

# ASYMMETRY OF MOVEMENTS AS A SIGNIFICANT INDICATOR OF WORKPLACE ERGONOMICS AND WELL-BEING

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## Introduction

In recent years, methods for assessing the ergonomics of movements have become more critical with the emergence of new technical developments, such as inertial systems for motion analysis. Research has indicated that workplace ergonomics assessments often overlook movement asymmetry, even though symmetrical limb moving and loading are expected to reduce the energy expenditure associated with activities such as walking and standing [1]. Asymmetry of movements has been recognised as a potential risk factor in work-related musculoskeletal disorders. However, there is a lack of evidence regarding the effectiveness of observation techniques in assessing the asymmetry of movements in the workplace. Thus, **the main objective of this research is to understand the risk factors associated with the asymmetry of movements and to develop an observational technique that can be used to assess the ergonomics of movements.** Additionally, we investigate the relationship between asymmetrical movements of line workers and their well-being.

## Methods

This observational, retrospective study investigated the standardised working tasks involved in the manufacturing process. In addition, a survey study was carried out to assess well-being at work.

The research included 42 machining workstation employees (MWE) (41.9±9.6ys, 79.9±13.6kg, 1.76±0.07m) working on 12 devices and 44 assembly workstation employees (AWE) (35.5±9.5ys, 69.2±13.3kg, 1.69±0.10m) working on nine devices.

An MR3 myoMuscle full-body inertial system was used to record movements during a 30-minute observation. The mobility was characterised by measuring linear accelerations, angular displacements and velocity of the main body parts, separately for the left and right sides. In addition to detailed kinematics, a Movement Activity Index is proposed based on the selected variables [2,3].

## Results

MAI [%]	MWE group	AWE group	p <sub>1</sub>	p <sub>2</sub>	p <sub>3</sub>
			MWE-AWE	in MWE (LT-RT)	in AWE (LT-RT)
MAI LT side	31.9±5.1	19.6±2.6	0.010		0.043
MAI RT Side	35.0±5.4	22.1±3.4	0.012		
Global MAI	36.6±6.8	25.5±2.7	0.019		

Table 1: The results of normalised motion activity indexes. Median +/- IQR of the MAI for the left (LT) or right (RT) side or a central segment is accompanied by

the significant p-values of test statistics between groups (p<sub>1</sub>) or between sides within groups (p<sub>2</sub>, p<sub>3</sub>).

	Mean value	Mean value of "healthy sample"	Mean value of "ill-healthy sample"
General GHQ	18	26.1	41.2
Somatic complaints	9.92	7.8	10.2
Anxiety and insomnia	5.3	7.3	10.8
Social dysfunction	7	7.9	10.9
Depression	1	3.1	9.3

## Discussion and Conclusions

The MWE group appeared to be more active in terms of all measured variables related to range of motion, maximum speed or maximum acceleration. Confirmation of this can be found in the Global MAI, which was significantly higher by approximately 11% for the MWE group. The right limb in both groups showed greater involvement in the work either of assembling or machining components. The AWE group, although on average showed less activity than the MWE group, proved to be significantly asymmetric. The right limb showed an 11% increase in activity.

The result suggests that repetitive movements imposed by manufacturing processes and asymmetrical positions decrease physical well-being and produce fatigue and exhaustion. Additionally, almost 74% of workers from a study sample exceeded the mean value of the "healthy sample" which implies serious problems related to poor somatic well-being, such as regular exhaustion, weakness, tiredness and aches from different parts of the body.

Movement activity index proved to be a good indicator of movements and workplace ergonomics and proved to correlate with the assessed well-being.

## References

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