Testing the Furniture Dimension Match Levels with Anthropometry among Indian Working Women of Defence Laboratories

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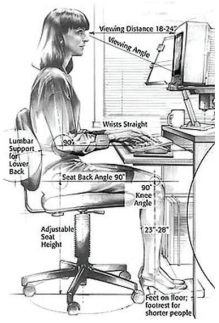

It is postulated that women employees in an office have increased risk of developing back pain due to the nature of their sedentary office work. Increased exposure to computers and related workstation, uncomfortable office furniture, types of jobs performed and the length of working hours/years have been identified as potential risk factors for back pain. Reasons for discomfort can be unchanging sitting position[1] and/or a general lack of movement[2]. In one study that investigated the incidence of back pain related to furniture dimension in Indian women, as much as 25.3% of the study population complained of back pain and for those who used the computer >6 hours daily, there was a statistically significant chance of developing back pain.[3] Despite many reports on mismatch of furniture dimension leading to musculoskeletal disorders (MSD) in India, there is still no specific legislation or standard for the definition of the appropriate furniture characteristics to be used by office workers. This situation can be a consequence of both the lack of knowledge from the governmental authorities and the lack of a representative anthropometric database of the concerned population.[4]

A total of 1072 women employees with a mean age of 40.2 (SD 10.6) years working in different research laboratories all over the country volunteered for this study. Seventeen laboratories were visited to obtain this sample size during 2009–2010. Five laboratories from Bangalore and Pune were classified as group A, nine laboratories from Delhi as group B, and three laboratories from Chandigarh and Dehradun formed group C. Laboratories were grouped together based mainly on their regional location proximity. All the subjects were given prior information about the study and signed informed consent was obtained. Anthropometric measurements such as stature, sitting shoulder height, popliteal height, hip width, thigh thickness, and buttock-popliteal length were measured using an anthropometer (GPM, Swiss). Seat height, seat width, seat depth, seat to desk clearance, backrest height, desk length, and desk breadth were measured with a retractable steel tape.

Data analysis computed descriptive statistics to describe the physical characteristics and furniture dimensions to evaluate the level of mismatch or match between the volunteers and the furniture used by them. A match criterion was defined between anthropometry and the median furniture dimensions (all 942 furniture were individually measured, hence the median

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was considered for the equation). We replaced the office furniture measure in each match criterion equation. Then, the established limits and body dimensions of the women were compared and three categories were defined in the case of the two-way equations: the limit was considered "Match" when the anthropometric measure was between the limits; considered "High mismatch" when the minimum limit of the criterion equation was higher than the anthropometric measure; and "Low mismatch" when the maximum limit of the criterion equation was lower than the anthropometric measure. For the one-way equations only two categories or levels were defined: "Match" and "Mismatch."[5]

Table 1 shows the furniture dimensions for the three studied groups. Results indicated that seat height, considered the first point to be taken into account for any furniture dimension design, was not appropriate for the workers popliteal height by as much as 49.13%, 53.87% and 12.97% in the three studied groups, respectively. It was also found that 49.35%, 48.48% and 51.89% of hip width was mismatched with their seat width in Lab A, in Lab B, and in Lab C, respectively. Buttock popliteal length against the seat depth, thigh thickness against seat to desk clearance, hip width against seat width, back rest height against sitting shoulder height, showed higher level of mismatch between anthropometry and furniture sizes. This reflected that the dimensions of female employees' furniture were quite ill fitted to their anthropometric body dimensions. Although fatigue may be caused by sitting for long periods and long duration of mental concentration, mismatch between the furniture and body dimensions may intensify the problem of fatigue. Studies have shown that any deviation of dimensions of furniture from the anthropometric dimensions may cause physiological and biomechanical load on the musculoskeletal system.[6] Therefore, a study on the present nature of working Indian women in relation to their anthropometric measurements and furniture dimension is of paramount importance.

The ability to adjust the chair height was present in some chairs belonging to senior officers. However, except for a few of them, this feature was not used. Some used cushions to adjust their sitting heights. Most of the furniture measured had been in use for some years. Only one laboratory reported that they had redone their whole furniture and acquired new ones. A common problem reported was the use of old furniture, which had been purchased quite a long time back. Changing the furniture by using newer improved ergonomically designed furniture can reduce the number of people with musculoskeletal disease and cases of mismatch. One way could be dissemination of information and awareness; another is by small interventions. For example, using a back cushion to sit and support the back and using footrests to raise the foot level. Overall, in our interactions with the women workers, many did not know that a slight adjustment of the computer screen height or increase in sitting plane or relocation of sitting angle could make their workplace more comfortable and they reported an improvement because of these slight changes.

While there are several potential limitations of the current study, this was the first of its kind in the defence research and development sector. We did not check if the commercially available furniture in the market would match the laboratory workers anthropometry, though it is felt that using ergonomically designed furniture compatible to their body dimensions with general awareness of ergonomic principle could help in reducing musculoskeletal disease. Ergonomic intervention in furniture acquisition, design, both for male and female employees in government sector is

For more information on anthropometric characteristics of Iranian military personnel see http://www.theijoem.com/ijoem/index.php/ijoem/article/view/399

Table 1: Furniture and anthropometric dimension of three studied laboratory groups. Values are 5th, 50th, and 95th percentiles.

Furniture dimension (cm)	Group A (n=460)	Group B (n=297)	Group C (n=185)
Seat height (SH)	41.0, 46.0, 54.0	42.5, 46.0, 51.1	43.0, 46.0, 54.0
Seat width (SW)	42.5, 46.0, 53.0	42.0, 46.0, 50.6	42.2, 46.0, 50.0
Set depth (SD)	40.0, 45.0, 51.0	41.0, 45.0, 50.0	40.0, 44.0, 50.26
Seat to desk clearance (SDC)	16.5, 27.3, 34.8	17.6, 26.3, 33.8	18.2, 26.6, 34.4
Backrest height (BKH)	36.0, 48.0, 62.0	29.0, 44.0, 63.4	39.2, 45.0, 57.0
Desk length (DL)	119.0, 150.0, 183.0	100.4, 136.0, 183.0	113.4, 138.0, 184.0
Desk breadth (DB)	60.0, 76.0, 93.0	60.0, 71.5, 92.0	60.0, 75.5, 93.0
Anthropometric measurements (cm)			
Stature (ST)	144.59, 154.30, 164.02	146.70, 155.50, 164.60	145.04, 154.60, 164.96
Popliteal height (PH)	33.80, 36.00, 39.40	33.08, 36.00, 39.30	33.30, 35.90, 38.58
Buttock-popliteal length (BPL)	37.49, 41.60, 45.50	36.40, 40.70, 45.20	37.50, 40.60, 45.48
Sitting shoulder height (SSH)	49.69, 54.40, 59.30	51.30, 55.50, 60.20	51.42, 55.50, 59.88
Hip width (HW)	29.79, 34.50, 40.91	28.97, 33.10, 40.15	28.52, 33.10, 38.56
Thigh thickness (TT)	10.60, 13.30, 16.00	9.10, 12.60, 15.62	10.50, 12.60, 15.30

lacking. Policy makers, government authorities, and R&D organizations can look into the aspect of undertaking a large scale representative anthropometric database of the working population, which is very much required in the organized sector, and much more so, in the unorganized sectors.

Conflicts of Interest: None declared.

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