The Influence of knowledge on decompression through diving behaviour of traditional diver at Barrang Lompo island

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ABSTRACT

Background: Divers in coastal areas are not aware of the risks of diving encountered which can disrupt health and threaten the safety of their lives. Diving activities have a long-term effect on the physiology of the human body. The diseases associated with diving are Barotrauma and decompression. Barrang Lompo Island Health Center data in Makassar City shows that the prevalence of accidents for traditional divers in 2011-2017 in Makassar City is quite high, with paralysis of 85 people, dead as many as 70 people**. Methods:** The type of research used was observational using a cross sectional study design. The population used in this study were traditional divers in the population. The population was a traditional diver on the Barang Lompo island with 124 divers. 100 samples were selected using accidental sampling techniques. Data collection was carried out by officers in the field and using questionnaires, microtoise and weight scales. The level of knowledge and decompression was measured using a questionnaire, while IMT measurements used microtoise and weight scales**. Results:** groups that tend to experience severe decompression are divers with sufficient level of knowledge (45.8%) and having unsafe diving behaviour habits (45.%) there is an influence of knowledge on diving behaviour with p value 0.05, and diving behaviour towards decompression p value of 0.037 <0.05 , indirectly and found an indirect influence of knowledge on decompression through diving behaviour. **Conclusion:** there is a direct influence of knowledge on diving behaviour and the indirect influence of knowledge on decompression through diving behaviour**.**

Keywords: Knowledge, Decompression, Diving Behaviour, Traditional Divers

INTRODUCTION

Traditional divers are divers whose diving capabilities are naturally obtained from the family environment and surrounding people and dive without using safe diving equipment. The uneducated traditional divers to dive well and rely on ordinary compressors and techniques that are not in accordance with the Standard Operational Procedure (SOP) are factors that exacerbate the problem of divers.

A data in the United States regarding accident cases due to diving is still very high and it is estimated that 3 to 4 cases per 10,000 divers, on average each year is 1000 cases and in the Asia-Pacific region ranges from 500-600 cases, excluding Japan.[1] China as the largest producer

of fish, there are also decompression events with 1 to 2 divers experiencing decompression of 1000 divers per year (0.15%), then in Tasmania reaching 1.4% per 100 divers / year and in the Galapagos reaching 3.3% of 100 divers /year. [2]

Data from the Ministry of Health of the Republic of Indonesia shows that out of 251 diver respondents in 9 provinces the diving technique used 56.6% breath-resistant divers, 33.9% compressor divers and 9.6% divers with SCUBA. Frequent complaints from 251 respondents included 21.2% headaches / headaches, 12.6% fatigue, 12.5% reduced hearing, 10.8% joint pain, 10.2% nose bleeding, 9.7% chest pain / tightness, 6.4% reduced vision, 6.0% red spots on the skin, 5.6% animal bites, 3.2% paralyzed and 1.7% lost consciousness. [1]

The profession of fishermen and divers in coastal areas is not aware of the risks of diving being faced, which can disrupt health and even threaten the safety of their lives. Health is a very important factor in supporting labor productivity. Workers who experience health problems will decrease their physical ability to work, think or carry out social work so that their work results are reduced. [3]

Diving activities have a long-term effect on the physiology of the human body. The diseases associated with diving are Barotrauma and decompression. Where physiological changes occur from manifestations of decompression symptoms. with an increased frequency of cases of dysbaric osteonecrosis and hearing loss. Diving activities are at risk for other organs due to latent symptoms that have an effect on the brain, spinal cord, eyes and lungs. [4]

Decompression Sickness (DCS) which is a syndrome is associated with the formation and increase of extravascular and intravascular bubble size when the insertion gas partial pressure in the blood and tissue exceeds ambient pressure. The main risk factors for decompression sickness are diving depth, duration, level of ascent, and repeated diving. Other risk factors involve low temperatures, height exposure, patent foramen ovale, female sex, old age, obesity, alcohol consumption, dehydration, previously suffering from decompression sickness, and strenuous exercise. [5]

Lack of knowledge of the dangers and risks faced by traditional divers is a factor that further worsens the incidence of decompression, this is due to the low level of education of traditional divers and a lack of increased knowledge of divers through safe diving training. [2] According to Bloom (1990) in Notoatmodjo [6] explained that knowledge itself is one of the domains of behaviour, including diving behaviour and speaking behaviour can not be separated from the other two domains, namely attitudes and actions.

Barrang Lompo Island Health Center data in Makassar City in 2014 showed that the prevalence of accidents for traditional divers in 2011-2017 in Makassar City was quite high, where there were paralysis of 85 people, died as many as 70 people. While other small islands (Barrang Lompo PKM, 2017), Amir's (2015) study on Lae- Lae Island found 40% of those experiencing DCS, with 60%.

Based on previous research data, and considering the potential of the sea in Indonesia specifically in South Sulawesi which is well-known as a great sailor, the researchers were interested in finding a model of knowledge affecting decompression through diving behaviour on traditional divers on Barrrang Lompo Island.

METHODOLOGY

Research design

The type of research used was observational using a cross sectional study design. This research was conducted on Barrang Lompo Island, Sangkarrang Sub-District, Makassar City, South Sulawesi.

Population and sample

The population used in this study is the traditional divers in the Population is Population is a Traditional Divers on Barang Lompo island as many as 124 divers. A sample of 100 was conducted using accidental sampling techniques where sample selection was accidentally coincidental or available at the study site. The choice of this technique was due to the large number of fishermen who were on the sea and their schedules returned to the island uncertainly.

Data analysis

Data collection was carried out by officers in the field and using questionnaires, microtoise and weight scales. the level of knowledge and decompression was measured using a questionnaire, while IMT measurements used microtoise and weight scales. The data collected was then analyzed by univariate and bivariate using the SPSS 16 application and for multivariate analysis in the form of Path Analysis using the AMOS 18 application. The results of the analysis are then presented in the form of tables and descriptions.

RESULTS

Sample Characteristics

Table 1 Characteristics of traditional divers based on decompression

Research variable	Decompression (n=100)				Total	
	Light		Weight			
	n	%	n	%	n	%
Age						
Young	43	67.2	21	32.8	64	64.0
Old	20	55.6	16	44.4	36	36.0
Working time						
New (< 5 yr)	21	75.5	7	25.0	28	28.0
Lama (> 5 yr)	42	58.3	30	41.7	72	72.0
Knowledge						
Less	50	65.8	25	34.2	75	75.0
Enough	13	54.2	12	45.8	25	25.0
Diving Behaviour						
Secure	21	75.5	7	25.0	28	28.0
Not safe	42	58.3	30	41.7	72	72.0

Table 1 shows the characteristics of traditional divers who were the sample of this study, most of them were young or <5 years old (64%). the highest tenure of the old group is> 5 years (72.0%), many of the divers have a lack of knowledge (76.0%), in terms of diving behaviour there are still more who dive in the safe category (54.0%) and not safe (45.0 %), for decompression there are still more people who experience mild decompression (63.0%) than weight (37.0%). Table 1 shows that groups that tend to experience severe decompression are divers with sufficient level of knowledge (45.8%) and have a habit of diving unsafe behaviour (45 %).

Multivariate Analysis

Tabel 2. Result of Direct Effect Path Analysis

No	Research variable	Direct Effect		
		Estimate	P value	Conclusion
1	Knowledge→ Diving Behaviour	-2.322	.050	Significant
2	Knowledge → Decompression	.392	.155	Not Significant
3	Diving Behaviour→ Decompression	.647	.037	Significant

Tabel 3. Result of Indirect Path Effect Analysis

Hypothesis (Path)	Indirect Effect	Total Effect
Knowledge →Diving Behaviour→ Decompression	-.034	.305

Table 2 shows that there is an effect of knowledge on diving behaviour with p value 0.05, and diving behaviour towards decompression p value 0.037 <0.05, indirectly in table 3 there is an indirect influence of knowledge on decompression through diving behaviour.

DISCUSSION

Knowledge is the result of knowing, and this happens after sensing certain objects. Sensing occurs through the five human senses, namely the senses of vision, hearing, smell, taste and touch. Most human knowledge is obtained through the eyes and ears. Knowledge or cognitive is a very important domain in the form of one's actions (overt behaviour). [6]

In the study tried to see the effect of knowledge on decompression without or through diving behaviour, which was then called diving behaviour. Most traditional divers on Barrang Lompo Island have a low level of knowledge of 76% and only 24% have sufficient knowledge. Many divers who have a low level of knowledge about decompression can shape diving behaviour or diving behaviour is not in accordance with standardization.

Divers are strongly suspected of not realizing that the pain complaints that they experience after diving are ranging from dizziness to difficulty urinating and having to catheter themselves (without expert medical professional assistance) because they are in an emergency in the middle of a cruise, is a decompression disease and threatens their lives. They assume that the disease they feel is caused by the cold of the sea water and the treatment methods tend to use

traditional methods such as massage, treatment by always walking (because being silent and lying down will make paralysis worse), and bathing with heated sea water.

According to Huchim-lara [2] the increase in DCS incidents among fishermen because fishermen did not have good and correct diving knowledge while high market demand, cost of living and debts that entailed require divers to face a serious risk of diving. According to Gold [7] Diving behaviour, especially the duration and depth of diving, greatly influences DCS incidents and requires increased knowledge and information on safe diving methods for traditional divers. The same thing was stated by Smart et al [8] that increasing diving safety knowledge can be a good step in preventing decompression.

The intervention step to increase knowledge in the form of training for divers is done by Blatteu et al [9] prove that since 2009 most fishermen divers have changed the way of diving by reducing the duration and depth of diving, the results of which have reduced mortality and severe neurological DCS events have decreased by 75%. In addition to training, policy reform by considering three dimensions, namely lifestyle and cultural identity, fishermen's perception of their environment, and fulfillment of catch targets, can be a good step to reduce decompression rates. [10].

The results of this study indicate that there is a relationship between diving behaviour and decompression coefficient value of 0.647 which means that if diving behaviour experiences a one point increase then decompression will increase by 0.647 points, while the indicator variable is diving depth, frequency, duration, pre-diving heating, resting time and consumption habits alcohol both before and after diving. In theory, the indicator variables of diving behaviour (depth, frequency, duration, rest, alcoholism and heating) greatly influence the incidence of decompression in divers, and some studies have proven it.

According to the results of research by Naranjo-Madrigal and van Putten [10] that young divers inherit diving skills and knowledge from surrounding people including alcohol and drug consumption habits, those with these bad habits tend to dive deeper and experience decompression. Research by Tseng et al 11 states that a 30-year-old man who experiences weakness and numbness on the left side after diving to a maximum depth of 15 m with a total dive time of 205 minutes (10 repeated dives).

Frequency as a diving behaviour indicator variable was examined in several studies that frequency has an influence on decompression, the results of this study amounted to 31% who dived with frequent frequency and 36.6% of them experienced complaints of severe decompression. The results of the research by Wijaya et al [12] and Huchim-Lara [2] shows that frequency has an influence on decompression.

Divers in Korea have a high DCS incidence. They are susceptible to DCS because they make repeated dives and it is estimated that more than 3000 divers ignore the symptoms of decompression, the incidence of DCS and other dive-related diseases is unlikely to decline in the near future. A large number of divers ignore DCS symptoms such as shoulder pain and

itching on the skin and fall into a vicious circle to relieve these symptoms by underwater recompression. [13]

The duration of diving which is an indicator variable in diving behaviour in this study theoretically and research is a risk factor for decompression as the results of this study showed that there were 13 divers who dived for> 30 minutes and 69.2% of them experienced severe decompression complaints. According to the study of Widyastuti et al [14] that dives> 2 hours in one dive are at risk of decompression. Prevention of decompression can be done either by reducing the duration of the dive. [15]

In addition to diving depth, frequency and duration, things to note are diving intervals or rest periods, where when divers do the next dives with a pause that is still close, the nitrogen bubbles formed at the dive have not been released before. When diving is done again, the bubbles will increase and increase. This will increase the occurrence of decompression sickness.

Research by Cha et al [13] Traditional divers in South Korea say that the average rest hour is 20.7 ± 12.5 minutes and habits and has an influence on decompression. Research by Blatteau et al [15] explained that divers with the frequency of diving three or four times a day use 1-3 hours of rest time between dives. Research Rahmadayanti et al [16] shows a different thing that is there is no effect of rest periods with the event of decompression on traditional divers.

The habit of consuming alcohol has become a risk factor for various diseases including decompression. In this study there were 15 (15%) divers who still consumed alcohol and 31 (31%) had consumed alcohol, the results of cross tabulation showed 40% of those who consumed alcohol 48.4% who had consumed alcohol experienced severe decompression complaints. The low number of traditional divers who consume alcohol on Barrang Lompo Island today is due to an increase in supervision of the local government in cooperating with the police on the prohibition of consuming alcohol, this is based on information from the public and was witnessed directly by researchers while at the research site.

Eating alcohol is not only a hereditary culture of the maritime community, but is also a solution for them to warm themselves up under the sea or after diving. Research by Naranjo-Madrigal et al [10] 63.9% of divers consume alcohol for cultural, behavioural reasons and face heavy diving conditions. Research Santos et al [17] mentions 93.2% of divers have the habit of consuming alcohol and those who experience spinal cord injury which end in decompression.

In this study, traditional divers on Barrang Lompo Island tended to consume alcohol after diving, in contrast to the results of the research by Mirasoglu et al [18] explained that 49% of male divers and 61% of female divers in Turkey consume alcohol during pre-dive (before diving), as is the case in Okinawa where divers also consume alcohol before diving [19].

Regarding the time to consume alcohol both before and after diving is just as bad as the diver's body. It should be noted that divers face environmental conditions with rapid changes in pressure especially when rising to the surface of the sea and this is the cause of decomretion

which is reflected from mild to serious symptoms, including numbness, weakness, and even serious spinal cord injury. Research Santos et al [17] explained that excessive alcohol consumption, the use of drugs is one of the main risk factors for behaviour that affects the incidence of occupational diseases in the fisheries sector.

As a form of prevention of decompression, heating before diving is something that must be part of the diving behaviour of divers, it is well known that heating is an activity carried out before carrying out sports activities including diving. But in reality many divers ignore this. Meanwhile, according to Arifin [20] warming can improve work performance, reduce the risk of muscle injury and slowly make the body go to the ideal temperature for exercise. Baskoro et al [21] shows that physical warming is related to muscle cramps.

Increased knowledge is very important to do to change the diving behaviour of traditional divers on Barrang Lompo Island, so divers are more concerned about always warming up when diving, diving with safe frequency, duration and depth, and increasing bad behaviour such as consume alcohol after diving. The divers must realize that the dangers and risks they face are enormous and their lives are far more valuable than millions and even hundreds of millions of rupiah they get from fishing, sea cucumber or pearls.

CONCLUSION

We conclude that there is a direct influence of knowledge on diving behaviour and the indirect effect of knowledge on decompression through diving behaviour, as illustrated by the model found in this study. Efforts to increase knowledge by the local government need to be carried out in the form of effective education given the high risks faced by traditional divers in Barrang Lompo Island, Makassar City.

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