



Research Article

Safety Goggles Myopi as a Worker Protector with Myopic Eye Complaints

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ABSTRACT

The number of workers who have near-sightedness and is supported by a lack of compliance in use of PPE for comfort reasons causes the potential for work accidents. This research aimed to reduce the number of eye injuries and become an innovation in safety glasses and PPE for workers complaints of myopia. This study used an analytical descriptive method with a cross-sectional study design, which was carried out from June to October 2022. The total respondents in this study were 60 respondents. Furthermore, this study used an instrument, namely a survey questionnaire through a comprehensive Google Form. From the survey, 55% of respondents used glasses, 53.3% of respondents experienced complaints of myopia, 18.3% of respondents have worn glasses before work, 20% of respondents were required to wear protective glasses while working, and 80% of respondents showed interest in "Safety Goggles Myopi". The test results at the laboratory of Nahdlatul Ulama University Surabaya using the Lutron Type-340A UV Metershowed that "Safety Goggles Myopi" is effective in reducing exposure to UV radiation from the sun and welding rays to 0 mW/m². Additionally, "Safety Goggles Myopi" also has a concept of glasses with 3 in 1 lenses that are comfortable and practical when used. Through these results, the idea of PPE innovation entitled "Safety Goggles Myopi" is appropriate to reduce the number of work accidents, increase compliance in the use of PPE protective glasses in the workplace, especially for workers who have near-sightedness, and improve the implementation of K3's culture in Indonesia.

Keywords: Eye complaints, K3 culture, near-sightedness, PPE use, safety goggles myopi, workers, work accidents.

INTRODUCTION

Based on BPJS Employment data, the number of work accidents in Indonesia in 2017 was recorded in 123,041 cases. However, the number of work accidents continues to increase and in 2018, it reached 173,105 cases (Social Security Administrator for Employment, 2019). The research of Tarwaka (2012) in (Huda, et al., 2021) stated that work accidents are the occurrence of unwanted things that occur suddenly and result in material losses, loss of time and even loss of life. In the ILCI (Loss Causation Model) theory, one factor affecting work accidents is based on personal factors, including workers' ability to absorb information, knowledge, and skills in their work (Agustian et al., 2020). According to the domino theory, the human factor is the leading



cause of work accidents, which is 88%. (Salim, 2019) The magnitude of accidents due to human factors is caused by abnormal worker conditions, causing work accidents. The abnormal condition in question is that one of them is that the worker has a visual impairment. Vision impairment is a condition in which the ability of the eyes to see clearly or function optimally is impaired, causing blurry, blurry, or lost vision (Ministry of Health, 2022).

According to the results of the Rapid Assessment of Avoidable Blindness (RAAB) survey conducted by the Indonesian Ophthalmologists Association (Perdami) in 2022, it is stated that so far, there are 8 million people with visual impairment, with details of 1.6 million suffering from blindness, 6.4 million suffering from moderate and severe visual impairment. It is undeniable that near-sightedness is now increasingly prevalent due to the adverse impact of technological developments, which cause workers to have minus eyes because they stare too often at the screen of their gadgets or are exposed to excessive light, for example when workers are welding. According to Hapsoro's (2012) research, there is a significant influence related using of welding glasses with vision in carbide welders. Furthermore, according to the research of Andika et al. (2022) eye complaints in welders are affected by age with the use of PPE.

Personal protective equipment protects workers from potential work accidents while working. Personal protective equipment is one of the factors that can reduce workplace accidents (Piri et al., 2012). Work accidents and occupational diseases can be reduced through the way workers obey in using PPE. It is hoped that the regulations that the company has agreed upon can be complied with by workers to reduce the risk of work accidents. Workers who do not comply in using PPE can experience accidents at work and diseases due to work such as organizational chaos, damage, abnormalities, complaints, sadness, disability and death (Arifin et al., 2013). The use of PPE is often considered unimportant or trivial by workers, where the use of PPE is essential and affects the health and safety of workers (Aprilianti et al., 2022).

Based on the problem of eye disorders and the lack of compliance of workers in using PPE, in this study, PPE innovation was carried out, which aims to protect the eyes of workers who have near-sightedness. The PPE innovation designed is called Safety Goggles Myopi, 3 in 1 protective glasses with three main lenses. First, a transparent polycarbonate lens on the outermost part that functions as protective glasses; the second is a near-sighted lens that can be removed, and the last is an additional welding lens that can also be removed if you want to use it. With the sides of the glasses using rubber material and having a fabric-based strapper strap that has elasticity, this innovation of eye protection PPE called Safety Goggles Myopi can be a solution for workers who have complaints of myopi eye problems while working.

MATERIAL AND METHODS

This research used a descriptive analytical method, the first step before implementing other analyses. The research design used was a cross-sectional study. The time of this study was carried out in June-October 2022, with a total population of 60 workers who do field work and sometimes also weld who have complaints of myopia. The sampling technique in this study was random sampling. Furthermore, the instrument used was a survey questionnaire distributed through a Google form with age variables, history of eye diseases or eye complaints, the use of near-sighted glasses while working, the obligation to use PPE protective glasses while working, interest in Safety Goggles Myopi as an innovation of eye protection PPE. So, the total questions in this research questionnaire amounted to 5 items using the Guttman/binary scale, namely yes and no. Furthermore, an analysis was carried out through the results of a survey with a descriptive method

assisted by previous research that had been carried out on complaints of eye disorders experienced by workers, and described in detail the parts of Safety Goggles Myopi as an innovation of PPE protective glasses.

RESULTS AND DISCUSSION

Characteristics of Research Respondents

Table 1. Characteristics of Research Respondents

Respondent Characteristics		Total	%
Gender	Male	32	53%
	Female	28	47%
Age	12 – 25 (Teenagers)	27	45%
	26 – 45 (Adults)	23	38%
	46 – 65 (Elderly)	10	17%
Employment Type	Field Workers	35	58%
	Non-Field Workers	25	42%
Total Respondents		60	100%

The total respondents in this study were 60 respondents. Of the total respondents, there was a significant difference in gender distribution. The analysis shows that as many as 53% of the respondents are men, while the remaining 47% are women. In a 2022 study on myopia in an African country that included school children, it was found that the prevalence of myopia was slightly higher in women (5.3%) compared to boys (3.7%) but not too significant (Ovenseri-Ogbomo et al., 2022). In line with the study, Lestari et al. (2020) stated that as many as 37 women or 56.9% of a total of 65 respondents experienced myopia/myopia, this is because women who experience myopia due to their lifestyle and environment rarely exposed to sunlight. In contrast to Enthoven's research, et al. (2024) showed that in the older generation, near sightedness is more common in men. Enthoven also mentioned that factors such as earlier growth conditions and more limited outdoor activity time for women than men can contribute to higher levels of myopia in women (Gong et al., 2015).

In age characteristics, there was a noticeable variation among respondents. Most of them, around 45%, fall into the youth category, while as many as 38% are in the adult category, and the other 17% are in the elderly category. This age characteristic is one of the factors that significantly influences the prevalence and manifestation of myopia. In adolescence, the prevalence of myopia increases with age, with a higher incidence rate at school age (Basri, 2014). Developmental myopia is a type of myopia that usually appears at the age of 7-14 years (Agustina, 2019). In adulthood, the prevalence of myopia in Indonesia reaches almost half of the population, with risk factors that include genetics, lifestyle, diet, daily activities, and environment (Anugrahsari et al., 2022). Meanwhile, in advanced age, myopia is less common, but changes in axial length, cornea, and refractive strength of the eye can affect the condition of myopia (Agustina, 2019).

This study has interesting details about the type of work carried out by the respondents. Out of a total of 60 respondents, as many as 58% of them, hold jobs related to the field. It includes

a wide variety of professions that require them to work outdoors to carry out their duties. On the other hand, as many as 42% of respondents carry out non-field work which usually does their work in an office or other indoor environment. Within the group of respondents working in the field, some have a specific responsibility to do welding work. This shows significant variation in the types of tasks carried out in the field, from physical work to technical work that requires special skills.

Thus, the suitability of a representative sample of respondents from various gender, age, and job types' backgrounds is strength in this study. This makes it possible to obtain a more comprehensive and in-depth understanding of the phenomenon being studied and increase the validity and generalizability of the findings of this study in a broader context.

Safety Goggles Myopi Survey Questionnaire Results

Table 2. Results of filling out the Safety Goggles Myopi Survey Questionnaire

Variable	Frequency	
	Yes	Not
Using Glasses	55%	45%
Having Myopia Complaints	53.3%	46.7%
Have worn glasses before work	18.3%	81.7%
Obligation to Use Protective Glasses While Working	20%	80%
Interest in Myopi Safety Goggles	80%	20%

The survey in this study involved 60 respondents who were field workers and sometimes did welding work. They obtained some important findings related to the use of glasses and eye health. Half of the total respondents involved, namely 55%, used glasses. This shows that the use of glasses is quite common among respondents. The survey also revealed that as many as 53.3% of the total respondents experienced complaints of myopia. In a study conducted by Astnaet al. (2018) stated that there was a significant relationship between the use of welding glasses and a decrease in eye vision in welders. This shows the importance of welding workers wearing Personal Protective Equipment (PPE) in the form of welding glasses. Furthermore, based on the data obtained, 81.7% of respondents who have not used glasses before work have complained of near-sightedness. This indicates that there is potential to increase awareness of the importance of using glasses to prevent myopia complaints, especially in the work environment.

Quoted from (Wahyuni, 2011) in Ayu and Rhomadhoni (2016), workers who use PPE poorly have a seven times greater risk of developing subjective complaints of welder's flash than workers who use PPE correctly and thoroughly. In addition, about 20% of respondents answered that they must wear protective glasses while working. This indicates that certain policies or rules related to occupational safety regulate the use of protective eyewear to reduce the risk of eye injury in the workplace. This statement is strengthened by a study conducted by Syahrizal and Natasya (2021) entitled "The Relationship between the Use of Personal Protective Equipment (PPE) and Eye Health in Welding Workers. A Case Study at PT. X, Aceh Besar" explained that the proper use of PPE has a significant effect on the safety and health of workers' eyes.

In a study conducted by Prasetyo (2015) entitled "The Influence of Knowledge, Attitudes, and Availability of Personal Protective Equipment (PPE) on Compliance in Using PPE in the Coating Unit of PT. Barutama Kudus Temple" said that the reason workers do not use PPE is because they feel uncomfortable (uneasy, hot, heavy, disturbed). This is in line with the results of

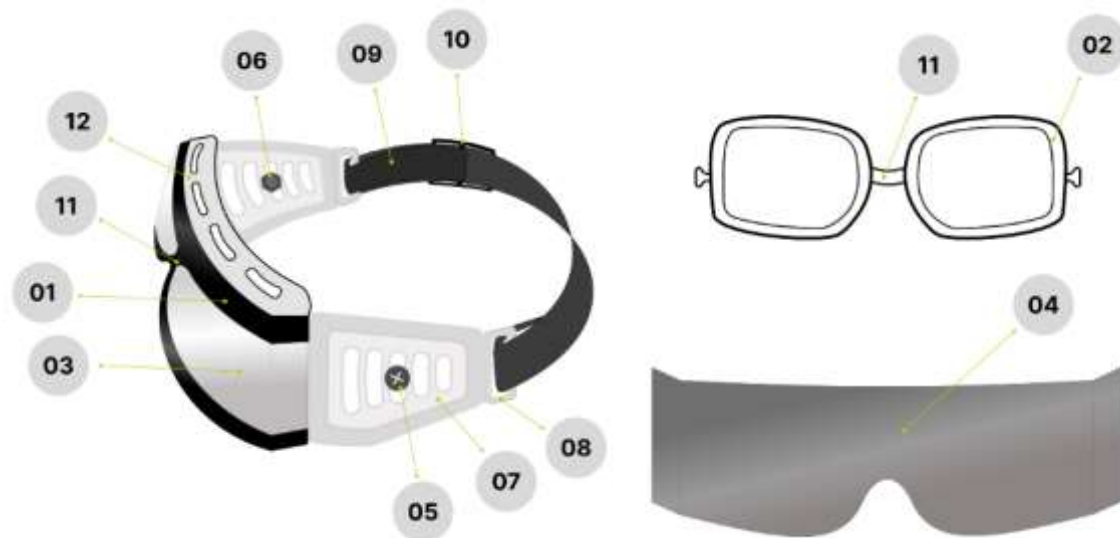
research by Ayu and Rhomadhoni (2016), which stated that workers in welding workshop X have a level of obedience in the use of PPE while working, which is still very lacking. However, the survey results in this study noted that around 80% of the total respondents showed interest in the innovation of protective glasses for work, called "Safety Goggles Myopi". This indicates the enthusiasm and potential for innovations designed to improve comfort and safety for eyewear users in wearing Personal Protective Equipment (PPE) in the work environment.

Overall, the findings of this survey provide a reasonably comprehensive picture of eyewear usage patterns, eye health issues, related occupational safety policies, and interest in Personal Protective Equipment (PPE) innovations, in this case, protective eyewear among respondents. Therefore, "Safety Goggles Myopi" is designed as an innovative idea that is expected to be able to answer the challenges and problems that were raised at the beginning. The common problem felt by workers, as mentioned in the Prasetyo (2015) research is that the reason workers do not use PPE is because they feel uncomfortable (uneasy, hot, heavy, disturbed). Supported by research, Ayu and Rhomadhoni (2016) stated that a worker only have PPE but compliance in use is still needs to be improved. Based on this, this innovation has a 3 in 1 glasses concept, whereby using only one glass workers can wear protective glasses, myopic glasses according to the complaint of the level of myopia, and welding glasses that can be removed in their use. Here is the design of the "Safety Goggles Myopi".

"Safety Goggles Myopi" Protective Goggles Design



**Picture 1. Design of "Safety Goggles Myopi"
Front View and Side View**



Picture 2. Explanation of Parts in the Design "Safety Goggles Myopi"

Explanation of the "Safety Goggles Myopi" Section

01. Polycarbonate-based safety glasses frame
02. Detachable myopic glasses frame
03. Polycarbonate-based safety glasses lens attached to the main frame
04. Plastic-based sunglasses
05. Iron nut for bolt fastening
06. Black-coloured plastic bolts
07. Hollow rubber connecting strapper (rope)
08. Strapper hook (rope)
09. Elasticated fabric strapper
10. A plastic road ring will be used to adjust the length of the strapper.
11. Rubberized myopic frame hook of frame number (1)
12. Rubberized spectacle user protection pads are characterised by spectacles with three lenses and black lens hooks in the form of plastic bolts and metal nuts.

UV Radiation Measurement Results "Safety Goggles Myopi"

Not only carried out as an idea on paper, "Safety Goggles Myopi" has also gone through a UV radiation exposure test carried out at the Integrated Research and Testing Laboratory (LPPT) of Nahdlatul Ulama University Surabaya using a Lutron Type-340A UV Brand UV Meter. Testing of "Safety Goggles Myopi" protective lenses is carried out on two different sources of UV exposure: the first is with a natural UV light source, namely sunlight, and the second is artificial UV light, which is sourced from welding rays.

This test was carried out by UNUSA Integrated Laboratory officers using a measurement method sourced from SNI 16-7060-2004 concerning "Measurement of Ultra Violet Radiation in the Workplace". This standard is intended to realize uniformity in measuring ultraviolet radiation in the workplace. This standard specifies the measuring instruments and procedures for their use. This standard refers to the ultra violet radiation measurement method published by the Centre for the Development of Occupational Safety and Hyper health, Research and Development Agency, Ministry of Transportation and Tourism, 2002. The following is the UV light measurement method according to the applicable SNI:

Working procedure

- Close the sensor and turn on the device.
- Set the control button so that the monitor shows zero adjustment.
- Bring the tool to the place of measurement measurement.
- Place the sensor at each measurement point in the direction facing the ultraviolet light source.
- Take measurements at each measurement point.
- Read and record the measurement results on the data-filling form.

Table 3. UV Radiation Measurement Results "Safety Goggles Myopi"

Point	Hours (WIB)	Yield (mW/m ²)		Information
		Before	After	
1	11.15	2589	0	UV source from sunlight
2	12.10	756	0	UV source from welding beam

Source: Integrated Research and Testing Laboratory (LPPT) Nahdlatul Ulama University Surabaya (2022)

Based on the results in Table 3 above, the measurement results showed a very significant positive value in the test of both UV light sources before and after being given the "Safety Goggles Myopi" protective lens. The test results on the first UV source, namely sunlight, were carried out at 11.15 to 11.30 WIB or for 15 minutes with sunny and cloudy weather conditions. Measurements are taken at this hour because experts consider it the most optimal time to measure the sun's UV rays. As a result, when measurements were taken using a UV meter before being given the "Safety Goggles Myopi", the result was very high, 2589 mW/m². This result exceeds the NAV (Threshold Value) set in Permenaker No. 5 of 2018 concerning Occupational Safety and Health of the Work Environment, which is 0.000033 mW/m² allowed for 15 minutes. Furthermore, the test was carried out with a UV meter facing the sun, but given a protective lens "Safety Goggles Myopi", the result was a significant decreases namely, 0 mW/m².

The second test was carried out using an artificial UV light source from a welding beam carried out by one of the workers doing his work. The results of this second test are the same as the initial test. Namely, the results from the UV meter before the workers wore the "Safety Goggles Myopi", got a relatively high result of 756 mW/m². Furthermore, after the worker wore the "Safety Goggles Myopia"; the measurement results decreased significantly, namely, 0 mW/m². This shows that "Safety Goggles Myopi" is able to reduce UV exposure very ideally, both from natural UV light sources from the sun and with artificial UV light sources, namely welding rays.

Therefore, "Safety Goggles Myopi" is an innovation of Personal Protective Equipment (PPE) that is very suitable in answering the challenges of problems that exist in workers, namely around comfort and feasibility in protecting workers' eyes. Comes with 3 lenses in 1 (protective lens, lens Myopia, and welding lenses) and is made of rubber material that is comfortable for workers. Researchers hope that "Safety Goggles Myopi" is not only limited to the concept of the idea but also can be applied in real life to reduce the high number of work accidents due to myopia owned by workers so that workers can work comfortably, safely and safely.

CONCLUSION AND SUGGESTION

This study involved 60 respondents with various gender, age, and employment status backgrounds. The survey results showed a significant prevalence of eye health problems in field and non-field workers, with a reasonably high percentage experiencing vision complaints. The

main focus of this study is the importance of using protective eyewear, such as welding glasses, to prevent eye injury and maintain visual acuity. "Safety Goggles Myopi" is an innovation of Personal Protective Equipment (PPE) designed to answer the challenges that have been an obstacle for workers, namely comfort and effectiveness. Equipped with 3 in 1 lens (protective lenses, myopia lenses, and welding lenses) and made of rubber materials that workers will feel comfortable using, not only that but the "Myopi Safety Goggles" has also been tested and proven to effectively reduce exposure to UV radiation from natural and artificial sources. The measurement results showed a significant reduction in UV exposure when using "Safety Goggles Myopi" for both natural UV sources, such as sunlight, and artificial UV sources, namely welding rays. These protective glasses effectively reduce UV exposure to zero, making them the proper Personal Protective Equipment (PPE) innovation for workers to protect their eyes and prevent work accidents.

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