with plantar flexion. Moreover, a significant difference was noted in the mean maximal pelvic floor muscles contractions between the ankle dorsiflexion and the horizontal standing [11].

INFLUENCE OF URINARY INCONTINENCE ON QUALITY OF LIFE

Problems that affect the pelvic floor include incontinence, leaking, and pelvic organ prolapse. Issues with the pelvic floor muscles are well known to have negative effects on the quality of life. Many individuals have reported negative effects on their home and work activities, personal relationships, social lives, and mental well-being [18]. Moreover, subjects with pelvic floor dysfunction are more depressed and feel worse than healthy subjects, they are psychologically stressed and socially isolated and they are associated with generally reduced quality of life. On the other hand, pelvic floor dysfunction is heavily under-reported as so many people don't feel comfortable speaking up about it. Many people find talking about pelvic health to be a difficult conversation to bring up. Only 17% of those with pelvic floor dysfunction seek medical help [19-22].

Saboia et al. in 2018 examined the impact of urinary incontinence types on women's quality of life. The authors identified the most frequent type of urinary incontinence in women assisted in two outpatient clinics of urogynecology, and compared general and specific quality of life among the different types of incontinence measured through validated questionnaires. The study included 3 types of urinary incontinence: Stress Urinary Incontinence, Urge Urinary Incontinence and Mixed Urinary Incontinence. Cross-sectional study was conducted at the urogynecology outpatient clinic. The following questionnaires were used for quality of life assessment: Medical Outcomes Study 36-item Short-Form Health Survey (SF-36), International Consultation Incontinence Questionnaire Short-Form (ICIQ-SF), King's Health Questionnaire (KHQ), and a Pelvic Organ Prolapse Incontinence Sexual Questionnaire (PISQ-12). The study included 556 participants (women aged 22-89). Mixed Urinary Incontinence was the most frequent type (n=348/62.6%), followed by Stress Urinary Incontinence (n=173/31.1%) and Urge Urinary Incontinence (n=35/6.3%). Women with mixed urinary incontinence had a greater impact on the general (SF-36) and specific quality of life (KHQ and ICIQ-SF) compared to the others (p<0.05). In the evaluation of sexual function (PISQ-12), there was no difference between groups (p=0.28). All types of urinary in-

continence interfere both in the general and specific quality of life, but women with mixed urinary incontinence are the most affected [23].

Studies of biomechanic of high-heeled shoes show that they create changes in lumbopelvic posture. Research shows that pelvic floor muscle resting activity in the hypolordotic posture is significantly greater compared to hyperlordotic posture. Moreover researchers found significantly greater pelvic floor muscles underwent maximal voluntary contraction in the normal standing posture compared to standing with hyper- or hypolordosis. Additionally pelvic floor muscles take part in the segmental stability of the lumbar spine and pelvis. So it can be concluded that changes in lumbopelvic posture (lumbar lordosis and pelvic tilt, inclination) might create changes in Pelvic floor muscle activity [24].

CONCLUSIONS

Based on the collected research, it can be concluded that walking in high heels forces the foot to be positioned in plantar flexion, which significantly decreases the tension of the pelvic floor muscles. This can contribute to an increased risk of urinary incontinence and therefore a deterioration in quality of life. Taking into account the cited studies and the effects of wearing high-heeled shoes, it may seem justified to implement exercises using the dorsiflexion movement of the foot as an additional therapy in the prevention of pelvic floor muscle weakness and urinary incontinence in women.

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