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Comparison of Support and Clothing Pressure Distribution in Japanese and Australian Maternity Support Garments

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Abstract

During the middle and late stages of pregnancy, the foetus grows rapidly, and the movements of the expectant mother are restricted. Therefore, a method that can support a sagging abdomen to support movement and distribute the weight of the lower abdomen throughout the torso to reduce the burden on the lower back needs to be investigated. This study aimed to develop a maternity support garment (MSG) that would provide comfortable support for rapid abdominal changes during the later stages of pregnancy. Nine types of MSGs used in Japan and Australia were analysed in terms of their clothing pressure distribution with a pregnant mannequin. In addition, pressure sense was indexed by the sensory evaluation of Japanese nongravid women in their 20 s and 30 s, and clothing pressure values obtained via simulation were analysed. The clothing pressure distribution of Japanese MSG is either almost perfect or looser, and when used alone, the MSGs keep the abdomen warm, except when the attached belt is used. Conversely, the Australian MSG is used with three types of tightness recommended by maternity hospitals; however, when double-layered with soft and hard types, the soft type concentrates pressure on the abdomen, and even the single-layer hard type MSG was observed to have higher pressure than the tight-fit sensation. Although the Australian MSGs provide support rather than insulation, the pressure that they exert on the gravid abdomen can restrict the blood flow to the foetus. Therefore, a narrow belt was combined with a single MSG and measured. The overlapping angle of the narrow belt generated excessive clothing pressure on the back from the heavy abdomen, making 15° the most suitable. The Australian soft-type single-layer MSG provided a perfect fit of clothing pressure but proved inadequate for supporting the heavy abdomen. Therefore, combining a narrow belt yielded good results. It was found that the medium type of MSG was preferred either as a single or double layer according to the pregnant woman's preference, rather than combined with the belt. These findings are expected to advance understanding of the effects of existing MSGs on the pregnant abdomen, thus propelling further development of MSGs.

Keywords: Pregnant mannequin; Maternity support garments; Clothing pressure; Pressure feeling

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1 Introduction

The participation of Japanese women in society still follows an 'M-shaped curve', as women take a leave of absence when they get married, give birth, or raise children. The labour force participation rate for women in their 20 s and 30 s is dropping [1]. To maintain Japan's working population, increasing the number of young women interested in entering the workforce and creating an environment that allows them to continue working during and after pregnancy are necessary. During the middle and late stages of pregnancy, the foetus grows rapidly, and the movements of the expectant mother are restricted. Therefore, a method that can support a sagging abdomen to support movement and distribute the weight of the lower abdomen throughout the torso to reduce the burden on the lower back needs to be investigated. According to a survey, 72% of the 891 Swedish gravid women experience lower back and pelvic pain during pregnancy [2] owing to the excessive weight gain during pregnancy that continues after childbirth [3]. The effectiveness of lifestyle interventions for overweight and obese pregnant women has been examined [4]. Studies were conducted in Ethiopia [5] and Saudi Arabia to evaluate knowledge, attitudes, and practices, as well as related factors, regarding exercise during pregnancy [6]. The study also investigated the potential for exercise to reduce the risk of pregnancy complications. Consequently, physical activity questionnaires for pregnant women have been developed [7], and Canada has formulated guidelines for physical activity throughout pregnancy, examining the significance of maternal physical activity for maternal, foetal and newborn health [8]. For example, Yoga is introduced to reduce lower back and pelvic pain and to help control weight during pregnancy [9]. In Japan, on the 'Inu no hi: Prayer for safe delivery ceremony day' after the fifth month of pregnancy, gravid women are instructed on correctly wrapping a cloth around their abdomen at maternity hospitals [10]. However, owing to the difficulty in handling the cloth [11], elastic maternity support garments (MSGs) are now commonly used [12], and instructions regarding their use are available [13]. However, the reports on their further development, including functionality, are almost non-existent both in Japan and overseas.

This study aims to advance the development of MSGs. Therefore, the MSGs currently used in Japan and Australia were analysed in this study regarding their clothing pressure distribution. Owing to the difficulty of the topic and the difficulty of recruiting gravid women as subjects [14], a substitute for gravid women was considered. Dr Rodriguez (RMIT University), who is currently studying MSGs recommended by Australian maternity hospitals, created a gravid mannequin. They reported poor comfort and support while wearing the MSGs during their pregnancy. The pressure was measured using a simple clothing pressure tester; however, the pressure values on the human body were not evaluated. Therefore, as a collaborative research project, we used a gravid mannequin from RMIT University [15]. A clothing pressure measurement system, based on the hydrostatic pressure-balanced method [16], has clarified the relationship with human sensory evaluation when wearing many types of clothing [17-20]. A gravid mannequin and this clothing pressure-measuring system were used to measure the clothing pressure distribution of MSGs and to obtain basic information for their development. By comparing MSG in both countries, the differences in its expected functions will become clear, as will the reasons why MSG in Australia is considered uncomfortable to wear and the problems with MSG in Japan. The final objective was to develop guidelines for MSG that support the foetus, correct the posture of pregnant women, increase daily activity, and prevent or reduce back and pelvic pain caused by pregnancy [21].