MEDISAINS
Science & Enlightenment
Jurnal Ilmiah Ilmu - Ilmu Kesehatan

Original Article

Mobile eye-exercise matasehatku application to reduce asthenopia in office workers: a quasi-experimental study

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ARTICLE INFORMATION

Received: July 21, 2025
Revised: September 21, 2025
Accepted: September 24, 2025

KEYWORDS

Asthenopia; Mobile Applications; Telemedicine; Occupational Health; Exercise Therapy

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ABSTRACT

Background: Asthenopia is common among computer users, yet limited evidence exists regarding interventions targeting office workers. Mobile health technologies offer new opportunities to promote ocular health in technology-intensive work environments.

Purpose: This study aimed to evaluate the effectiveness of the MataSehatKu mobile eye-exercise application in reducing asthenopia among office workers in the information technology sector.

Method: A quasi-experimental pre-test–post-test control group design was conducted with 39 office workers (17 intervention, 22 control) selected by purposive sampling. Asthenopia levels were measured using the Digital Eye Strain Questionnaire (DES-Q) before and after a two-week intervention.

Result: The intervention group showed a significant reduction in mean asthenopia scores (8.82 ± 5.13 to 2.71 ± 1.96; mean decrease = 6.11; $p < 0.001$), while the control group showed a significant increase (12.45 ± 9.10 to 19.82 ± 12.91; mean increase = 7.36; $p < 0.001$). Between-group post-test comparison revealed significantly lower scores in the intervention group ($p < 0.001$). Effect size analysis indicated a large impact (Cohen's d = 1.57 within-group; d = 1.74 between-groups).

Conclusion: The MataSehatKu application effectively reduced asthenopia among office workers, supporting the potential of mobile health–based eye-exercise programs as scalable occupational health strategies.

INTRODUCTION

The rapid advancement of digital technology has transformed global work practices, especially in occupations that require prolonged computer use. While digital tools enhance productivity, they also contribute to ocular discomfort and strain due to extended screen exposure. Continuous screen exposure reduces blink frequency by over 50% within 45 minutes,[1] disrupting ocular lubrication and predisposing individuals to ocular surface disorders and asthenopia (eye strain).[2,3] Asthenopia is a visual disorder characterized by eye fatigue, discomfort, dryness, diplopia, and blurred vision, often triggered by poor lighting, extended screen exposure, or uncorrected refractive errors.[4] This condition may lower work productivity by up to 40%, increase mental fatigue, and impair quality of life. Despite its decades-long recognition, asthenopia remains under-addressed in occupational health, particularly in digitalized workplaces.[5-7]

Digital eye strain affects approximately 60 million individuals worldwide, with symptoms reported in 50–90% of computer users.[8-10] In Indonesia, local studies indicate a prevalence of 50–80% among students and office workers.[11,12] These findings highlight the importance of preventive and therapeutic approaches for individuals exposed to digital screens for long hours.

Eye exercises have been identified as an effective approach to alleviate strain and improve ocular function.[13] Previous studies show that exercise programs, with or without warm compresses, can significantly reduce asthenopia severity,[14,15] while behavioral interventions such as the 20-20-20 rule also demonstrate benefits.[16,17] However, most interventions rely on direct instruction, limiting accessibility and sustainability, especially for employees who spend 6–8 hours daily in front of screens. This gap calls for scalable, practical solutions aligned with modern workplace demands.[18,19]

https://doi.org/10.30595/medisains.v23i3.27494

Mobile health (mHealth) applications represent a promising approach by integrating guided exercise programs into digital platforms. Such tools allow workers to practice independently, receive reminders, and maintain healthy visual habits without disrupting productivity. This study focused on employees from an information technology company in Jakarta, a setting characterized by intensive screen-based work. The MataSehatKu application was developed to provide guided eye exercises accessible through mobile devices. This study aimed to evaluate the effectiveness of the MataSehatKu application in reducing asthenopia among office workers and to contribute to the growing body of evidence on mHealth strategies for occupational well-being.

METHOD

Study Design

This study employed a quasi-experimental design with a pre-test–post-test control group.[20]

Setting and Respondent

The study was conducted in an information technology company located in Jakarta, Indonesia, from June to July 2025. Thirty-nine employees participated: 17 in the intervention group and 22 in the control group. The intervention group performed guided eye exercises using the MataSehatKu application, while the control group did not receive any intervention. Participants were selected using purposive sampling with the following inclusion criteria: employees working full-time in the same office unit, with daily screen exposure of more than two hours. Exclusion criteria included systemic or ocular diseases (e.g., diabetes mellitus, hypertension, Sjögren's syndrome, Meibomian gland dysfunction), use of medications affecting ocular function (e.g., diuretics, antihistamines, psychotropics, antidepressants), and the use of antiglare screens.[21] Although randomization was not applied, participants were selected to ensure homogeneity in job roles and environmental conditions.

The Variable, Instrument, and Measurement

The independent variable was the MataSehatKu mobile eye-exercise program, while the dependent variable was asthenopia, measured using the Digital Eye Strain Questionnaire (DES-Q). The DES-Q is a 16-item instrument assessing ocular and visual symptoms by frequency and intensity. A total score ≥8 indicates clinically relevant digital eye strain. The DES-Q has demonstrated strong validity and high internal consistency (Cronbach's α = 0.94).[22]

MataSehatKu Application Development

The MataSehatKu application was developed in three stages: pre-production, production, and post-production. Pre-production: conceptual design, literature review, and feature planning based on validated eye-exercise protocols. Production: implementation of guided exercises including near–far focusing, blinking, and eye rotation routines. The prototype was built collaboratively using Figma. Post-production: usability testing and validation of the interface and content. The final version includes guided 10–15 minute sessions, reminder notifications, and progress monitoring.

Intervention Procedure

Participants in the intervention group performed eye exercises guided by the MataSehatKu application for 10–15 minutes every two hours of screen use, three times per week, for two weeks. The control group continued their usual routines without intervention.

Data Analysis

Descriptive statistics were used to summarize participant characteristics. The Shapiro–Wilk test assessed data normality. Within-group comparisons were analyzed using the Wilcoxon signed-rank test, while between-group comparisons were conducted with the Mann–Whitney U test. A significance level of $p < 0.05$ was applied.[23]

Ethical Consideration

The study was approved by the Ethics Committee of the Optometry Study Program, ARO Gapopin Jakarta (No. 576/S.Kel/ARO GAPOPIN/VIII.60/2025). Written informed consent was obtained from all participants.

RESULTS

MataSehatKu App

The eye exercises used were similar to those in Bhutada's study.[23] The MataSehatKu application integrates guided eye exercises with visual health tips, self-assessment tools, and reminders. Exercises are presented through simple illustrations, brief instructions, and audio guidance to facilitate correct performance and improve adherence (Figure 1).

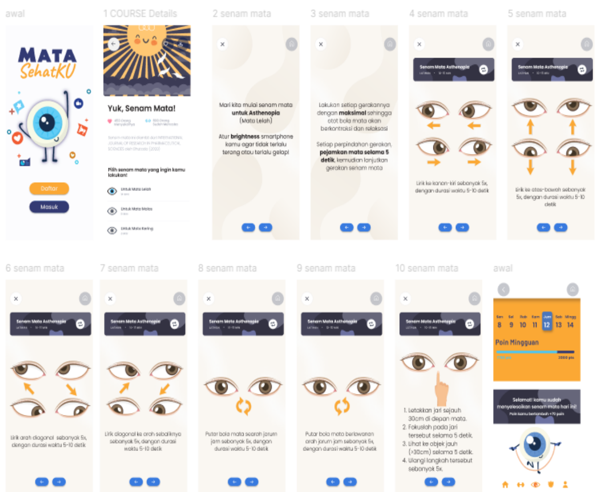

Figure 1. Eye-exercise interface of the MataSehatKu application

Participants Characteristics

The characteristics of the 39 respondents are shown in Table 1. The majority in both groups were male (58.8% in the intervention group and 63.6% in the control group). The largest age categories were 26–30 years (29.4%) and 31–35 years (29.4%) in the intervention group, and 26–30 years (36.4%) in the control group. All respondents in the intervention group reported daily computer use >2 hours. Although demographic data were collected, no subgroup analysis was performed, as the study focused exclusively on asthenopia outcomes.

Table 1. Characteristic of Respondent (n=39)

Characteristics	Intervention Group	Control Group
Gender		
Male	10 (58.8%)	14 (63.6%)
Female	7 (41.2%)	8 (36.4%)
Age (years)		
20–25	1 (5.9%)	0 (0.0%)
26–30	5 (29.4%)	8 (36.4%)
31–35	5 (29.4%)	5 (22.7%)
36–40	3 (17.6%)	6 (27.3%)
41–45	1 (5.9%)	2 (9.1%)
46–50	2 (11.8%)	1 (4.5%)
Duration of computer use/day		
> 2 hours	17 (100%)	18 (81.8%)
≤ 2 hours	0 (0.0%)	4 (18.2%)

Effect of MataSehatKu Eye Exercise Intervention on Asthenopia

Baseline mean asthenopia scores were 8.82 ± 5.13 in the intervention group and 12.45 ± 9.10 in the control group, with no significant difference ($p = 0.275$). Within-group analysis revealed a significant reduction in the intervention group from 8.82 to 2.71 (69.3% decrease; $p < 0.001$). In contrast, the control group significantly increased from 12.45 to 19.82 (59.2% increase; $p < 0.001$). Between-group comparison of post-test scores demonstrated significantly lower asthenopia scores in the intervention group compared with the control group ($p < 0.001$), confirming the effectiveness of the MataSehatKu application in reducing digital eye strain among Telkomsigma employees (Table 2).

Table 2. Effect of MataSehatKu Intervention on Asthenopia (n = 39)

Group	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	p-value [a]
Intervention (n = 17)	8.82 ± 5.13	2.71 ± 1.96	< 0.001
Control (n = 22)	12.45 ± 9.10	19.82 ± 12.91	< 0.001
p-value [b]	0.275	< 0.001*	—

Exp: [a] Within-group comparison (Wilcoxon test for intervention group, paired t-test for control group); [b] Between-group comparison (Mann–Whitney test).

DISCUSSION

This study demonstrated that guided eye exercises delivered via the MataSehatKu mobile application significantly reduced self-reported asthenopia among office workers. Participants in the intervention group experienced a substantial improvement in ocular comfort, while symptoms in the control group worsened over the same period. The large effect sizes (Cohen's d = 1.57 within-group; d = 1.74 between-groups) indicate meaningful clinical benefits, suggesting that the intervention contributed to reduced eye fatigue and improved visual comfort in daily work.

The beneficial effects can be attributed to both physiological and behavioral mechanisms. Guided routines such as near–far focusing, blinking, and eye rotations help recalibrate ciliary muscle accommodation, improve tear film distribution, and mitigate near-focus strain. Structured breaks interrupt prolonged visual tasks, reducing cumulative ocular load in line with ergonomics principles.[24,25] The app format supports adherence through reminders and real-time guidance, addressing a common limitation in traditional eye-exercise programs.

These results align with previous literature showing that prolonged screen use without adequate rest increases the likelihood of asthenopia. Reduced blink frequency during extended computer tasks has been shown to increase ocular strain.[26] Protocols incorporating vergence shifts and blinking redistribute accommodative load and normalize tear dynamics.[27] Prior studies reported that individuals using computers for ≥2 hours daily were more likely to develop asthenopia,[25] while short, frequent visual breaks proved more effective than infrequent longer ones.[24,28] The present study extends this evidence by demonstrating comparable benefits within a mobile application format, adapted to office-based digital work environments.

Novelty arises from applying a mobile health–based intervention among information technology workers in Indonesia, a population rarely studied. Previous eye-exercise interventions often relied on printed materials or direct supervision, limiting scalability. For example, video-based demonstrations reduced fatigue in students,[15] while a leaflet-based program improved symptoms in wig-industry workers.[19] In contrast, the MataSehatKu application integrates validated exercise protocols into a digital platform, enabling structured, accessible, and scalable delivery within occupational settings.

Several limitations warrant consideration. The relatively small, geographically limited sample constrains external validity. Reliance on self-reported asthenopia may introduce subjective bias, as objective measures such as blink rate or accommodative response were not assessed. The short two-week duration also restricts insights into long-term sustainability. Additionally, unmeasured factors such as lighting conditions, workstation ergonomics, or screen use outside work hours could have influenced outcomes, particularly the symptom increase observed in the control group. Although appropriate nonparametric testing was applied, small sample sizes may have reduced statistical robustness. A key strength lies in integrating validated exercise protocols within a mobile health application, which enhances scalability, adherence, and practical applicability in real-world workplaces.

CONCLUSIONS AND RECOMMENDATIONS

The MataSehatKu mobile application significantly reduced asthenopia among office workers, providing both statistical and clinical benefits. These findings support the feasibility of mobile health–based eye-exercise programs as practical tools for promoting visual comfort in technology-intensive workplaces. Integrating digital interventions into occupational health policies could help enhance employee well-being and productivity. Future research should explore long-term implementation and combine mobile eye exercises with ergonomic and behavioral strategies for comprehensive prevention of digital eye strain.

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