


Chapter 11

Application of Fuzzy Expert System for Prediction of Farmer Muscle Strength: A Collective Database and Analysis in Agricultural Sectors of Odisha in India

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ABSTRACT

In this chapter, 168 anthropometric dimensions and the back-leg-chest (BLC) strength as the muscle strength of 113 male farmers and 31 female farmers of Odisha are statistically analyzed. Factor analysis is done to identify the most significant anthropometric dimensions. Then correlation coefficient and regression analysis are done considering the anthropometric dimensions and BLC strength. Further, an attempt is made by using ANFIS tool to predict the BLC strength of both male and female farmers. It is found that ANFIS could better predict the muscle strength of farmers.

INTRODUCTION

Indian agricultural sector is expected to be the most important driver of its economy within few years because of high investments for agricultural facilities, warehousing and cold storage. The utilization of genetically modified crops and organic farming will improve the fertility of land and the crop production rate of Indian farmers. But still the small and medium agricultural sectors are very poor and neglected, and they are found following the traditional methods of crop production. The conventional methods of

DOI: 10.4018/978-1-5225-9175-7.ch011

farming results in physical problems like lungs problem due to exposure to dust, and musculoskeletal disorders. Moreover, extreme weather conditions, and heavy work loads give them early old age, bone and muscle problems. So to attain better efficiency of performance and to improve productivity of the worldwide farmers in the agricultural sector, it is essential to design the tools and equipments keeping in consideration the farmers capability and limits. The tools and equipments design should be able to provide more human comfort, of good quality, more output focused and able to reduce the musculoskeletal injury. While designing the equipments the operator's biological needs are taken into consideration. The ergonomic guidelines and physical requirement of the equipments are the essential key elements for this purpose (Das and Grady, 1983; Das and Sengupta, 1996). Moreover, anthropometry helps to establish the physical geometry, properties and capabilities of mass as well as strength of the human body. It primarily involves the systematic measurement and dimensional descriptors of body size and shape. As the knowledge of body dimensions is essential for designers of equipment and work places, the anthropometric measurements are essential for the correct design of the work areas (Ray et al., 1995). Thus the anthropometric body dimensions are the most required factors in this regard.

BACKGROUND

Many literatures are found discussing agricultural sectors of India, their problems, but less have focused on anthropometric and muscle strength of farmers. Chakrabarti (1997) has compiled Indian anthropometric dimensions data for males and females. Victor et al. (2002) have collected and compared anthropometric data of 5 males chosen randomly in Chattisgarh and compared with other regions in the world. It was found that except popliteal height in sitting and buttock popliteal length which are higher, other dimensions are lower than western population like American, Sweden and German. Kar et al. (2003) have found a significant difference in hand dimensions of both right and left hand of male and female farmers of West Bengal with other regions in India and the world. Dewangan et al. (2008) have considered only female farmers of Arunachal Pradesh and Mizoram for anthropometric study. Koley and Melton (2010) have collected height, weight and body mass index (BMI) for both males and females of Amritsar in India. Higher mean values for all measurements were found for males. The study concluded with a regular increase of hand grip strength for both males and females. Yadav et al. (2010) have studied 14 strength parameters of both male and female farmers of Saurashtra, Gujarat and found the average push/pull strength of hands and legs, in standing/sitting posture. Sengupta and Sahoo (2012) have considered male tea garden workers of Cooch Behar District in West Bengal and found variations in measurement. Singh et al. (2013) have collected anthropometric data of 150 female farmers of 3 villages of North Gujarat in India and revealed some considerable changes in the body composition characteristics with the increment of age of female farmers. Dixit et al. (2014) have carried out an anthropometric survey of both male and female agricultural farmers of Ladakh region in India and reported a significant variation in the body dimensions when compared with other parts in the country and in other countries i.e. Egyptian, Japanese, British, Thailand, Mexican and Chinese. Premkumari et al. (2016) have studied the anthropometric data of female farmers of Hyderabad Karnataka region in India and recommended to use these data in the design of farm equipments or to improve farm tools ergonomically. Mishra et al. (2018) have considered 10 farm women of Odisha in India and analyzed them while using plain and

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