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Knowledge, attitudes, and behaviors on personal protective equipment use in paper production facilities

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ABSTRACT: This study examines the knowledge, attitudes, and behaviors of workers regarding the use of personal protective equipment (PPE) in several paper production facilities in Türkiye, where employees are exposed to various physical, chemical, and mechanical hazards. The aim of the research is to assess workers' occupational health and safety (OHS) awareness, their knowledge and perceptions of PPE, usage habits, and the factors influencing compliance, with particular attention to demographic characteristics such as age, gender, education level, professional experience, accident history, and OHS training status. Data were collected through a structured questionnaire administered to employees from different departments of the facility and analyzed using descriptive statistics and chi-square tests. The results indicate that although most workers recognize the importance of PPE, regular and consistent use remains insufficient. Barriers to PPE compliance were primarily associated with discomfort, lack of ergonomic suitability, inadequate information, and limited supervision. Workers who had received OHS training demonstrated higher awareness levels, more positive attitudes toward PPE, and significantly higher compliance rates, while education level and work experience were also found to influence PPE usage behaviors. Overall, the findings emphasize the need for continuous training programs, improved ergonomic design of PPE, and stronger supervisory mechanisms to enhance safety culture and reduce occupational risks in paper production environments.

Keywords: Personal protective equipment, occupational health and safety, safety culture, paper industry

Kağıt üretim tesislerinde kişisel koruyucu donanım kullanımına ilişkin bilgi, tutum ve davranışlar

ÖZET: Bu çalışma, Türkiye'de faaliyet gösteren bir oluklu mukavva üretim tesisinde çalışanların, çeşitli fiziksel, kimyasal ve mekanik tehlikelere maruz kaldıkları bir ortamda, kişisel koruyucu donanım (KKD) kullanımına ilişkin bilgi, tutum ve davranışlarını incelemektedir. Araştırmanın amacı; çalışanların iş sağlığı ve güvenliği (İSG) farkındalık düzeylerini, KKD'ye ilişkin bilgi ve algılarını, kullanım alışkanlıklarını ve uyumu etkileyen faktörleri; yaş, cinsiyet, eğitim düzeyi, mesleki deneyim, kaza geçmişi ve İSG eğitimi durumu gibi demografik özellikler çerçevesinde değerlendirmektir. Veriler, tesisin farklı bölümlerinde çalışan personele uygulanan yapılandırılmış bir anket aracılığıyla toplanmış ve tanımlayıcı istatistikler ile ki-kare testleri kullanılarak analiz edilmiştir. Bulgular, çalışanların büyük çoğunluğunun KKD'nin önemini kabul etmesine rağmen, düzenli ve tutarlı kullanımın yetersiz kaldığını göstermektedir. KKD kullanımına uyumu engelleyen başlıca faktörlerin; rahatsızlık hissi, ergonomik uyumsuzluk, yetersiz bilgilendirme ve sınırlı denetim ile ilişkili olduğu belirlenmiştir. İSG eğitimi almış çalışanların, daha yüksek farkındalık düzeylerine, KKD'ye yönelik daha olumlu tutumlara ve istatistiksel olarak anlamlı düzeyde daha yüksek uyum oranlarına sahip olduğu; ayrıca eğitim düzeyi ve iş deneyiminin de KKD kullanım davranışlarını etkilediği tespit edilmiştir. Genel olarak sonuçlar, kâğıt üretim ortamlarında güvenlik kültürünün geliştirilmesi ve mesleki risklerin azaltılması için sürekli eğitim programlarına, KKD'nin ergonomik tasarımının iyileştirilmesine ve daha güçlü denetim mekanizmalarına duyulan gereksinimi vurgulamaktadır.

Anahtar kelimeler: Kişisel koruyucu donanım, iş sağlığı ve güvenliği, KKD uyumu, güvenlik kültürü, kağıt endüstrisi

INTRODUCTION

Occupational health and safety is regarded as one of the essential components of industrial sustainability because it directly influences worker well-being, productivity, and organizational performance (Jilcha & Kitaw, 2017; Farmanesh et al., 2025; Kabiesz et al., 2025). In industrial environments, the interaction between humans, machinery, and materials creates a variety of risks that must be systematically managed. International bodies such as the International Labour Organization and the World Health Organization emphasize that unsafe working conditions and inadequate preventive measures continue to cause millions of occupational injuries globally each year, particularly in sectors that involve continuous production cycles and heavy physical operations (Shabani et al., 2024; Debelu et al., 2025). This framework underlines the necessity of effective occupational safety practices in all industrial branches, including the paper manufacturing industry.

The paper industry is recognized as a high-risk sector due to its reliance on mechanical operations, thermal processes, and chemical applications (Sadorsky & Henriques, 2001; Tutuş et al., 2018; Byrne et al., 2024; Rahdiana et al., 2025). During production, workers may encounter hazards such as cutting and crushing mechanisms, steam and heat sources, chemicals used in pulping and bleaching, airborne particulate matter, and high noise levels. These hazards have been widely documented as leading causes of occupational accidents and chronic illnesses among paper factory workers (Kubo et al., 2014; Ashuro et al., 2023; Negash et al., 2023). Furthermore, the repetitive nature of tasks and the continuous operation of machinery increase

the likelihood of exposure to ergonomic and mechanical risks. Therefore, ensuring a safe working environment requires not only engineering controls and administrative measures but also widespread and consistent use of personal protective equipment.

Personal protective equipment constitutes one of the most basic preventive tools designed to reduce occupational risks. Yet, numerous studies emphasize that PPE alone is insufficient unless workers possess adequate knowledge and motivation to use it appropriately. Research from various industrial contexts indicates that workers tend to underestimate risks when they become accustomed to routine tasks, leading to lower PPE compliance (Afolabi et al., 2021; Adu-Gyamfi, 2025; Ghosh et al., 2025; Teym & Zeleke, 2025). Several studies have highlighted that ergonomic discomfort, a lack of training, limited supervision, and negative attitudes are among the most influential barriers to PPE use (Tsang et al., 2023; Atasoy et al., 2024; Lohiniva et al., 2025). Moreover, the perception that certain jobs can be performed safely without protective equipment persists in many workplaces, which contributes to unsafe practices despite the availability of PPE.

In Türkiye, the paper manufacturing sector has grown steadily in parallel with increasing production capacities and technological investments. The sector relies heavily on recycled fibers and modern production systems, which has resulted in more complex operational environments (Müftüoğlu & Kayacan, 2019; Aytaç & Korkmaz, 2022; Eşidir & Gür, 2024). This growth has brought renewed attention to occupational safety challenges within paper mills. Although the legislation on OHS has become more comprehensive in recent years, there remains a gap between regulatory requirements and actual workplace practices. Previous research conducted in Turkish industrial settings shows that workers often lack sufficient awareness of PPE use and that OHS training programs vary significantly between workplaces (Atasoy et al., 2024; Medeni et al., 2025). Despite the importance of PPE in preventing accidents, empirical studies focusing specifically on the Turkish paper sector are still limited.

The scarcity of sector-specific research highlights the importance of examining workers' PPE-related behaviors within real operational settings. Understanding the factors that influence compliance, such as demographic structure, accident history, and workplace culture, provides valuable insights for improving safety management (Wong et al., 2021; Cheng et al., 2022; Al-Bayati et al., 2023). Furthermore, evaluating workers' perceptions of equipment comfort, accessibility, and supervision contributes to identifying practical challenges that may not be evident through policy-level analyses alone (Wong et al., 2020; Zufra Inayah et al., 2025).

The present study aims to investigate the knowledge, attitudes, and behaviors related to PPE use among employees working in a corrugated paper production facility in Türkiye. The study examines how demographic and occupational characteristics influence PPE practices, identifies barriers that lead to inconsistent or incorrect PPE use, and assesses workers' general awareness of occupational health and safety. By providing empirical data specific to the paper production environment, this research contributes to the broader literature on industrial safety and offers practical recommendations for the improvement of safety culture in paper manufacturing plants. The findings are expected to support the development of effective training programs, ergonomic PPE design strategies, and targeted safety interventions tailored to the needs of the sector.

MATERIAL AND METHODS

Research Area and Study Population

This research was conducted in several paper production facilities operating in Türkiye. These facilities typically consist of several major units, including raw material preparation, pulping, paper forming, drying, finishing, and packaging. These departments involve continuous production cycles and high exposure to mechanical, thermal, and chemical hazards. For this reason, the participating facilities provide an appropriate setting for evaluating personal protective equipment (PPE) awareness and safety-related behaviors.

The study population included all operational employees actively working in production areas across the participating facilities during the data collection period. These employees perform tasks requiring close interaction with high-speed machinery, elevated temperatures, and noisy environments, making PPE usage an essential requirement for routine work.

Sample Size and Sampling Approach

A total of approximately 100 employees from the participating paper production facilities participated in the study. Rather than relying on a sampling method, the research adopted a census-style approach, aiming to reach the entire workforce present in the production units of the participating facilities. Participation was voluntary, and employees who agreed to take part completed the questionnaire in full. This approach ensured that the data reflected the perspectives of a wide range of workers with diverse demographic and occupational backgrounds across different production environments.

Data Collection Instrument

Data were gathered using a structured questionnaire developed specifically for this study. The questionnaire consisted of four main sections. The first section focused on demographic information, covering age, gender, education level, job position, duration of employment, shift status, and accident history. The second section addressed occupational health and safety information, including workers' knowledge of OHS regulations, awareness of workplace risks, and perceptions regarding the adequacy of existing safety measures. The third section examined PPE knowledge and attitudes, focusing on perceptions of the importance of PPE, comfort and ergonomics, accessibility, suitability for specific tasks, and attitudes toward compliance. The final section explored PPE usage behaviors, including frequency of PPE use, types of PPE used, reasons for non-use, and perceptions regarding supervision and enforcement.

The questionnaire items were adapted from relevant literature, national OHS standards, and expert consultations. Prior to full implementation, the content was reviewed by specialists in occupational safety to ensure clarity, relevance, and content validity. The internal consistency of the questionnaire was evaluated prior to analysis, and the items were found to be suitable for descriptive and comparative assessment.

Data Collection Procedure

The questionnaires were administered in person during scheduled work breaks in order to avoid disrupting production activities. Participants were asked to complete the forms individually and without external influence to ensure unbiased responses. Completion of each questionnaire required approximately 10 to 15 minutes. The data collection process was completed within a one-week period.

Statistical Analysis

All responses were coded and analyzed using the Statistical Package for the Social Sciences (SPSS). The analysis included descriptive statistics, such as frequency and percentage distributions, to summarize demographic characteristics and PPE-related responses. Cross-tabulations were used to examine associations between PPE usage and selected demographic and occupational variables. In addition, chi-square (χ^2) tests were applied to identify statistically significant relationships between variables such as OHS training status, work experience, accident history, and PPE compliance. A p-value of less than 0.05 was considered statistically significant for all analyses.

Ethical Considerations

Prior to data collection, ethical approval for the study was obtained from the Ethics Committee for Science and Engineering of Kahramanmaraş Sütçü Imam University (Approval No: 92405296-050.04-10268, Date: 16.12.2025). In addition, official written permission was granted by the participating paper production facilities. Participation in the study was voluntary, and all respondents were informed about the purpose of the research. The questionnaires were completed anonymously, and no personal identifying information was collected, ensuring confidentiality in accordance with ethical research principles.

RESULTS AND DISCUSSION

Demographic Characteristics, Work Experience, and OHS Training Status of the Participants

The demographic characteristics, work experience, and occupational health and safety (OHS) training status of the participants are summarized in Table 1. A total of approximately 100 employees from the participating paper production facilities were included in the study. The majority of the participants were male, reflecting the general workforce structure of the paper manufacturing sector. Most employees were between 31 and 45 years of age, and a considerable proportion had completed secondary or higher levels of education. Notably, a substantial number of workers held at least a bachelor’s degree, indicating a relatively educated workforce across the participating facilities.

Table 1. Demographic Characteristics, Work Experience, And Ohs Training Status of The Participants

Variable	Category	n	%
Gender	Male	56	56.0
	Female	44	44.0
Age group (years)	18–30	27	27.0
	31–45	55	55.0
	≥46	18	18.0
Education level	Primary / Secondary school	23	23.0
	Associate degree	15	15.0
	Bachelor's degree	42	42.0
	Graduate degree	20	20.0
Work experience (years)	≤1	12	12.0
	1–5	34	34.0
	>5	54	54.0
OHS training status	Received training	62	62.0
	Not received training	38	38.0

Regarding occupational background, the distribution of work experience indicated that a large proportion of employees had more than five years of experience in the participating facilities. This reflects prolonged exposure to workplace conditions and occupational risks and provides a solid basis for evaluating PPE-related knowledge, attitudes, and behaviors shaped through long-term interaction with production processes.

With respect to occupational health and safety practices, more than half of the participants reported having received formal OHS training. Workers with prior training demonstrated higher levels of awareness regarding workplace hazards and safety procedures, whereas those without training reported lower familiarity with OHS regulations and preventive measures. Taken together, the combined evaluation of demographic characteristics, work experience, and training status suggests that the study group represents an experienced workforce with heterogeneous levels of safety awareness.

PPE Usage Behaviors

Workers' personal protective equipment usage behaviors are summarized in Table 2. The results indicate that PPE usage frequency varies considerably depending on the type of equipment. Safety shoes and gloves were the most frequently used PPE items, whereas hearing protection, eye protection, and respiratory equipment were used less consistently. Although most participants reported using at least one type of PPE during daily work activities, regular and comprehensive PPE use was not observed across all employees.

Table 2. Frequency Of Personal Protective Equipment (PPE) Use Among Workers

Type of PPE	Regular use (n)	Occasional use (n)	Rare / No use (n)
Safety shoes	78	15	7
Gloves	72	18	10
Helmet	61	21	18
Hearing protection	39	27	34
Eye protection (goggles)	36	29	35
Respiratory protection	31	26	43

This selective pattern of PPE use has been widely reported in the industrial safety literature. Previous studies indicate that workers tend to prioritize PPE perceived as essential or unavoidable for task completion, particularly equipment that does not significantly interfere with work performance, such as safety shoes and gloves (Balkhyour et al., 2019; Garrigou et al., 2020; Savicheva et al., 2023; Trubetskov et al., 2023). In contrast, PPE that restricts movement, affects sensory perception, or causes physical discomfort is more likely to be neglected. The relatively low use of hearing protection, eye protection, and respiratory equipment observed in this study supports this interpretation.

In paper production facilities, exposure to high noise levels, airborne dust, and chemical substances is common, and failure to use appropriate PPE may result in long-term occupational health problems rather than immediate injuries. Several studies emphasize that workers often underestimate chronic occupational risks because their effects are not immediately visible, leading to lower compliance with protective measures intended to prevent long-term harm (Korhonen et al., 2004; Tutuş et al., 2018; Torén et al., 2020; Mykhailova et al., 2025; Tafese et al., 2024). This tendency contributes to the awareness–behavior gap frequently observed in industrial safety research.

The findings further suggest that PPE usage behavior is influenced not only by individual preferences but also by workplace culture and organizational practices. Inadequate supervision, limited enforcement, and insufficient ergonomic adaptation of PPE may reinforce selective compliance. The literature consistently highlights that management commitment and continuous monitoring are critical for transforming PPE use from an optional behavior into a routine safety practice (Wong et al., 2020, 2021; Rahman et al., 2025). Without consistent supervision and clear enforcement mechanisms, workers may develop informal safety norms that prioritize productivity over protection.

The results indicate that PPE usage behavior in the participating facilities is selective rather than systematic. Addressing this issue requires a comprehensive approach that goes beyond the mere provision of protective equipment. Improving ergonomic design, strengthening training programs, enhancing supervision, and fostering a strong safety culture are essential steps for increasing PPE compliance in paper production environments.

Factors Affecting PPE Use

The relationship between occupational health and safety (OHS) training status and regular PPE use is presented in Table 3. The results demonstrate a clear association between receiving formal OHS training and consistent PPE usage among workers. Employees who had received OHS training reported substantially higher rates of regular PPE use compared to those who had not received any formal training.

Table 3. Relationship Between OHS Training Status and Regular PPE Use

OHS Training Status	Regular PPE use (n)	Irregular / No PPE use (n)	Total (n)
Received training	48	14	62
Not received training	18	20	38
Total	66	34	100
		*Chi-square (χ^2) = 6.42, p-value = 0.011**	

*Statistically significant at $p < 0.05$

As shown in Table 3, 48 of the 62 workers who had received OHS training reported regular PPE use, whereas only 18 of the 38 untrained workers demonstrated similar behavior. Chi-square analysis confirmed that this difference was statistically significant ($\chi^2 = 6.42$, $p = 0.011$), indicating that OHS training is a significant factor influencing PPE compliance.

These findings are consistent with previous studies highlighting the critical role of training in improving occupational safety behavior. Effective training programs enhance workers' risk perception, increase awareness of workplace hazards, and reinforce the importance of preventive measures, thereby leading to higher compliance with PPE requirements (Robson et al., 2012; Ricci et al., 2016; Casey et al., 2021; Lukander et al., 2025). In industrial environments characterized by complex and continuous hazards, such as paper production facilities, structured OHS training serves as a key mechanism for translating safety knowledge into practical behavior.

In contrast, workers without prior training exhibited lower levels of regular PPE use, suggesting deficiencies in safety awareness and preventive practices. This outcome aligns with earlier research indicating that the absence of formal training contributes to risk normalization and unsafe behavior, particularly among workers who rely primarily on routine experience rather than established safety guidelines (Smith et al., 2024; Hardianty et al., 2025; Yusriyanto & Asran, 2025). Without continuous training and reinforcement, occupational risks may be underestimated and PPE use perceived as unnecessary.

In addition to OHS training, education level was evaluated as a demographic factor potentially influencing PPE compliance. Although no statistically significant association was identified between education level and regular PPE use ($p > 0.05$), descriptively higher compliance rates were observed among employees with higher educational attainment. This pattern suggests that education may contribute to improved risk awareness and safety perception, even if the relationship did not reach statistical significance in the present sample.

The results underscore that OHS training is not merely an informational activity but a central determinant of safety-related behavior. Continuous, task-specific, and practical training programs are essential for strengthening safety culture and ensuring consistent PPE use across paper production facilities. Integrating regular training initiatives with effective supervision and ergonomic improvements may further support sustainable occupational safety outcomes.

Reasons for Not Using PPE

The reasons reported by workers for not using personal protective equipment are presented in Table 4. The findings indicate that barriers to PPE use arise from a combination of individual, organizational, and environmental factors. Rather than being driven by a single dominant cause, PPE non-use appears to be shaped by multiple interacting elements related to work organization, equipment characteristics, and workplace safety culture. It should be noted that the questions presented in Table 4 were administered to all employees, not exclusively to those reporting irregular or non-use of PPE. This approach was adopted to capture broader perceptions and situational barriers related to PPE use across the entire workforce. Even workers who report regular use may occasionally experience discomfort, task interference, or contextual challenges affecting compliance. Including all participants therefore allowed for a more comprehensive assessment of attitudinal and organizational factors influencing PPE behavior.

Table 4. Reasons For Not Using Personal Protective Equipment

Reason for not using PPE	n	%
Wearing PPE interferes with my work	17	17.4
I neglect to use PPE while working	14	14.3
PPE is not provided to me by the enterprise	13	13.3
PPE causes physical discomfort	13	13.3
PPE provided by the enterprise is not sufficient or well equipped	13	13.3
I do not know how to use the PPE	10	10.2
My co-workers do not use PPE	9	9.18
I do not believe PPE is beneficial	5	5.10
Wearing PPE feels ridiculous to me	4	4.08

As shown in Table 4, the most frequently cited reason for PPE non-use was that wearing PPE interfered with work tasks (17.4%). This finding suggests that workers may perceive PPE as an obstacle to productivity or task efficiency. Similar observations have been reported in industrial safety studies, where PPE is often viewed as restrictive, particularly in environments requiring manual dexterity, speed, or sustained attention (Adler et al., 2021; Brisbine et al., 2022; Okobo & Onosemuode, 2025; Al-Amin & Rony, 2025). Closely related to this issue, physical discomfort was reported by 13.3% of participants, indicating that ergonomic incompatibility remains a critical challenge for sustained PPE use.

Organizational factors also played a substantial role in PPE non-compliance. A notable proportion of workers reported that PPE was either not provided by the enterprise or was insufficient or inadequately equipped (13.3%). Inadequate provision and poor quality of protective equipment may reduce workers' motivation to comply with safety requirements and weaken their trust in management's commitment to occupational safety. Previous research has emphasized that insufficient organizational support is strongly associated with lower PPE compliance, even among workers who are aware of occupational risks (George et al., 2023; Kim & Choi, 2025; Hussain, 2025).

Behavioral and cultural factors further contributed to PPE non-use. Forgetting to use PPE during work was reported by 14.3% of participants, suggesting that PPE use has not yet been fully internalized as a routine work practice. In addition, 9.18% of workers indicated that their behavior was influenced by colleagues who did not use PPE, highlighting the role of social norms and peer behavior in shaping safety practices. Although reported by a smaller proportion of participants, the perception that PPE is unnecessary or "ridiculous" reflects deeper attitudinal barriers and resistance to safety rules.

Taken together, these findings indicate that improving PPE compliance requires more than simply providing protective equipment. Effective interventions should address ergonomic design, continuous and practical training, consistent supervision, and the development of a strong safety culture. Integrating PPE use into daily work routines and reinforcing positive safety norms at both individual and organizational levels are essential for achieving sustainable improvements in occupational safety across paper production facilities.

Accident History, Risk Perception, and Supervision of PPE Use

Work-Related Accident History

As presented in Table 5, a considerable proportion of participants (41.0%) reported having experienced at least one work-related accident during their employment in the participating paper production facilities. The most frequently reported accident types involved cuts, falls, and contact with moving machinery. These findings indicate that paper production environments continue to pose significant occupational risks despite the implementation of existing safety measures.

Table 5. Work-Related Accident History of Participants

Variable	Category	n	%
Accident experienced	Yes	41	41.0
	No	59	59.0
Type of accident*	Cut	18	43.9
	Fall	13	31.7
	Machinery contact	10	24.4

*Percentages calculated based on participants who experienced an accident.

From a behavioral perspective, accident experience may serve as a critical factor shaping workers' risk perception and subsequent safety-related behavior. Previous studies have shown that workers who have personally experienced an occupational accident tend to exhibit heightened awareness of workplace hazards and stronger beliefs regarding the necessity of protective measures (Oah et al., 2018; Qiu et al., 2024; Wang et al., 2025). However, reliance on accident experience as a primary learning mechanism reflects a reactive rather than preventive approach to occupational safety, underscoring the need for proactive interventions such as continuous training, effective supervision, and systematic risk management strategies.

Perceived Workplace Risk Level

Workers' perceptions regarding workplace risk are presented in Table 6. The majority of participants described the production environment as either risky or very risky, indicating a high level of hazard awareness among employees across the participating paper production facilities. This finding suggests that workers generally recognize the occupational risks inherent in paper manufacturing processes.

Table 6. Perceived Workplace Risk Level Among Participants

Perceived risk level	n	%
Very risky	36	36.0
Risky	44	44.0
Moderately risky	15	15.0
Low risk	5	5.0

Despite this high level of perceived risk, earlier results demonstrated that PPE usage was not always regular or comprehensive. This discrepancy highlights a well-documented phenomenon in occupational safety research known as the awareness–behavior gap, whereby knowledge of workplace hazards does not necessarily translate into consistent protective behavior (Kim et al., 2022; Das et al., 2024; Shubayr, 2025). Over time, workers may normalize occupational

risks or prioritize productivity and task efficiency over preventive measures, particularly when hazards do not lead to immediate or visible consequences.

Perceived Adequacy of PPE Supervision

The perceived adequacy of PPE supervision is presented in Table 7. While 38.0% of participants considered supervision to be adequate, a substantial proportion reported that supervision was either partially adequate or inadequate. This finding points to potential weaknesses in enforcement mechanisms related to PPE use across the participating paper production facilities.

Table 7. Perceived Adequacy of PPE Supervision

Supervision level	n	%
Adequate	38	38.0
Partially adequate	42	42.0
Inadequate	20	20.0

The literature consistently emphasizes that management commitment and effective supervision are among the strongest determinants of sustained PPE compliance (Garrigou et al., 2020; George et al., 2023; Yusriyanto & Asran, 2025). When supervision is inconsistent or perceived as insufficient, PPE use may be regarded as optional rather than mandatory, thereby reinforcing selective or situational compliance. In contrast, consistent monitoring and clear enforcement practices contribute to the normalization of PPE use as an integral component of routine work activities.

Overall, the combined evaluation of accident history, risk perception, and supervision suggests that PPE compliance is shaped by both individual experience and organizational factors. Although workers demonstrate high awareness of workplace risks, deficiencies in supervision and enforcement may hinder the translation of awareness into consistent protective behavior. These findings underscore the importance of integrating proactive safety management strategies, continuous supervision, and preventive training programs to strengthen occupational safety culture and improve PPE compliance across paper production facilities.

Relationship Between Accident History and PPE Use

The relationship between workers' accident history and regular PPE use is presented in Table 8. The results reveal a statistically significant association between experiencing a work-related accident and consistent PPE usage. Employees who had previously experienced an occupational accident demonstrated higher rates of regular PPE use compared to those who had not experienced any accidents.

Table 8. Relationship Between Work-Related Accident History and Regular PPE Use

Accident history	Regular PPE use (n)	Irregular / No PPE use (n)	Total (n)
Accident experienced	34	7	41
No accident experienced	32	27	59
Total	66	34	100
		*Chi-square (χ^2) = 8.11, p-value = 0.004**	

*Statistically significant at $p < 0.05$

As shown in Table 8, 34 of the 41 workers with accident experience reported regular PPE use, whereas only 32 of the 59 workers without accident experience demonstrated similar behavior. Chi-square analysis confirmed that this difference was statistically significant ($\chi^2 = 8.11$, $p = 0.004$), indicating that accident history is an important factor influencing PPE compliance.

These findings suggest that direct exposure to occupational accidents increases workers' risk awareness and reinforces preventive behavior. Previous studies have demonstrated that personal experience with workplace accidents often leads to heightened sensitivity to hazards and a stronger perception of vulnerability, which in turn promotes protective actions such as PPE use (Goulart et al., 2020; García-Mainar & Montuenga, 2024; Mastrantonio et al., 2024). Accident experience appears to function as a behavioral trigger that temporarily alters safety-related attitudes and practices.

However, reliance on accident experience as a primary driver of safe behavior reflects a reactive rather than preventive approach to occupational safety. Ideally, consistent PPE use should be motivated by structured training, effective supervision, and a well-established safety culture rather than by personal exposure to injury. The lower PPE compliance observed among workers without accident experience suggests a tendency to underestimate workplace risks, further supporting the presence of an awareness–behavior gap identified in earlier sections of this study.

When considered alongside the findings related to OHS training and supervision, the results underscore that PPE compliance is shaped by both experiential and organizational factors. While accident experience may temporarily enhance safety behavior, sustainable improvement requires proactive strategies, including continuous training programs, consistent supervision, and reinforcement of positive safety norms. These findings highlight the importance of shifting occupational safety practices from reactive learning toward preventive risk management across paper production facilities.

Practical Implications for the Paper Industry

The findings of this study offer several practical implications for improving occupational health and safety practices within the paper manufacturing industry. The selective use of personal protective equipment observed among workers indicates that PPE compliance should not be addressed solely as an individual responsibility. Instead, management practices, ergonomic suitability of equipment, and workplace safety culture play decisive roles in shaping safety-related behaviors.

One key implication concerns occupational health and safety training. The significant association between OHS training and regular PPE use demonstrates that continuous, task-specific, and practical training programs are essential for improving compliance. Training initiatives should extend beyond theoretical instruction and incorporate hands-on demonstrations, scenario-based learning, and periodic refresher sessions to reinforce correct PPE use and sustain safety awareness over time.

Ergonomic factors also emerged as major barriers to PPE compliance. Discomfort, restricted movement, and interference with work tasks were frequently cited reasons for non-use. Accordingly, paper production facilities should prioritize the selection of ergonomically designed PPE that is compatible with specific production tasks. Providing PPE in appropriate

sizes and ensuring comfort during prolonged working hours may substantially increase worker acceptance and promote consistent use.

The results further highlight the importance of effective supervision and enforcement mechanisms. Workers' perceptions of inadequate or partial supervision suggest that PPE use is not consistently monitored in practice. Regular inspections, visible managerial commitment, and clear enforcement of safety rules can help normalize PPE use as an integral component of daily operations rather than an optional practice.

The influence of accident history on PPE compliance indicates that workers often adopt safer behaviors following personal exposure to occupational accidents. This reactive pattern underscores the need for preventive strategies that enhance risk perception before accidents occur. Proactive risk communication, routine safety briefings, and the use of anonymized accident case examples may help raise awareness and encourage protective behavior without relying on personal injury experiences.

These findings suggest that improving PPE compliance in the paper industry requires an integrated approach combining effective training, ergonomic adaptation, consistent supervision, and a strong safety culture. Implementing such measures may contribute to reducing occupational accidents, enhancing worker well-being, and supporting sustainable production practices across paper manufacturing facilities.

When compared with findings reported from paper facilities in other countries, the level of regular PPE compliance observed in this study appears broadly consistent with trends reported in developing industrial contexts, yet slightly lower than compliance rates documented in highly regulated European facilities. Studies conducted in Scandinavian and Western European paper production environments report higher PPE adherence, often exceeding 80%, largely attributed to stricter regulatory enforcement, continuous safety audits, and mature safety cultures (Khoshakhlagh et al., 2024; Mulyana & Sinaga, 2024). In contrast, research from comparable developing economies indicates similar barriers related to discomfort, work interference, and risk normalization (Febriyanti et al., 2025). These comparisons suggest that while PPE awareness in Turkish paper production facilities demonstrates positive tendencies, structural and organizational improvements may further enhance compliance levels.

CONCLUSION

This study examined the knowledge, attitudes, and behaviors of workers regarding personal protective equipment use across paper production facilities and revealed that, although workers generally recognize the importance of PPE, its use remains selective rather than systematic. Equipment perceived as essential for task completion, such as safety shoes and gloves, was used more consistently, whereas PPE associated with discomfort, restricted movement, or interference with work tasks demonstrated lower compliance rates. Despite high levels of perceived workplace risk, inconsistencies in PPE usage indicate the presence of a persistent awareness–behavior gap. Factors including ergonomic discomfort, insufficient supervision, and organizational practices were identified as major barriers to translating safety awareness into consistent protective behavior, emphasizing that PPE availability alone is insufficient to ensure effective occupational safety.

The findings further demonstrated that occupational health and safety training plays a critical role in promoting regular PPE use. Workers who had received formal training exhibited higher compliance levels and more positive safety-related behaviors, underscoring the importance of continuous, practical, and task-oriented training programs. In addition, accident history was found to influence PPE behavior, with workers who had experienced occupational accidents showing greater adherence to protective measures. While this suggests that personal experience increases risk awareness, reliance on reactive learning highlights the need for preventive strategies that strengthen safety behavior before accidents occur. Overall, the study emphasizes that effective PPE use in the paper industry requires an integrated approach combining training, ergonomic adaptation, consistent supervision, and a strong safety culture. Addressing these interconnected factors may contribute to reducing occupational risks, improving worker safety, and supporting sustainable production practices across paper manufacturing environments.

AUTHOR CONTRIBUTIONS

Mustafa Çiçekler supervised the study, contributed to data analysis, and revised the manuscript. **Çiğdem Gençboy** collected the data, conducted statistical analyses, and prepared the initial draft. Both authors approved the final manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

ETHICS COMMITTEE APPROVAL

Ethical approval was obtained from the Ethics Committee for Science and Engineering of Kahramanmaraş Sütçü Imam University (Decision date: 09.12.2025, Meeting No: 2025/35).

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