

## Ergonomic Evaluation of Least Fatiguing Stairs in Indian Houses for Women Users\*

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**Abstract.** Climbing stairs is a routine for Indian females, who live in flats or work in multistoried buildings. Sometimes they have to climb with considerable loads. Present study was thus conducted to examine stairs commonly seen in the country, to ergonomically evaluate the suitability of these stairs for routine climbing and to suggest the least fatiguing stair type to them. Evaluated ergonomic parameters were: heart rate, energy expenditure, total cardiac cost of work, physiological cost of work and time spent on climbing twenty stairs at a stretch by 20 young women having similar physiological parameters. Results of the study revealed that average depth of tread was 10.2", riser height 7.8", width 32.8" and angle of stairways varied from 25° - 50°. It was further seen that maximum exertion was found for climbing spiral type of stairs. Maximum increase over base in average heart rate was 51.09 beats/min while subjects climbed spiral type stairs as compared to L-shaped stairs (23.27 beats/min). Similarly energy expenditure was also maximum while climbing spiral stairs that is 8.13 as compared to L-shaped i.e. only 3.7 HJ/min. So, subjects found spiral stairs most tiring and L-shaped stairs least tiring. Major problem, which they faced, was breathlessness, pain in legs and giddiness while climbing spiral stairs only.

**Key words:** spiral type stairs, L-shaped stairs, total cardiac cost of work, physiological cost of work

**Abstrak.** Menaiki tangga adalah salah satu kegiatan rutin bagi para wanita India yang tinggal di flat-flat atau bekerja di bangunan bertingkat. Kadangkala mereka harus mendaki tangga membawa beban yang cukup berat. Studi ini meneliti tangga-tangga yang umumnya terdapat di negara ini, untuk secara ergonomik melihat kecocokan tipe tangga untuk dinaiki secara rutin, dan mengusulkan jenis tangga yang paling tidak melelahkan mereka. Parameter ergonomik yang dievaluasi adalah: denyut jantung, pengeluaran energi, beban kerja jantung total, beban kerja fisiologis dan waktu yang dihabiskan untuk menaiki 20 anak tangga sekaligus pada 20 wanita muda dengan ukuran fisiologis yang sama. Hasil penelitian ini menunjukkan bahwa kedalaman pijakan anak tangga rata-rata adalah 10.2", ketinggian antar-undakan 7.8", lebar 32.8" dan sudut tangga bervariasi antara 25°-50°. Lebih jauh terlihat bahwa yang paling melelahkan adalah menaiki tangga tipe spiral. Peningkatan paling banyak di atas detak jantung rata-rata adalah 51.09 denyut/menit ketika subjek menaiki tangga spiral dibandingkan dengan tangga bentuk L (23.27 denyut/menit). Pengeluaran tenaga juga maksimal ketika menaiki tangga spiral, yaitu 8.13, dibandingkan dengan bentuk L yang hanya 3.7 HJ/menit. Jadi, subjek merasa tangga spiral paling melelahkan dan bentuk L paling tidak melelahkan. Masalah utama yang mereka hadapi, adalah kehabisan napas, rasa sakit di kaki, dan pusing hanya ketika menaiki tangga spiral.

**Kata kunci:** tangga bentuk spiral, tangga bentuk-L, beban kerja jantung total, beban kerja fisiologis

Stair climbing is classified as a heavy physical activity which may have an effect on maximal aerobic power (Morris, Adam,

Sirey, Epstein, & Shefhan, 1973). In fact it is a physically extremely strenuous form of work which man tries to avoid.

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