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Ovako Working Postural Analysis in Ergonomic Risk Factors among Photographers: A Cross Sectional Study

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: An ovako postural analysis is a systematic observation method that assesses postures and related factors. It can help identify risk factors associated with awkward postures and repetitive movements and that evaluates whole-body postures, including the upper and lower extremities, to assess the risk of musculoskeletal disorders. Objectives of the
Study: To evaluate the ovako postural assessment on posture among photographers. To evaluate the ovako postural analysis on ergonomic risk factors among photographers.

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Methodology: A convenience samples of 50 male photographers participated this study and basis upon the inclusion and exclusion criteria. This study starts before asked to filled the informed consent form and to Obtain demographic information from participants, including age, gender, years of experience, and any existing musculoskeletal issues. The analysis of posture by using ovako postural analysis system identifies the most common work postures of back (4 postures), arms (3 postures) and lower limbs (7 postures). It should be noted in this study, sampling was performed through photographic postures.
Results: The working posture of photographers found the ergonomic risks such as the shoulder, neck and back regions of the body. The most common musculoskeletal disorders present in the upper limb, back and lower legs.
Conclusion: In conclusion, the Ovako Working Postural Analysis can be a useful tool for assessing ergonomic risk factors among photographers. It provides insights into the working postures and potential risks associated with different body parts. However, it's important to acknowledge the limitations of this analysis and consider additional factors for a comprehensive ergonomic evaluation. By combining the Ovako Working Postural Analysis with objective measurements, task analysis, and consideration of environmental factors, a more accurate assessment of ergonomic risks can be obtained. It is also recommended to utilize validated tools and guidelines specific to photographers, involve photographers in the assessment process, and provide ergonomic training and education.

Keywords: Ovako; posture; ergonomics; photographers.

1. INTRODUCTION

Postural analysis of photographers is crucial to identify and address potential musculoskeletal issues related to their work. It is essential to conduct a comprehensive postural analysis by observing the photographer during various tasks, gathering subjective feedback, and considering ergonomic factors [1,2]. A trained professional, such as an occupational therapist or ergonomics specialist, can provide expertise in conducting a thorough postural analysis and recommending appropriate interventions to improve posture and prevent musculoskeletal issues. Relate reported symptoms to observed postural issues to determine potential causative factors [3]. Ovako Postural Assessment offers a comprehensive and detailed analysis of the entire body posture, making it suitable for identifying specific musculoskeletal issues and task-specific movements in photographers. On the other hand, REBA provides a quick and simple assessment of the whole body posture, which can be useful for identifying general postural issues but may lack specific details or task specificity [4].

The choice between the two approaches depends on the level of detail required, the time available for assessment, and the specific needs of the photography environment. Ovako evaluates the overall body posture, including the upper limbs, neck, and trunk. This holistic approach helps identify potential musculoskeletal issues throughout the body [5]. The assessment provides in-depth analysis of joint angles, muscle activity, and alignment of body segments, allowing for a thorough understanding of the photographer's posture. Ovako assesses body posture while performing tasks specific to photography, which can provide valuable insights into the ergonomics of the photographer's work [3]. Ovako Postural Assessment requires more time and expertise to conduct compared to quicker assessment methods [6,7]. The analysis can be complex and may require trained professionals to interpret the results accurately [2]. Ovako postural analysis provides a rapid assessment of the entire body posture, making it suitable for time-sensitive environments [3, 2]. It uses a scoring system to evaluate body posture quickly, without requiring extensive training or expertise. Photographers are prone to developing musculoskeletal disorders (MSDs) due to the nature of their work, which often involves repetitive movements, prolonged periods of static postures, and the use of heavy equipment.

Here are some common musculoskeletal disorders that photographers may experience Repetitive Strain Injuries. It can occur in the hands, wrists, and forearms due to repetitive movements, such as operating camera controls, clicking a mouse, or gripping equipment. Compression of the median nerve in the wrist can lead to pain, numbness, and tingling in the hand and fingers [8,9]. Inflammation of the tendons in the hands, wrists, or arms can cause

pain, swelling, and limited range of motion. Overhead shooting or carrying heavy equipment can lead to impingement of the rotator cuff tendons, causing pain and limited shoulder mobility. Prolonged periods of looking through a camera viewfinder or editing at a computer can strain the neck muscles, leading to pain and stiffness. Poor posture, such as rounded shoulders or forward head posture, can contribute to upper back pain and muscle tension [9,10]. Low Back Pain: Long hours of standing, carrying heavy equipment, or maintaining static postures can strain the muscles and structures in the lower back. Repetitive gripping or use of the camera controls can cause inflammation of the tendons in the fingers, resulting in triggering or locking of the finger joints. Frequently leaning forward to look through the camera viewfinder or towards a computer screen can lead to imbalances in neck and shoulder muscles, contributing to postural issues. Carrying heavy camera equipment or prolonged computer use can cause the shoulders to roll forward, leading to muscle imbalances and postural abnormalities [10]. Preventing and managing musculoskeletal disorders in photographers involves several strategies: Maintaining good posture and taking regular breaks to stretch and change positions. Using ergonomic equipment, such as camera straps or harnesses, tripods, and ergonomic keyboards or mouse. Engaging in regular exercise, including strength training and flexibility exercises to support the muscles and joints. Applying proper lifting and carrying techniques when handling heavy equipment [1,10]. Early intervention and proactive measures to promote proper ergonomics and body mechanics can help reduce the risk of musculoskeletal disorders and maintain long-term well-being for photographers.

Objective of the study:

- To evaluate the ovako postural assessment on posture among photographers
- To evaluate the ovako postural analysis on ergonomic risk factors among photographers.

2. METHODS

A convenient samples of 50 male photographers with the age group of 20 to 45 and who regularly engage in photography activities. Ensure a diverse range of photographers in terms of age, experience, and workload. Randomly assign participants to undergo the Ovako Postural Assessment. Ensure both assessments are conducted by trained professionals to maintain consistency and accuracy. Conduct the assessments in a controlled environment, such as a photography studio or laboratory. This study starts before asked to filled the informed consent form and to Obtain demographic information from participants, including age, gender, years of experience, and any existing musculoskeletal issues. This study to collected the data on the basis upon the inclusion and exclusion criteria.

Inclusion criteria:

- Participants must work as photographers, either as professionals or hobbyists, engaged in photography-related activities regularly.
- photographers with varying levels of experience, ranging from beginners to experienced professionals.
- Age group between 20 to 45
- Who are all willing to participate the study
- Participants should not have any existing or significant musculoskeletal disorders or injuries that could significantly impact their posture

Exclusion criteria:

- Spinal deformities
- Malignancy
- Infectious diseases
- Neurological disorders
- Spinal cord injuries
- Intervertebral disc prolapse
- Arthritis and inflammation
- Soft tissue and other injuries
- Medically ill patients

Study Design: A cross-sectional study design

3. PROCEDURE

Conduct the assessments in a controlled environment, such as a photography studio or laboratory. Obtain demographic information from participants, including age, gender, years of experience, and any existing musculoskeletal issues. Use standardized protocols for conducting both assessments. Record the data using appropriate tools and equipment (e.g., cameras, goniometers).

3.1 Ovako Postural Assessment

Follow the guidelines and protocols outlined in the Ovako Postural Assessment method. Assess

participants' overall body posture, including upper limbs, neck, and trunk. Analyze joint angles, muscle activity, and alignment of body segments. Document any identified postural issues and associated risks. Evaluate the participants' entire body posture, considering upper and lower limbs, neck, and back. Assign scores based on body postures and movements during specific tasks. Identify potential postural risks and ergonomic issues.

4. RESULTS AND DISCUSSION

Table 1. Socio demographic Data

S.No	Demographic Data	Mean & SD
1.	Age	35.1 ± 1.8
2.	Height	158.61 ± 1.2
3.	Weight	65.13 ± 1.1
4.	BMI	24.5 ± 0.2

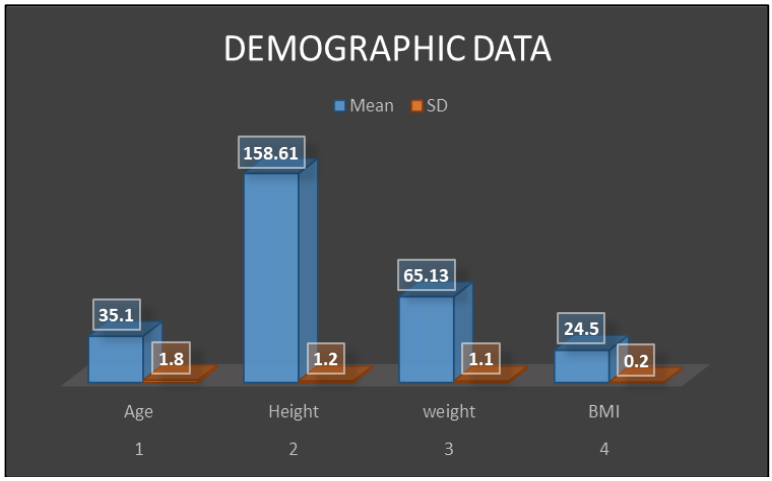

Fig. 1. Socio Demographic Data

Table 2. Working posture Back

S.no	Reported Posture	Frequency	Percentage
1.	Straight	21	42%
2.	Bent	18	36%
3.	Straight with twisted	23	46%
4.	Bent and twisted	24	48%

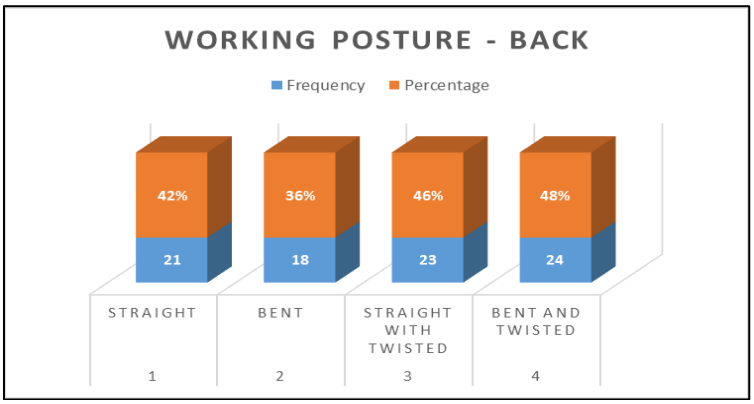

Fig. 2. Working posture - Back

Table 3. Working posture arms

S.no	Reported posture	Frequency	Percentage
1.	Both arm below the shoulder	24	48%
2.	An arm above the shoulder	23	46%
3.	Both arm above the shoulder	23	46%

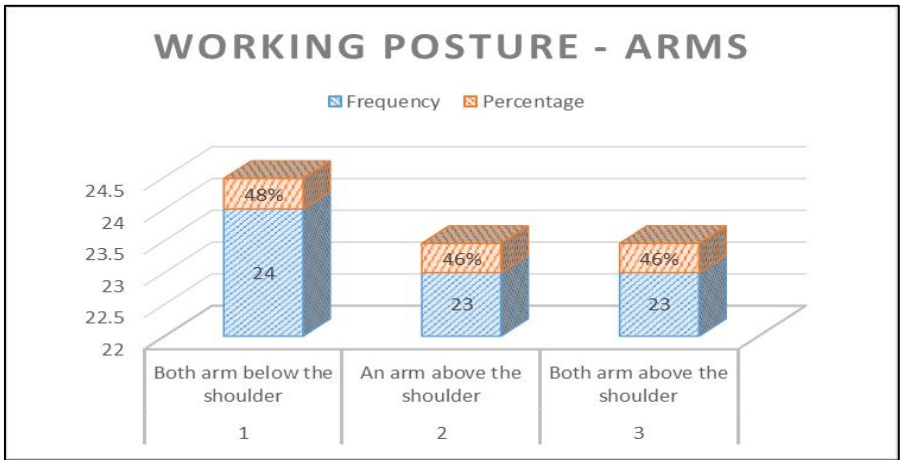

Fig. 3. Working posture - Arms

Table 4. Working posture Lower legs

S.no	Reported posture	Frequency	Percentage
1.	Seated	13	36%
2.	Standing	23	46%
3.	Unipodal support	22	44%
4.	Knees bent	21	42%
5.	Kneeling or Squatting	19	38%
6.	Walking	21	42%

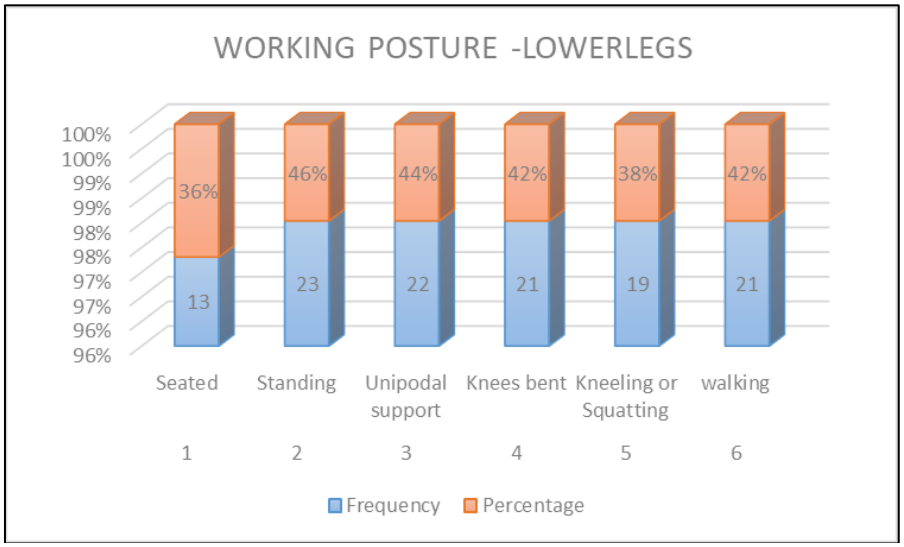

Fig. 4. Working posture lowerlegs

Table 5. Working posture – Force and Load

S.no	Load	Frequency	Percentage
1.	Below 22 lb	17	36%
2.	22- 44 lb	20	40%
3.	Above 44lb	21	42%

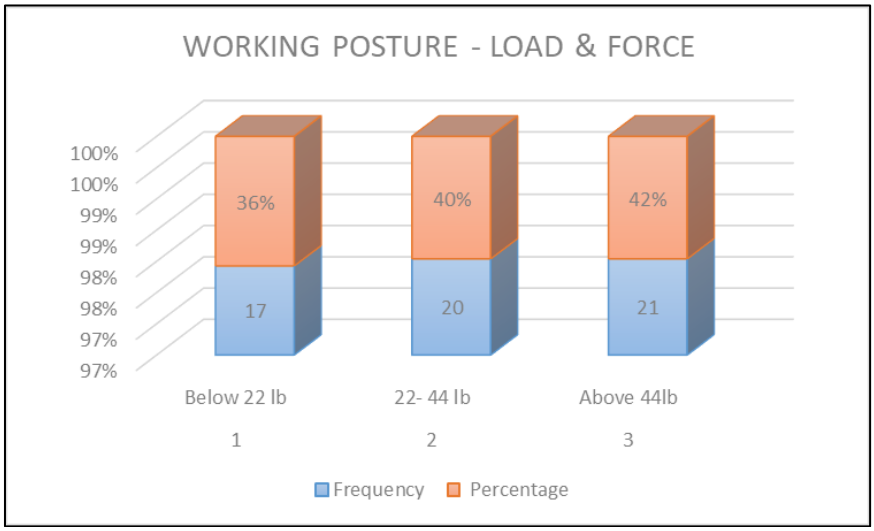

Fig. 5. Working posture – Force and Load

Table 6. Ergonomic risk factors in Photographers

S.no	Ergonomic posture	Force and load Frequency	Percentage of ergonomic risks
1.	Neck and shoulder	34	68 %
2.	Arms	32	64%
3..	Forearms	30	60%
4.	Wrist & Hand	29	58%
5.	Back	33	66%
6.	Lower leg	31	62%

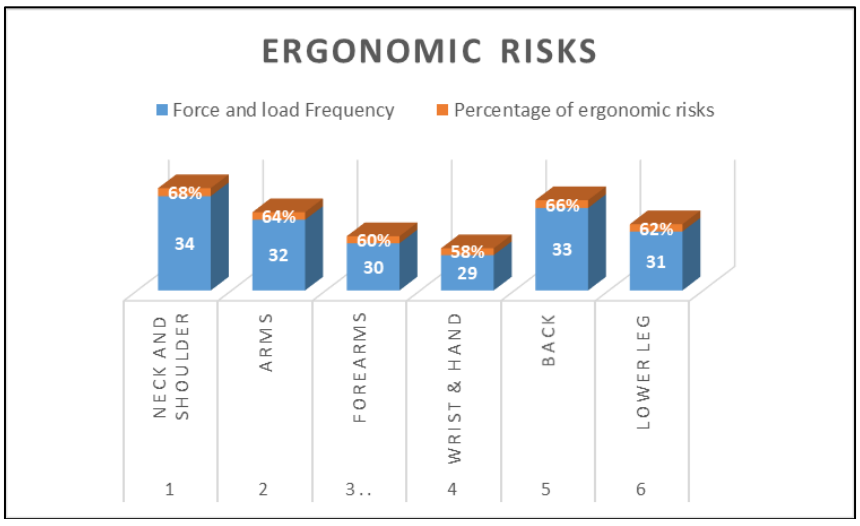

Fig. 6. Ergonomic risk factors in photographers

The mean age of the photographers is 35.1 years with a standard deviation (SD) of 1.8. This indicates that, on average, photographers in the dataset are around 35 years old. The relatively low standard deviation suggests that the ages of the photographers are relatively close to the mean, indicating a relatively homogeneous age distribution. The mean height of the photographers is 158.61 cm with a standard deviation of 1.2 cm. This indicates that, on average, photographers in the dataset are around 158.61 cm tall. The standard deviation suggests that there is some variation in height among the photographers, although the magnitude of this variation is relatively small. The mean weight of the photographers is 65.13 kg with a standard deviation of 1.1 kg. This indicates that, on average, photographers in the dataset weigh around 65.13 kg. The standard deviation suggests that there is some variability in weight among the photographers, although again, the magnitude of this variability is relatively small. The mean BMI of the photographers is 24.5 with a standard deviation of 0.2. BMI is calculated by dividing weight in kilograms by the square of height in meters [11,12]. A BMI of 24.5 falls within the normal weight range, suggesting that, on average, the photographers in the dataset have a healthy body mass index. Overall, based on the given data, that the photographers in the dataset have similar ages, heights, weights, and BMI values, indicating a relatively homogeneous socio-demographic profile within this particular group. However, it's important to note that this analysis is based on the provided mean and standard deviation values and assumes that the data follows a normal distribution.

The indicate the different working postures of photographers and the percentages associated with each posture. These postures and their potential impact on photographers' backs. The 42% of photographers work with a straight back. This posture is generally considered to be the most ergonomic and is recommended to maintain good spinal alignment. Working with a straight back can help reduce the risk of developing back pain or discomfort [1]. The Bent posture shows that 36% of photographers work with a bent back. This posture involves bending forward at the waist while photographing. It can be caused by factors such as the need to get closer to the subject or focusing on the camera controls. Maintaining a bent posture for extended periods may increase the strain on the back, potentially leading to muscle fatigue or strain. Straight with twisted posture indicate that 46% of photographers work with a straight back but twisted torso. This posture often occurs when photographers need to capture images from different angles without repositioning their entire bodies. While maintaining a straight back can be beneficial, the twisting motion may place additional stress on the spine and supporting muscles. The Bent and twisted posture 48% of photographers work with a bent and twisted back posture. This combination of bending and twisting can further increase the strain on the back, as it involves both forward flexion and rotational movements. This posture may be particularly prevalent when photographers need to capture shots in challenging or confined spaces.

The working postures of photographers' arms, specifically the positioning of the arms relative to the shoulders. Let's discuss these postures and their potential impact on photographers. Both arms below the shoulder 48% of photographers work with both arms positioned below the shoulders. This posture suggests that photographers typically keep their arms at or below shoulder level while photographing. This position can provide stability and support to the arms, reducing strain on the shoulder joints. 46% of photographers work with one arm positioned above the shoulder. This posture suggests that photographers may need to elevate one arm, potentially to capture shots from higher angles or adjust camera settings. Working with an arm above the shoulder may increase the strain on the shoulder joint and associated muscles over time [13]. Both arms above the shoulder posture, 46% of photographers work with both arms positioned above the shoulders. This posture suggests that photographers frequently need to elevate both arms while photographing. Similar to the previous posture, this position may place additional stress on the shoulder joints and muscles. It is important to note that these represent the reported working postures of photographers' arms. Individual experiences and practices may vary, and different photography specialties or shooting conditions may require specific arm positions.

The working postures of photographers' lower legs, these postures and their potential implications for photographers. 36% of photographers work in a seated position. This posture typically involves sitting on a chair or stool while photographing. While seated, photographers may have more stability and support, especially for tasks that require

precision or prolonged concentration. However, sitting for long periods without proper ergonomics can lead to issues such as reduced circulation, muscle stiffness, or lower back discomfort. In standing posture show that 46% of photographers work in a standing position provides greater mobility and flexibility, allowing photographers to move around freely to capture different angles and perspectives. However, standing for extended periods can lead to fatigue, strain on the legs and feet, and potential issues with circulation. The Unipodal support indicates that 44% of photographers utilize unipodal support, which means supporting their weight on one leg while the other leg remains off the ground [14]. This posture is commonly used when photographers need stability or balance, such as when shooting handheld or in dynamic environments. However, prolonged reliance on unipodal support may result in muscle fatigue or imbalances in the legs and hips. The 42% of photographers work with bent knees. This posture may occur when photographers need to lower their center of gravity for stability or to maintain a lower profile while photographing. It can help distribute the load on the legs and provide a more stable base. However, prolonged bent knees can lead to muscle fatigue or discomfort in the quadriceps and calves. Kneeling or squatting position suggests that 38% of photographers adopt a kneeling or squatting position while working [15]. This posture allows photographers to shoot from a lower angle or to access ground-level subjects. While kneeling or squatting, photographers may experience pressure on the knees, ankles, or feet. It's important to be mindful of any discomfort and avoid prolonged periods in this position to prevent strain or joint issues.42% of photographers engage in walking while working. This may involve moving around a location or actively pursuing subjects. Walking can provide cardiovascular benefits, promote blood circulation, and help photographers maintain an active and engaged approach to their work. However, uneven terrain or carrying heavy equipment while walking can increase the risk of tripping or falling.

The load and force exerted by photographers during their work. The results show that 36% of photographers work with a load below 22 lb. This suggests that a significant portion of photographers handle relatively lighter equipment or have workflows that involve minimal physical exertion. Lighter loads generally require less muscular effort and may result in reduced strain on the body and 40% of photographers work with a load between 22 and 44 lb. This load category represents a moderate level of equipment weight and may include cameras, lenses, tripods, and additional accessories. Working with these loads may require photographers to exert more muscular effort, especially when carrying equipment for extended periods or in challenging shooting conditions [16]. Then 42% of photographers work with a load above 44 lb. This indicates that a significant proportion of photographers handle heavier equipment or engage in activities that require substantial physical strength. Working with heavier loads can place increased demands on the musculoskeletal system, potentially leading to fatigue or strain if proper precautions are not taken. It's important for photographers to consider their physical capabilities, equipment handling techniques, and ergonomics to minimize the risk of musculoskeletal issues [17].

The study indicates the ergonomic risk factors for photographers in relation to different body parts. The study suggests that 68% of photographers face ergonomic risks related to the neck and shoulder. This is a common concern due to the prolonged use of cameras and equipment, which can lead to muscle tension, discomfort, and even musculoskeletal disorders. Other studies have also highlighted the impact of neck and shoulder posture on photographers' well-being. It is recommended for photographers to maintain proper posture, take regular breaks, and perform stretching exercises targeting the neck and shoulder muscles. The 64% of photographers face ergonomic risks related to their arms. The repetitive and sustained use of arms during photography, including holding the camera and operating controls, can lead to muscle fatigue, strain, and potential issues like tendonitis [18]. Studies emphasize the importance of adopting neutral arm positions, using ergonomic camera grips, and taking breaks to minimize these risks. The study indicates that 60% of photographers face ergonomic risks in their forearms. Repetitive activities such as operating camera buttons or adjusting lenses can contribute to forearm strain and overuse injuries. Ergonomic solutions like using larger buttons, maintaining a relaxed grip, and incorporating forearm stretches into the routine can help reduce these risks. The 58% of photographers face ergonomic risks related to their wrists and hands. Frequent use of small buttons, dials, and prolonged gripping of camera equipment can contribute to issues like wrist strain and carpal tunnel syndrome. Proper

ergonomics, such as using camera straps to distribute weight, using larger and more comfortable camera grips, and performing hand and wrist exercises, are recommended to mitigate these risks. The 66% of photographers face ergonomic risks related to their back [17]. Poor posture, prolonged standing or sitting, and carrying heavy equipment contribute to back pain and discomfort. Other studies have highlighted the importance of maintaining good posture, using supportive equipment like backpacks or camera harnesses, and incorporating core-strengthening exercises to alleviate back strain. The data indicates that 62% of photographers face ergonomic risks related to their lower legs. This can be attributed to prolonged standing, uneven terrain, or carrying heavy equipment during photography sessions. Studies suggest the use of comfortable and supportive footwear, taking breaks to rest the legs, and performing leg stretches to minimize lower leg strain. It's worth noting that the percentages of risk factors in the photographers that provided represent reported risks, and actual experiences may vary among photographers. However, the identified risk factors align with existing research on ergonomics for photographers [19].

Regarding the discussion related to other studies, it's important to note that the provided information solely focuses on the reported postures of the photographers in the dataset. To draw meaningful comparisons or conclusions with other studies, it would be beneficial to consider additional factors such as the sample size, demographics, and methodology used in those studies [20]. This would help in understanding whether the reported postures align with findings from previous research or if there are any notable differences. Additionally, it would be relevant to explore the potential implications of these postures on the photographers' health and well-being. Certain postures, such as having the arms above the shoulder for extended periods, may contribute to increased strain or discomfort in the shoulder and neck areas. Further investigation and analysis would be necessary to assess any possible correlations or impacts of these postures on photographers' physical health [18,17].

Limitations:

- Simplified postural assessment: This study was typically categorizes postures into a limited number of options, which may not capture the full complexity of photographers' working postures. It may overlook subtle variations or combinations of postures that can contribute to ergonomic risks.
- Lack of individual context: The analysis may not consider individual factors such as capacity,musculoskeletal injuries and years of experience which can influence a photographer's tolerance for specific postures. Individual differences should be taken into account for a more accurate assessment.
- The Ovako Working Postural Analysis primarily focuses on postures and may not consider other important ergonomic factors such as force exertion, duration of tasks, environmental conditions, or psychological factors. These factors can significantly impact the overall ergonomic risk profile of photographers.

Recommendations:

- Combine with objective measurements: To enhance the accuracy and reliability of ergonomic assessments, consider combining the Ovako Working Postural Analysis with objective measurements, such as motion capture systems or wearable sensors. These technologies can provide more detailed and quantifiable data on postures, forces, and movements.
- A comprehensive ergonomic assessment should include an analysis of specific tasks performed by photographers. This analysis can help identify task-specific risks and develop targeted interventions or modifications to reduce ergonomic hazards.
- Educate photographers about ergonomic principles, risk factors, and preventive measures. Training programs can raise awareness, teach proper techniques, and empower photographers to proactively address ergonomic concerns.

5. CONCLUSION

In conclusion, the Ovako Working Postural Analysis can be a useful tool for assessing ergonomic risk factors among photographers. It provides insights into the working postures and potential risks associated with different body parts. This study combining the Ovako Working Postural Analysis with objective measurements, task analysis, and consideration of environmental factors, a more accurate assessment of

ergonomic risks can be obtained. It is also recommended to utilize validated tools and guidelines specific to photographers, involve photographers in the assessment process, and provide ergonomic training and education. A holistic approach to ergonomics in photography can help identify and address the specific risks faced by photographers, leading to improved well-being, reduced musculoskeletal issues, and increased productivity. By implementing appropriate interventions and promoting awareness of ergonomic best practices, photographers can optimize their work conditions and enhance their overall work experience.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

CONSENT AND ETHICAL APPROVAL

It's not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Lee YH, Chiou WK. Ergonomic analysis of working posture in nursing personnel: example of modified Ovako Working Analysis System application. Res Nurs Health. 1995;18(1):67-75.
   DOI: 10.1002/nur.4770180109.
   PMID: 7831497
2. Huisstede BM, Wijnhoven HA, Bierma-Zeinstra SM, Koes BW. Prevalence and characteristics of complaints of the arm, neck, and/or shoulder (CANS) in the open population. Clinical Journal of Pain. 2008;24(3):253-259.
3. Wang MH, Chen YL, Chiou WK. Using the OVAKO working posture analysis system in cleaning occupations. Work. 2019;64(3):613-621.
   DOI: 10.3233/WOR-193022.
   PMID: 31658093.
   Da Costa BR, Vieira ER. Risk factors for work-related musculoskeletal disorders: a systematic review of recent longitudinal studies. American Journal of Industrial Medicine. 2010;53(3): 285-323.
4. do Rosário JL. Photographic analysis of human posture: a literature review. J Bodyw Mov Ther. 2014;18(1):56-61.
   DOI: 10.1016/j.jbmt.2013.05.008.
   Epub 2013 Jun 14. PMID: 24411150.
5. Löfqvist L, Pinzke S. Working with horses: An OWAS work task analysis. J Agric Saf Health. 2011 Jan;17(1):3-14.
   DOI: 10.13031/2013.36230.
   PMID: 21452755.
6. Karhu O, Kansi P, Kuorinka I. Correcting working postures in industry: A practical method for analysis. Appl Ergon. 1977;8(4):199-201.
   DOI: 10.1016/0003-6870(77)90164-8
   PMID: 15677243
7. Ogiwara I, Yamamoto G, Araki T, Kikuchi C, Kawamura S, Ninomiya S, Toyama S.. Practical use of wearable agri-robot suit for assisting farm work. Hort. Res. (Japan) 8 (Suppl.1): 387 (In Japanese);2010.
8. Lins C, Fudickar S, Hein A. OWAS inter-rater reliability. Appl Ergon. 2021;93: 103357.
   DOI:10.1016/j.apergo.2021.103357
   Epub 2021 Jan 30. PMID: 33524664.
9. Ismail AR, Rahman RA, Sha'ameri AZH. Ergonomic risk assessment for photography workstation: A case study of photojournalists. Procedia Manufacturing. 2016;7:154-159.
10. Kant I, Notermans JH, Borm PJ. Observations of working postures in garages using the Ovako Working posture Analysing System (OWAS) and consequent workload reduction recommendations. Ergonomics. 1990;33 (2):209-20.
    DOI: 10.1080/00140139008927111.
    PMID:Ando, T. 2006.
11. Evangelista WL, de Fátima Tinoco I, de Souza AP, Minette LJ, da Costa Baeta F, da Silva EP, de Oliveira LA. Postural analysis of workers in a typical meat processing company in Brazil. Work. 2012;41(Suppl 1):5392-4.
    DOI: 10.3233/WOR-2012-0829-5392
    PMID: 22317561.
12. Hignett S. Postural analysis of nursing work. Appl Ergon. 1996;27(3):171-6.
    DOI: 10.1016/0003-6870(96)00005-1.
    PMID: 15677057.
    Tuure V. 1992. Determination of physical stress in agricultural work. International Journal of Industrial Ergonomics 10: 275–284. Yonetake, U. and S. Toyama. 2005.

13. Abraham T, Binoosh SA, Remesh Babu KR. Virtual modelling and analysis of manual material handling activities among warehouse workers in the construction industry. Work. 2022;73(3): 977-990.
DOI: 10.3233/WOR-210742.
PMID: 36245350.
14. Kee D. Systematic Comparison of OWAS, RULA, and REBA Based on a Literature Review. Int J Environ Res Public Health. 2022 Jan 5;19(1):595.
DOI: 10.3390/ijerph19010595.
PMID: 35010850; PMCID: PMC8744662.
15. Petromilli Nordi Sasso Garcia P, Polli GS, Campos JA. Working postures of dental students: ergonomic analysis using the Ovako Working Analysis System and rapid upper limb assessment. Med Lav. 2013;104(6):440-7.
PMID: 24640831
16. Xu YW, Cheng AS. An onsite ergonomics assessment for risk of work-related musculoskeletal disorders among cooks in a Chinese restaurant. Work. 2014;48(4):539-45.
DOI: 10.3233/WOR-131805.
PMID: 24346265.
17. Hayati A, Marzban A. Ergonomic problems in agricultural farms: Explainable relationship between awkward postures and body discomforts in Iranian leafy vegetable cultivation. Work. 2022;71(3):709-717.
18. Engels JA, Landeweerd JA, Kant Y. An OWAS-based analysis of nurses' working postures. Ergonomics. 1994;37 (5):909-19.
DOI: 10.1080/00140139408963700.
PMID: 8206059.
19. Burdorf A, van Duuren L. An evaluation of ergonomic improvements in the woodworking industry. Ann Occup Hyg. 1993;37(6):615-22.
DOI: 10.1093/annhyg/37.6.615.
PMID: 8304682.
20. Chauhan MK, Sondhi A. Posture-Related Musculoskeletal Problems among Hotel Receptionists in Mumbai: A Cross-Sectional Study. Indian J Occup Environ Med. 2020;24(3):157-162.
DOI: 10.4103/ijoem.
IJOEM_275_18.
Epub 2020 Dec 14.
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