A PILOT STUDY ON PROBLEMS WITH WOMEN'S ATHLETIC SUPPORTIVE WEAR

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INTRODUCTION: A study was conducted to investigate some of the discomfort women experienced with athletic supportive wear (sports bras) while playing soccer. Players from a recreational women's soccer league were surveyed. The objective of the survey was to identify specific biomechanical problems female soccer players encountered during the game with their supportive wear. This investigation was conducted as a pilot study for a full-scale biomechanical analysis of discomfort caused by the design of women's supportive wear.

METHODS: Questionnaires were distributed to 35 players in a recreational women's soccer league in Madison, Wisconsin, U.S.A.. The respondents were asked to identify discomfort they encountered while playing soccer with regular and athletic supportive wear. The return rate was 40 % with 14 returned surveys. The ages, heights, weights, bust sizes, and cup sizes (converted to the difference between bust size and circumference of the trunk beneath the breasts) of the respondents are shown in Table-1.

	Mean	SD	Minimum	Maximum
Age (years)	32.71	7.22	26.00	46.00
Height (cm)	167.59	6.41	154.94	177.80
Weight (Kg)	61.87	7.44	49.94	77.18
Bust Size (cm)	90.35	4.43	81.28	96.56
Cup Size (cm)	17.78	1.99	15.24	22.86

Table-1 Ages, heights, weights, bust size and cup size of the respondents.

A more comprehensive survey will be conducted to extend this pilot study to a larger population in different sports activities. The results from the survey will be used in a full-scale biomechanical analysis utilizing a dynamic model with dimensions and mass distribution of the average female 18 to 45 years of age. Added to the model will be variables which are functions of breast size, elastic and damping properties of supportive wear as well as tightness. The dynamic model will also concentrate on the response of the system at the breast interface with the support during the course of different sports activities. The friction and temperature at the interface will be modeled considering the metabolic heat generation, the frictional heat and sweating. Different heat transfer and ventilation coefficients for the supportive wear materials will be incorporated in the heat transfer model which was previously used to analyze ulcer formation under different pressure and frictional properties at the interface with the skin (Chang, 1998).

RESULTS: The major discomfort reported by respondents who had played soccer in regular supportive wear were lack of support (50%), heat (33%), excessive perspiration (33%), and friction on the skin (22%). For playing soccer in athletic supportive wear, 5 respondents (25.71%) reported no discomfort; the others listed the following as the major discomfort: heat (57%), excessive perspiration (36%), excessive tightness (28%), and friction on the skin (14%).

CONCLUSIONS: Athletic supportive appeared to improve the support of the breasts for female recreational soccer players in this survey. The wearers' breasts 'bounced' less. However, the supportive wear also increased the discomfort caused by the accumulation of body heat. Excessive perspiration and friction on the skin remained problematic. Furthermore, excessive tightness became a new discomfort for some players. The data collected in the study will serve as guide for detailed biomechanical studies and complete analysis of the discomfort caused by athletic supportive wear worn by female athletes in different sports. The authors will conduct further investigation on the improvement of the design of women's supportive athletic wear, which is summarized in the following. A biomechanical model for a 50% female will be utilized to investigate the breast bounce due to different sports activities. The transmission of the impulses to the chest due to jumping, kicking, throwing, etc. will be evaluated. A dynamic model for the breast-supportive wear system will be incorporated to evaluate the necessary elastic and damping characteristics for minimizing the bounce. The model will deal with the effect of the breast size on the dynamic response of women's breasts. It would also integrate frictional condition at the interface between the supportive wear and the skin based on the study of Chang and Seireg (1998). The thermal regulation computer simulation used for the study of ulcer formation on the skin (Chang, 1997) will be used for determination of the skin temperature and sweating. The existing thermal model will be extended by combining different heat transfer and ventilation coefficients of different materials, which can be used in the bras. Both the dynamic and thermal regulation models will be integrated to optimize the mechanical and thermal characteristics of the supportive wear for best comfort with respect to heat, tightness, relative motion, friction and excessive perspiration.

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