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Jurnal Keolahragaan, 11 (1), 2023, 66-75

The benefits of scuba diving for people with physical disabilities: a systematic review of the literature

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Received: April 13, 2023; Revised: April 17, 2023; Accepted: April 17, 2023

Abstract: The purpose of this study was to find out other benefits of scuba diving for persons with physical disabilities through a systematic literature review. The technique used in this research is a literature study. The literature analysis used the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) method. A total of seven articles were selected for review. A review of articles shows that diving can be treated as a multidimensional therapy in water, allowing people with and without disabilities to share activities together. Such rehabilitation involves comprehensive stimulation of the human body through social interaction through participation in class, influencing the mental and physical environment to regain awareness of one's own body and the movements one can perform, to feel one's own body position and the possibility of providing direction of motion and the benefits of increasing self-reliance in water. Utilization the aquatic environment allows muscle relaxation, which, as a result, can have a positive effect on spasticity and often increase the very limited range of motion of joints in a natural environment allowing increased movement and coordination in a much easier manner than in a terrestrial environment. A person who scuba dives could learn and demonstrate independence by keeping himself safe, as well as the safety of his colleagues. Diving encourages a person to spend time with other people and, as such, provides an opportunity to be in a group whose members include people without disabilities, as well as people with locomotor system dysfunction, providing a sense of affiliation with the group and responsibility for it. members and create a positive mental state.

Keywords: scuba diving, physical disability, psychosocial.

How to Cite: Guntur, G., Solikin, M.S., Fauzi, F., Shahril, M.I.B., Salimin, N.B. (2023). The benefits of scuba diving for people with physical disabilities: a systematic review of the literature. *Jurnal Keolahragaan,* 11 (1), 66-75. doi:https://doi.org/10.21831/jk.v11i1.60136

INTRODUCTION

Every human being needs to fulfill his basic needs to sustain life. Basic needs are elements that are needed by a person in maintaining the balance of his life physiologically and psychologically. This is done to maintain life and well-being, including for persons with disabilities (Radissa et al., 2020). In various fields, persons with disabilities face various challenges and injustices. The inherent stigma as 'persons with disabilities' makes the existence of persons with disabilities seen as people who have damage, are not perfect, so that the value and quality is not good, even in previous Indonesian law the term 'persons with disabilities' was misused. the label attached to persons with disabilities by society, it becomes a growing stereotype in society (Niyu, 2017). Persons with disabilities are the largest minority group in the world. Because in every society, on average 10% of them are persons with disabilities. The number of people with physical, mental, and social disabilities in the world today is more than 15 people out of 100 people with disabilities in the world (KEMENKES, 2018). Nowadays people with physical disabilities often have difficulty in obtaining appropriate facilities and infrastructure for rehabilitation in their activities (Jacobus et al., 2017), restoring the psychosocial aspects experienced and building self-confidence in addition to fulfilling specifically for the health and

quality of life of persons with physical disabilities. The health of individuals with disabilities is a field that is often overlooked and neglected. Moreover, they often face challenges in accessing healthcare services and frequently experience discrimination or stigma. These circumstances make them more susceptible to various health conditions, leading to significant impacts on their quality of life. Hence, individuals with disabilities require specialized healthcare services that cater to their unique needs. It is crucial for all healthcare providers to be sensitive and ensure that persons with disabilities have access to quality, affordable, and accessible healthcare services. This can be achieved by incorporating appropriate guidelines for disability-inclusive healthcare in national health programs and collaborating with relevant ministries to support individuals with disabilities in their healthcare journey(Senjam & Singh, 2020).

The aquatic environment offers a distinct setting for children to flourish. With the properties of water being different from other environments, swimming not only encourages physical activity but also provides therapeutic advantages for children with disabilities. In recent years, there has been a significant rise in the number of published articles on pediatric aquatic intervention. However, due to the diversity of participants, various types of aquatic programs, and numerous new publications that have yet to be synthesized in the literature, there is a clear need to integrate and disseminate the current state of the pediatric aquatic literature(Cross et al., 2013).

Scuba diving is an underwater diving activity in which the diver uses equipment completely independent of the surface supply to breathe underwater. Scuba divers carry their source of breathing gas, usually compressed air, giving them greater freedom of movement than other types of dives supplied from the surface directly, in addition to having a longer underwater endurance compared to freediving or holding dives (Brubakk, et.al, 2003). The underwater environment is in principle not meant for humans where the compounds of water are denser than air, the activity in the buoyant environment allows them to feel weightless. The aquatic environment provides significant support for persons with disabilities to improve their physical and mental conditions (Henrykowska et al., 2022). Considering the above, the purpose of this research is to synthesize in the literature a numerous publication about the potential the benefits of diving for people with physical disabilities include aspects of physical, locomotor and mental health.

METHODS

This study uses a systematic literature review (SLR) to determine the benefits of scuba diving for people with disabilities including psychosocial benefits and restoring confidence in the quality of life. The literature search was carried out in October 2022 using database sources of Scopus and Pubmed. The literature search was carried out using keywords that became the main topic: scuba diving "AND" physical disability. Researchers set no limits in the search for related literature that is used as data as journals published to obtain valid and out-of-date information. Figure 1 describes the process of selecting articles according to the guidelines of the Preferred Reporting Literature Review and Meta-analysis (PRISMA). This review report use inclusion and exclusion criteria as shown in Table 1.

Table 1. Inclusion Criteria and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
1. Scientific article	1. Books, book chapters
2. International journal	2. IMRAD is not clear
3. Controlled intervention studies, observational cohort and cross-sectional studies, case-control studies, case series studies	3. Systematic review 4. Study reports not included
4. Articles containing elements of scuba diving, physical disability	

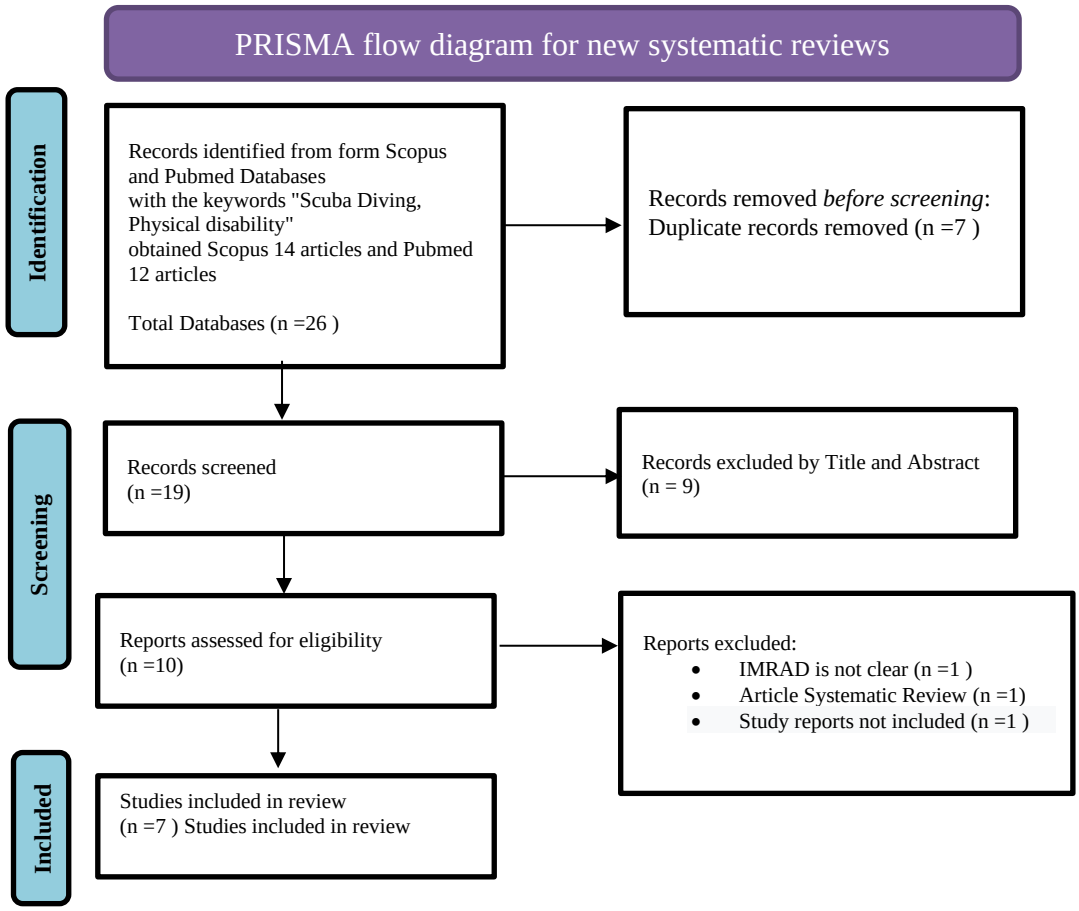

Figure 1. Preferred Reporting Literature Review and Meta-analysis (PRISMA)

RESULT AND DISCUSSION

Based on the systematic review process, selected, and extracted data for each article obtained, a detailed description of the researcher's name, title, research design, respondents, strengths and research results, and research limitations are summarized. The inclusion criteria: international journal and research design include controlled intervention studies, observational cohort and cross-sectional studies, case-control studies, case series studies, and articles containing elements of scuba diving, and physical disability. Quality assessment tools of the paper use NHLBI with low, and medium, assessment criteria.

In this systematic review process, 26 articles collections were using Scopus and Pubmed Databases with the keywords "Scuba Diving, Physical disability" obtained from Scopus 14 articles and Pubmed 12 articles. The stage continued by searching for the same articles and obtained 7 out of 26 databases so that 19 articles were obtained before the screening stage. The first screening stage continued by excluding the title and abstract and obtained 9 articles from the 19 databases, so 10 articles were obtained at the screening stage. The next stage was eligibility, excluding 7 articles based on IMRAD (Introduction, Method, Result, and Discussion) is not clear, Article Systematic Review, and Study reports were not included where finally meet 7 articles were evaluated for eligibility based on the title and abstract as well as the entire article excluded on inclusion and exclusion were obtained that matched the article criteria to be reviewed in this study.

Table 2. Description of the selected articles

No.	Article Identity	Research methods	Sample Characteristics	Result
1.	Henrykowska et al., (2021)	Quantitative Experimental Survey Methods on Groups of Physical	Polish citizens Aged 22 – 75 years old	The results of the analysis showed that out of the initial 58 respondents, their questionnaires were rejected for various formal reasons. Therefore, the further

	doi: 10.3390/ijerph18115678	Disabilities who do Scuba Diving and those who don't Self Assessment on: mental state. self-assessment. belief in one's abilities Network and quality of social interaction. overall physical fitness. muscle strength. Success rates in acquiring new motor skills. respiratory system efficiency. comfort with pain relief.	A total of 240 Persons with Physical Disabilities participated. Disability-adjusted by Polish law with three degrees of disability: severe, moderate, and mild	analysis was conducted only on fully completed questionnaires. Additionally, questionnaires were accepted only from respondents aged 22 to 75 years, and those that did not provide information about the type and severity of disability or failed to answer all questions were excluded from the analysis. The final sample size for the analysis comprised of 182 correctly filled out questionnaires, which were divided into two groups: group A with 118 respondents and group B with 64 respondents. The findings revealed significant improvements in self-esteem, self-confidence, and social interactions among scuba divers with disabilities compared to individuals with disabilities who did not practice diving.
2.	Carin-Levy & Jones, (2007) https://doi.org/10.2182/cjot.06.07	Qualitative In-depth, semi-structured interviews	3 volunteers recruited from a diving club specializing in training people with disabilities to dive.	The respondents in the analysis expressed that diving is not only a challenging and enjoyable activity, but it also has a positive impact on their quality of life. They reported that engaging in diving enriched their social experiences and improved their self-concept. The buoyant environment of the water allowed them to feel weightless, providing a sense of freedom from their disability and making them feel on par with non-disabled divers.
3.	Henrykowska et al., (2022) doi: 10.3390/healthcare10050761	Qualitative Non-experimental cross-sectional. The survey method used in the study involved the use of SF-36 and SF-12 questionnaires, which are widely used tools for measuring health-related quality of life. The Short Form Health Survey (SF-36 and SF-12) is a well-established instrument that assesses various aspects of health-related quality of life, including physical functioning, role limitations due to physical or	• Polish Citizens • A total of 240 Persons with Physical Disabilities participated. • 64 persons are persons with disabilities as well as divers	This study involved 64 divers with disabilities. Scuba divers with disabilities reported that diving can impact the quality of life of persons with disabilities by improving their physical and mental condition. This survey shows that those who engage in diving report a better quality of life in terms of mental and physical health compared to non-divers.

		emotional problems, bodily pain, general health perceptions, vitality, social functioning, and mental health. These questionnaires provide a comprehensive and standardized assessment of participants' overall sense of health-related quality of life.		
4.	Naumann et al., (2021) DOI: 10.12688/F1000RESEARCH.27889.1	Quantitative Experimental Case-Control Studies	2 women and 4 men with disabilities with an age range of 24-54 years	During a typical session of Immersion Therapy (IT), which utilizes underwater experience with SCUBA equipment for people with disabilities, both active and inactive treatments were carried out. Various activities were observed, and all participants showed an increase in heart rate, assessment of perceived exertion, and affect. The participants described their experience of IT as 'fun, challenging, and social', expressing that they enjoyed the sense of freedom and the overall experience. The therapy was found to be enjoyable and engaging, providing opportunities for participants to challenge themselves physically and socially.
5.	(Morgan et al., 2019) DOI: 10.1080/09638288.2018.1480667	Qualitative Non-experimental cross-sectional. The methodology used in the study involves a retrospective and current quantitative measurement of mental well-being and functional ability using the General Health Questionnaire-28 (GHQ-28), as well as semi-structured interviews.	15 British War Veterans	The participants in the organized scuba diving activities reported significant improvements in various psychological and social outcomes. Specifically, they reported increased levels of anxiety, depression, and social functioning, as well as reduced insomnia related to war trauma after their involvement in the program. The mean difference in the General Health Questionnaire-28 scale variance between previous interactions with Depth therapy and current perceptions after involvement with the program was 14.3 points, indicating a significant improvement in overall mental health.
6.	Lucrezi & Makuyana, (2022) DOI:https://doi.org/10.3727/154427322X16678075188517	qualitative study assessed the perspectives on disability inclusion in diving tourism	The study included a sample of 28 respondents who were members of the diving industry and did not have disabilities, as well	The findings of the study using SF-36 and SF-12 questionnaires indicated that diving has multidimensional benefits for individuals with disabilities. These benefits may include improvements in mental well-being, functional ability,

			as one representative from the largest disabled diving organization in South Africa who was a disabled diver. This sample was selected to capture perspectives from both non-disabled divers within the diving industry and a representative from the disabled diving community in South Africa.	social interactions, self-concept, and quality of life
7.	L.Colbert& C. Huserik, (2016) DOI: 10.1080/10790268.2016.1207963	Quantitative measures, such as pre- and post-program assessments using standardized tools like the SF-36 or SF-12 questionnaires The study aims to evaluate the impact of SCUBA diving on individuals with SCI, specifically looking at changes in physical and psychosocial well-being, functional abilities, and quality of life. The participants are likely to have varying levels of SCI, with different levels of mobility and functional abilities. The program is designed to provide them with an opportunity to engage in a challenging and enjoyable activity that may have positive effects on their overall well-being.	Participants are individuals who have sustained a SCI and attend Discover SCUBA diving program through Craig Hospital's Therapeutic Recreation Department. Participants attend a one-hour SCUBA Diving orientation course, and then participate in a 45-minute under water dive experience at a PADI Certified Dive Shop	The preliminary results shed light on the characteristics of individuals with SCI who choose to volunteer for the Discover SCUBA diving experience. This may include demographic information such as age, gender, level and severity of SCI, and other relevant factors that may influence participation. Understanding the baseline characteristics of the participants can provide valuable information for designing tailored interventions and programs for individuals with SCI who are interested in SCUBA diving. The study also provides information on the rate of unplanned and adverse events that may occur during the dive. These events could include issues such as equipment malfunction, discomfort, pain, or other complications. Analyzing the incidence of such events can help identify potential risks and safety concerns associated with SCUBA diving for individuals with SCI. This information can be used to develop appropriate safety protocols and guidelines to ensure the well-being of participants during the diving experience

The paper discusses the benefits of scuba diving in several aspects including psychosocial motivation to participate, participant experience, and effects on cognition and physical self-concept. One study reported an increase in self-concept in most of the participants. Furthermore, respondents also reported increased efficiency of the respiratory system and emphasized that the water environment

improved their motor skills and relieved pain. These results suggest that scuba diving can have positive effects on the physical and psychological well-being of individuals with disabilities. The findings of this analysis provide evidence for the potential benefits of scuba diving as a recreational activity for individuals with disabilities. It highlights the positive impact of scuba diving on various aspects of their lives, including self-esteem, self-confidence, social interactions, and physical health. These findings may have implications for promoting inclusive recreational activities and improving the quality of life for individuals with disabilities. Further research in this area can contribute to a better understanding of the therapeutic effects of scuba diving for individuals with disabilities and inform the development of interventions and programs tailored to their needs (Henrykowska et al., 2021).

Scuba diving activities were also reported to be able to motivate people with disabilities including pleasure and excitement. The physical and psychosocial measures used to capture the experiences of the participants in IT were effective in detecting changes. The observed increase in heart rate and perceived exertion indicates that the participants were physically engaged in the activities, while the positive affect reflects the enjoyment and satisfaction they experienced during the therapy. The participants' descriptions of IT as 'fun, challenging, and social' highlight the holistic nature of the therapy, which not only addresses physical aspects but also provides opportunities for social interaction and engagement. The positive feedback from the participants underscores the potential of IT as an effective intervention for individuals with disabilities, providing them with enjoyable and beneficial experiences. Further research can continue to explore the specific benefits of IT in terms of physical and psychosocial outcomes, and the optimal ways to implement and tailor the therapy to meet the diverse needs of individuals with disabilities. The findings can contribute to the development of evidence-based practices in using IT as a therapeutic intervention, and ultimately enhance the well-being and quality of life of individuals with disabilities (Naumann et al., 2021). Recently, it was reported that diving activity has become a fashionable, prestigious, and very attractive leisure activity (Dimmock, 2009) and (Musa, Ghazali, 2013). Diving can be treated as a multidimensional therapy in water (Compton et al., 1989), allowing people with and without disabilities to share common activities These findings highlight the significant psychological and social benefits of scuba diving for individuals with disabilities.

The opportunity to participate in an exciting and challenging activity like diving can boost their self-esteem and self-confidence, and enhance their social interactions. The feeling of weightlessness in the water can also have a therapeutic effect, allowing individuals with disabilities to experience a sense of freedom and empowerment.These results support the notion that inclusive recreational activities, such as scuba diving, can play a significant role in improving the well-being and quality of life of individuals with disabilities. It emphasizes the importance of promoting accessible and inclusive recreational opportunities that cater to the diverse needs of individuals with disabilities, and provide them with opportunities for social engagement, self-expression, and personal growth. Further research in this area can continue to explore the benefits of scuba diving and other recreational activities for individuals with disabilities, and inform the development of inclusive programs and interventions. By recognizing and promoting the value of inclusive recreational activities, we can contribute to creating a more inclusive and empowering society for individuals with disabilities. (Carin-Levy & Jones, 2007).

Such rehabilitation involves comprehensive stimulation of the human body through social interaction through participation in class, as well as by influencing the mental and physical environment. Classes that take place in water and diving help to break the barriers of being in a new environment, namely water, to regain awareness of one's own body and the movements that can be performed, to feel one's own body position, to feel the possibility of providing direction of motion and the benefits of being able to increase independence in water (Kovacs & Walter, 2015) . The aquatic environment allows muscle relaxation which, as a result, may have a positive effect on spasticity (Haydn et al., 2007), and increases joint range of motion significantly than when movement is restricted in a natural environment (Bartels et al., 2016) and (Geytenbeek, 2002).

Furthermore, the preliminary findings may shed light on the physical and emotional experiences of the participants after the dive. This may include changes in physical sensations, pain levels, mood, and emotional well-being reported by the participants. Understanding the physical and emotional impact of SCUBA diving for individuals with SCI can provide valuable insights into the potential benefits and challenges of this recreational activity for this population.

Overall, the preliminary findings from this study provide valuable descriptive information about the characteristics of individuals with SCI who volunteer for the Discover SCUBA diving program, as well as the outcomes of the diving experience. These findings can contribute to the knowledge base in the field of SCI rehabilitation and recreational therapy and may inform future research and interventions aimed at improving the well-being and quality of life of individuals with SCI who are interested in SCUBA diving. However, it is important to note that these findings are preliminary and further analysis and interpretation of the data are needed to draw conclusive statements (L. & C., 2016).

In addition, it is known that diving has multidimensional benefits for persons with disabilities. These benefits may include improvements in mental well-being, functional abilities, social interactions, self-concept, and quality of life. However, studies conducted in South Africa indicate that there are also barriers to inclusive diving tourism related to logistics, knowledge, awareness and attitudes of the diving industry, marketing, and collaboration between stakeholders. such as accessibility of dive sites, availability of suitable equipment and trained personnel to support the unique needs of divers with disabilities. Knowledge and awareness among the diving industry and stakeholders is a challenge for the future (Lucrezi & Makuyana, 2022).

In short, it allows for increased movement and coordination in a much easier way than in a terrestrial environment. Such exercises have a positive effect on the respiratory system and blood circulation as a result of learning how to breathe properly (Garcia et al., 2012). An individual who engages in diving activities has the opportunity to learn and demonstrate independence by maintaining the safety of himself, as well as the safety of his friends. Diving encourages you to spend time with other people and, in so doing, provides the opportunity to be in a group whose members are people without disabilities, as well as people with locomotor system dysfunction, providing a sense of affiliation with the group and responsibility for its members (Patkiewicz, 2017). Diving may eliminate disability-related limitations, often enabling people with disabilities to outpace their able-bodied peers who report average levels of physical activity(Haydn et al., 2007) and (Carin-Levy & Jones, 2007). Awareness of being a person with a disability doing something out of the ordinary helps a person with a disability feel extraordinary, which facilitates the process of accepting his or her own status (Patkiewicz, 2017) and (AGANOVIC, 2019). However, one should not forget the possible dangers and risks that come with diving. Regardless of the initial health condition, factors that affect the human body include underwater pressure, respiratory gases, temperature, type of diving environment, mental barriers, and possible problems with equipment (Bosco et al., 2018).

CONCLUSSION

The aquatic environment allows muscle relaxation, which, as a result, may have a positive effect on spasticity and often increase the range of motion of joints that are very limited in natural environments. In short, it allows for increased movement and coordination in a much easier way than in a terrestrial environment. Such exercises have a positive effect on the respiratory system and blood circulation as a result of learning to breathe correctly. A person who scuba dives have the opportunity to learn and demonstrate independence by keeping himself safe, as well as the safety of his colleagues. Diving encourages spending time with other people and, thus, provides the opportunity to be in a group whose members include people without disabilities, as well as people with locomotor system dysfunction, giving a sense of affiliation with the group and responsibility for it. members and create a positive mental state. It will be a challenge in the future to provide inclusive diving programs related to logistics, knowledge, awareness, and attitudes of the diving industry, marketing, and cooperation between stakeholders. such as accessibility of dive sites, availability of suitable equipment, and trained personnel to support the unique needs of divers with disabilities in an integrated manner including knowledge and awareness among the diving industry and stakeholders.

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