Background

- One of the key elements in situations with higher levels of relief, performance, and safety is mental workload (MWL).
- Thus, using a sensitive measure to accurately detect differences in subjective responses in two levels of MWL is essential.
- Researchers have established three indirect subjective- (e.g., rating scale mental effort [RMSE] and NASA-TLX), objective- (e.g. heart rate variability [HRV] and EEG), and performance-based (e.g. the responses of compensatory tracking task and choice reaction time task (CRR) measures to evaluate the MWL variable.
- Therefore, we aimed to assess and compare different levels of MWL in males and females by applying some subjective, objective, and performance measures among Iranian community.

Methodology

- Healthy males (n= 13; M±SD: age: 25.9 ±4 years; BMI: 23.5±2.74) and females (n= 13; M±SD: age: 25±2.68 years; BMI: 21.65±2.61) university students voluntarily participated in the study.
- They completed a two level of difficulty computerized dual task (Figure 1), presented in a 19" display, including a tracking task and a choice reaction time task in a pre-defined trial.
- The trial included four periods, each one 5 minutes (in total 20 minutes), two rests and two tasks (two levels of MWL difficulty), with the order of rest-task were considered (Figure 1).
- Heart rate variability (HRV), NASA-TLX, RSME, and performance responses measures were used to assess MWL.
- Independent and Paired sample T-test, repeated measure ANOVA, and Cohen’s dz statistic were applied for statistical analysis.

Results

- The results indicated that the most sensitive measures are performance responses (effect size [d], male=1.71; female=1.12), weighted NASA-TLX score and the non-linear HRV variable of alpha2 for males (d=0.69) and Unweighted NASA-TLX score for females (d=0.68), and the time domain HRV variable of TINN for females (d=0.48).
- The only and most sensitive measure to distinguish between genders was weighted NASA-TLX score (p<0.05) (Figure 3 and 4).

Discussion

- The current findings indicated that in short-term periods, performance-based measure, specifically primary task responses, is the most sensitive measure to detect changes in the MWL levels.
- The most sensitive measure to distinguish between males and females was unweighted NASA-TLX score. This variable also showed a moderate magnitude of effect size to detect the changes in the level of MWL difficulties.
- HRV variables can detect the different MWL difficulties with the lowest sensitivity in comparison to other two measures.
- The main results of the HRV analysis revealed that in short-term periods, alpha1 in the males and TINN in the females showed the biggest effect size estimates.
- The limitation of this study was relatively low participants. Future studies might need more numbers of cases to achieve more reliable findings.

Conclusion

- The findings of this study suggest performance-based method as a sensitive measure in both gender and weighted NASA-TLX score to distinguish between Iranian males and females.
- Thus, more than one measure should be used in order to assess MWL when gender difference is a priority.
- Furthermore, this hypothesis emerged that non-linear HRV analysis can be a sensitive measure in different task demands.

References