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# Lumbar load in common work tasks for baggage handlers

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**Introduction:** Baggage handlers have a history of frequent occupational injuries. The lumbar spine is often the site of these injuries. The baggage-handlers often work in constrained spaces, yielding sitting, kneeling or stooping positions. These positions have been associated with low back pain. The purpose of the study was to investigate the biomechanical loading of the lumbar spine during common working tasks for baggage handlers.

**Methods:** We selected ten different but common working tasks. The tasks were: 1) loading without belt-loader, 2) loading and 3) unloading with belt-loader, 4) sitting, 5) kneeling, and 6) stooped work position, 7) loading and 8) unloading baggage-containers, and 9) pulling and 10) pushing baggage/container carts. In each task 10 different baggage-handlers were filmed. Segment-angles were measured on still-pictures using ImageJ (National Institute of Health, USA) and used as input to the software-program Watbak (University of Waterloo, Canada) which calculated the compression force of the L4/L5-segment. A linear mixed model with Tukey-adjusted post-hoc multiple comparisons was applied to determine significant differences between tasks. Significance was accepted at $p < 0.05$.

**Results:** The average compression was largest in the stooped task (3,893 N) (Figure 1), while kneeling (2,631 N) work showed the second largest compression. Third and fourth largest compressions were in loading (2,582 N) and unloading (2,522 N) baggage-containers. The lowest compressions were in pulling (1,388 N) and pushing (1637 N) carts and loading aircrafts without belt-loader (1,572 N). The compression in the stooped task was significantly larger than all other tasks. Loading and unloading containers and kneeling posture were significantly lower than stooping, but significantly larger than the remaining tasks (Table 1).

| COMPRESSION | | TASK | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TASK | mean | LNA | LBE | UBE | STO | KNE | SIT | PULL | PUSH | UCO | LCO |
| LNA | 1572.51 | x | | | | | | | | | |
| LBE | 1933.23 | | x | | | | | | | | |
| UBE | 2016.04 | | | x | | | | | | | |
| STO | 3893.52 | | | | x | | | | | | |
| KNE | 2631.08 | | | | | x | | | | | |
| SIT | 1783.81 | | | | | | x | | | | |
| PULL | 1388.89 | | | | | | | x | | | |
| PUSH | 1637.52 | | | | | | | | x | | |
| UCO | 2522.10 | | | | | | | | | x | |
| LCO | 2582.71 | | | | | | | | | | x |

*Table 1. Differences between tasks. Green areas represent significant differences between tasks.*

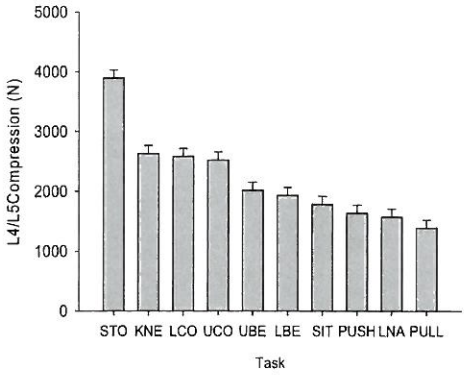


*Figure 1. L4/L5 compressions. Error bars are SEM. STO=stooped, KNE=kneeling, LCO=load container, UCO=unload container, UBE=unload belt, LBE=load belt, SIT=sitting, PUSH=push carts, LNA=loading without belt, PULL=pull carts.*

**Discussion:** Only the compression force in the stooped task exceeded the limit of 3.4 kN, which has been suggested by The National Institute for Occupational Safety and Health (NIOSH). The NIOSH equations, however, do not take restricted workspace, working position as seated or kneeling or one-handed lifting into account. The seated position produced a significantly reduced compression compared to the kneeling position. Thus this position may be recommended instead of kneeling when loading baggage inside an aircraft.