Ergonomic Suitability Tables Chairs Worker Anthropometry Finance Subdivision Semarang City Health Office

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ABSTRACT

Modern office environments are dominated by static activities that pose health risks, particularly ergonomic factors that trigger fatigue and musculoskeletal disorders. At the Finance Subdivision of the Semarang City Health Office, employees experience subjective complaints of aches and fatigue; however, a systematic objective evaluation of tool compatibility with workers' physical profiles had not been conducted. This descriptive quantitative study evaluates the suitability of work desk and chair dimensions based on workers' anthropometric data. Data collection involved direct measurement of 14 respondents, comparing actual facility dimensions to the 5th (P5) and 95th (P95) percentile values based on the Minister of Manpower Regulation No. 5 of 2018. Scientific findings revealed significant gaps; the actual desk height (75 cm) was well below the P5 minimum (88.59 cm), and the chair backrest height (45 cm) fell below the P5 minimum (55.24 cm). Additionally, seat height (43 cm) was lower than the popliteal height (44.74 cm). This mismatch forces workers into hunched postures, triggering static loads on back and neck muscles. The study concludes that work facilities do not meet ergonomic standards and are misaligned with employee physical profiles. The primary recommendation is the redesign or procurement of adjustable facilities to improve occupational health and efficiency. Future research should expand sample coverage and integrate the Nordic Body Map to map specific muscle pain levels.

Keywords: Anthropometry, design, ergonomic, musculoskeletal complaints

INTRODUCTION

Office work in the modern era is dominated by long periods of static activity in front of a computer. Offices also have potential hazards that can affect worker safety and health. In general, hazards in the office are divided into two categories: safety hazards and health hazards. One factor that can cause work-related illnesses is ergonomics. The impact can vary from person to person, but if ignored, it can lead to complaints such as work fatigue. Work fatigue is characterized by a decrease in worker energy and concentration, which increases the risk of errors at work, leads to poor decision-making, decreases productivity, and can result in workplace accidents (1).

Previous studies have also stated that long hours of computer work and poor ergonomic posture trigger myofascial pain in the back and neck area (2). This study practically shows that anthropometry-based design interventions can reduce the risk of musculoskeletal strain, emphasizing the relationship between the incompatibility of work facility dimensions and health disorders (3). Based on Minister of Manpower Regulation No. 5 of 2018, every work environment must meet ergonomic standards to ensure the safety, health, and comfort of workers (4). In the Finance Subdivision of the Semarang City Health Office, the high intensity of administrative work requires adequate facility support. However, initial observations indicate subjective

complaints of soreness and fatigue among employees, while objective evaluations of work equipment suitability have never been conducted systematically (5).

The phenomenon of work fatigue experienced by office workers is often considered normal, even though its long-term effects can reduce productivity and the quality of public health services. Ergonomics, as a science that studies human interaction with elements of the work system, aims to create a comfortable, safe, and efficient work environment that can improve worker welfare and organizational productivity (6). The application of ergonomic principles, particularly in the selection of work desks and chairs, must be based on accurate anthropometric data, given the variation in body size between individuals as represented by the 5th percentile (P5) and 95th percentile (P95) values.

Previous studies have shown that a mismatch between the height of the work desk and the height of the seated elbow can cause additional strain on the shoulder and neck muscles and accelerate muscle fatigue in these areas (7). Similarly, designs that do not properly support the curves of the body in the backrest and seat can increase pressure on soft tissues, including in the popliteal area of the lower thigh, during prolonged sitting (3). In government agencies such as the Semarang City Health Office, the layout of workspaces and facilities often prioritizes aesthetics or budget availability over ergonomic aspects based on workers' physical data. An ergonomic work environment can promote good posture, improve blood circulation, reduce the risk of musculoskeletal disorders such as back, neck, and shoulder pain, and reduce the risk of work fatigue. Thus, investing in ergonomic work facilities not only supports worker health but also has a positive impact on overall organizational productivity and performance (8).

The actual conditions in the field show that most work equipment in financial units still uses general size standards that may not be suitable for the diversity of employees' bodies. This is reinforced by previous research which shows that work chairs that are not suitable for the anthropometry of users often cause discomfort and musculoskeletal disorders (MSDs). Discomfort in the lower back is the most common complaint (9). Therefore, this study is crucial to provide empirical evidence on the extent to which existing work facilities meet ergonomic standards. The objective of this study is to conduct a descriptive study to evaluate the level of suitability of desk and chair dimensions based on the anthropometric data of workers in the Finance Subdivision of the Semarang City Health Office, so that targeted recommendations for improvement can be formulated to improve health and work efficiency.

METHODS

The research method used in this study was quantitative descriptive, which aimed to evaluate the ergonomic suitability of work facilities. The research was conducted by measuring the anthropometric dimensions of workers and the physical dimensions of desks and chairs in the Finance Subdivision of the Semarang City Health Office. The data obtained was then compared with the standards set in Minister of Manpower Regulation No. 5 of 2018 to determine the level of ergonomic suitability (4).

The data collection process was carried out through direct measurements of 14 respondents. The research instruments included observation sheets and standard measuring tools to obtain the body dimensions of workers and facility dimensions. Data analysis techniques used descriptive statistics to calculate the mean, standard deviation, and percentile values. The 5th percentile (P5) was used as the minimum limit to determine the range, while the 95th percentile (P95) was used as the maximum limit for spatial dimensions (10).

The analysis of the adequacy and suitability of facilities is based on mathematical calculations involving average and standard deviation formulas to obtain ergonomic threshold values. All procedures in this study were conducted in compliance with research ethics standards. As a form of compliance with global ethical standards, each participant in the ergonomic study was required to be given an explanation of the objectives and risks of the study. Written informed consent ensured that anthropometric data was collected with the full consent of the participants and that their identities remained confidential throughout the analysis process (11).

Measurements were analyzed by calculating the average measurement, standard deviation, 5th percentile value (P'5) for the minimum, and 95th percentile value (P'95) with reference to Permenaker Standard No. 5 of 2018. Measurements were made using the following formula:

1. Calculating the Average Measurement

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{N}$$

$\bar{x}$ = Rata − rata hasil pengukuran
x_i = Data hasil pengukuran ke − i
$i = 1$ = Nilai data ke − 1
n = Nilai data ke − n
N = Banyaknya data pengukuran

2. Calculating the Standard Deviation

$$SD = \sqrt{\frac{\sum(x_i - \bar{x})^2}{N-1}}$$

SD = Standar Deviasi
x_i = Nilai data ke − i
$\bar{x}$ = Rata − rata hasil pengukuran
N = Banyaknya data pengukuran

3. Calculating the 5th Percentile

$$P5 = \bar{x}_i - (1,645 \, x \, SD)$$

$P5$ = Persentil 5,5% ukuran tubuh terkecil dari suatu pengukuran
$\bar{x}_i$ = Rata − rata ukuran antropometri tertentu
SD = Standar Deviasi

4. Calculating the 95th Percentile

$$P5 = \bar{x}_i - (1,645 \, x \, SD)$$

$P5$ = Persentil 5,5% ukuran tubuh terkecil dari suatu pengukuran
$\bar{x}_i$ = Rata − rata ukuran antropometri tertentu
SD = Standar Deviasi

RESULT

This study was conducted on 14 workers in the Finance Subdivision of the Semarang City Health Office by comparing the dimensions of work facilities (desks and chairs) with the workers' anthropometric data. The scientific findings from these measurements are summarized in the following tables.

1. Workers' Anthropometric Characteristics and Work Desk Dimensions

Based on anthropometric measurements, ideal work table dimensions for workers were determined using the 5th percentile (P5) and 95th percentile (P95) values. Summary statistics of anthropometric data and actual table conditions in the field are presented in Table 1.

Table 1. Summary of Workers' Anthropometric Statistics and Work Table Dimensions

Measurement Variable	Mean (cm)	SD	P5 (Standard)	P95 (Standard)	Actual Dimensions (cm)
Table Length (PRT)	165,57	10,65	148,00	183,14	120,00
Lebar Meja (PGD)	72,64	5,59	63,42	81,86	60,00
Table Heigh (TP)	97,50	5,40	88,59	106,41	75,00

Source: Processed Primary Data (2025)

As shown in Table 1, there is a significant gap between the actual dimensions of the work table and ergonomic standards. The actual table length (120 cm) is below the P5 value (148 cm), which means that the table is too short to accommodate the worker's arm span. Similarly, the actual desk height (75 cm) is well below the minimum P5 standard (88.59 cm), forcing workers to adopt a hunched posture while working.

2. Worker Anthropometric Characteristics and Work Chair Dimensions

The evaluation of work chairs was conducted by comparing 11 chair dimension variables against worker anthropometric standards in a seated position. A summary of the data is presented in Table 2.

Table 2. Kesesuaian Antropometri Pekerja dengan Dimensi Kursi Kerja ($n=14$)

Chair Variables	Anthropometric Standard	P5 (cm)	P95 (cm)	Actual Dimensions (cm)
Seat Leg Height Seat Width	Popliteal Height Hip Width	44,74	46,99	43,00
Lebar Alas Duduk	Lebar Pinggul	35,42	41,15	45,00

Seat Length	Popliteal-Buttock Distance	44,14	49,86	50,00
Backrest Width	Upper Shoulder Width	36,94	47,49	45,00
Backrest Height	Seat Shoulder Height	55,24	60,76	45,00
Armrest Length	Lower Arm Length	43,78	47,08	37,5
Armrest Height	Elbow height	20,60	22,26	18,6

Source: Processed Primary Data (2025)

The results in Table 2 show that the evaluation of the suitability of work chair dimensions was carried out using the 5th percentile (P5) anthropometric approach as the minimum limit and the 95th percentile (P95) as the maximum limit. The results show that the height of the chair legs, which refers to the P5 popliteal height, does not meet the standard because the actual dimensions are below the P5 value. The seat width compared to the P95 hip width is considered too wide because it exceeds the maximum limit, while the seat length evaluated using the P5 popliteal-buttock distance is considered inappropriate. Furthermore, the seat back width referring to the P95 upper shoulder width does not meet the suitability criteria, and the seat back height compared to the P5 sitting shoulder height is considered too low. For the armrest length and armrest height, both were analyzed using the P95 approach, and the measurement results showed that the actual dimensions did not meet the maximum anthropometric limits set. Overall, these results indicate that the dimensions of the work chair are not yet able to optimally accommodate variations in worker body size based on the percentile approach used.

DISCUSSION

This study aims to evaluate the suitability of desk and chair dimensions with the anthropometry of workers in the Finance Subdivision of the Semarang City Health Office. The main findings show that the majority of work facilities, both desks and chairs, do not meet the ergonomic standards set by Permenaker No. 5 of 2018. The most prominent discrepancies were found in the height of the desks, which were too low, and the dimensions of the chairs, which were unable to accommodate variations in workers' body sizes, thus posing a high risk of causing work fatigue and musculoskeletal complaints.

These findings are consistent with previous studies that found that the mismatch between the dimensions of work chairs and popliteal height directly contributes to physical discomfort among workers. However, the results of this study differ slightly from some general literature that states that standard office desks are usually sufficiently ergonomic for the local population. In this context, the difference is most likely due to the use of older desk types that were not designed with the latest anthropometric data or changes in current static work requirements in mind (8).

Scientifically, the high table mismatch (actual 75 cm vs. standard P5 88.59 cm) causes workers to be in a prolonged trunk flexion position. According to ergonomic theory, this awkward posture results in static load on the back and neck muscles, which explains why the phenomenon of work fatigue occurs in this unit. This mechanism occurs because muscles must work extra hard to maintain body balance on disproportionate facilities, which ultimately reduces work efficiency (12).

The findings of this study have important practical implications for occupational health management in government agencies. The provision of work facilities should not be based solely on availability or aesthetics, but should be standardized based on the physical profile of employees (13). In terms of policy, this reinforces the urgency of implementing Minister of Manpower Regulation No. 5 of 2018 in the office environment to prevent occupational diseases.

This study has limitations in terms of the relatively small sample size (14 people) and only covers one sub-section, namely finance, so the results must be generalized with caution. However, these limitations do not invalidate the findings because the measurements were taken precisely using direct anthropometric data and comparisons with valid regulatory standards. This study remains valid despite certain limitations because the anthropometric measurements were taken directly and the results were compared with the ergonomic standards regulated by Permenaker No. 5 of 2018, so that the findings reflect valid and relevant empirical conditions (14).

Further research is recommended to expand the sample coverage to all units in the Health Office and to add subjective measurement variables such as the Nordic Body Map (NBM) method for to correlate physical data with the specific muscle pain levels experienced by workers. In conclusion, these findings clearly answer the research objective that there is a mismatch between the dimensions of work tools and worker anthropometry, which provides a strong basis for the need to redesign or procure ergonomic work facilities (15).

CONCLUSION

This study concludes that the work facilities in the Finance Subdivision of the Semarang City Health Office, particularly the desks and chairs, do not meet ergonomic standards that are in line with the anthropometric profiles of the employees. The mismatch between the actual dimensions of the facilities and the workers' percentile values causes uncomfortable working postures, which theoretically and empirically are the main triggers of work fatigue and the risk of musculoskeletal disorders. These findings confirm that the provision of work facilities in this government agency has not fully implemented the mandate of Minister of Manpower Regulation No. 5 of 2018 concerning ergonomic standards in the workplace.

As a follow-up to this study, it is recommended that management immediately redesign or procure work facilities that have flexibility features to accommodate the diversity of employee body sizes. Additionally, future research should expand the sample coverage to other work units and integrate subjective evaluation methods, such as the Nordic Body Map (NBM), to map the correlation between facility dimension mismatches and the level of specific muscle pain experienced by workers.

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REFERENCES

1. Yogaswara T, Djunaidi Z. Analisis ergonomik di tempat kerja dan kelelahan pada pekerja dalam upaya peningkatan kinerja di pt x. Jurnal Kesehatan Masyarakat Inovatif. 2023;6(No 4):7–19.
2. Sarah Y, Andriani AT, Setyawan FEB. Hubungan Ergonomi dan Durasi Kerja Terhadap Kejadian Myofascial Pain Syndrome pada Pekerja Kantoran. Jurnal Ilmu Kesehatan. 2023;4(2):103–7.
3. Ramadhan Fitrianto T, Prakoso G, Risman Nugroho A, Silmi Afifah A, Anggiriani S, Widiastuti R, et al. Redesain Kursi Kerja Pegawai berdasar Antropometri Pengguna Guna Meningkatkan Kenyamanan dan Produktivitas Redesigning Workplace Chairs Based on User's Anthropometric to Improve Comfort and Productivity. 2025;1–11.
4. Pemerintah Indonesia. Tentang Keselamatan Dan Kesehatan Kerja Lingkungan Kerja. Peraturan Menteri Ketenagakerjaan Republik Indonesia No 5 Tahun 2018. 2018;5:11.
5. Pramono T, Sayuti AM, Gaffar MR, Puspitaningrum RA. Penilaian Risiko Ergonomi Pada Lingkungan Kerja Perkantoran Menggunakan Metode Rapid Office Strain Assessment (ROSA). Jurnal Pendidikan Administrasi Perkantoran (JPAP). 2022;10(3):246–55.
6. Fiqih MEK Al, Hasibuan A. Ergonomic Performance Evaluation in the Workplace to Increase Productivity. Variable research journal. 2025;02(01):132–40.
7. Chairani N, Harahap RA, Harahap SSM, Zulaika T. Penilaian dan Penerapan Ergonomi Terhadap Kesehatan Kerja Pada Karyawan. 2025;16(3):248–52.
8. Kautsar F, Dewi NK. Kursi Kerja Ergonomis PT XYZ. Journal of Industrial View. 2020;2(2):36–44.
9. Fitrianto TR, Rahmat B, Nugroho AR, Prakoso G, Afifah AS, Anggiriani S, et al. Evaluation of Office Chair Design From Ergonomic and Anthropometric Perspectives. J@ti Undip: Jurnal Teknik Industri. 2025;20(3):148–54.
10. Akhirul DY, Maksum AH, Suhartono. Tingkat Kesesuaian Fasilitas Kerja PT BMJ dari Sisi Ergonomi. Jurnal Ilmiah Wahana Pendidikan. 2022;8(8):8.
11. Haryani W& S. Modul Etika Penelitian. Modul Etika Penelitian,Jakarta selatan. 2022. 32 p.
12. Nurrohkayati AS, Inayah S, Zen ZH, Setyaningrum R. MAKRO ERGONOMI. 2026.

13. Suarjana IWG, Pomalingo MF, Palilingan RA, Parhusip BR. PERANCANGAN FASILITAS KERJA ERGONOMI MENGGUNAKAN DATA ANTROPOMETRI UNTUK MENGURANGI BEBAN FISIOLOGIS PENDAHULUAN Ergonomi adalah ilmu , seni dan teknologi yang berupaya menyerasikan pekerja atau aktivitas manusia dengan lingkungannya untuk mencapai efisie. 2022;10(2):109–17.

14. Madani H, Pratiwi I. Analisis Work-Related Musculoskeletal Disorders (Wmsds) Dan Postur Kerja Karyawan Customer Service Bank Menggunakan Metode Nordic Body Map (Nbm) Dan Rapid Office Strain Assessment (Rosa). Simposium Nasional RAPI XX – 2021 FT UMS. 2021;(7):99–108.