

## THEORETICAL AND PRACTICAL STUDY ON DIVERS' DIET DURING THEIR TRAINING PRACTICE

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**Abstract:** *The hereby paper briefly presents the specific objectives announced, the ways in which they have been carried out, the measures taken by the Divers Center, the divers' awareness towards their duties, further measures to be taken, and finally the way all these are applied to divers' everyday life. The paper concludes with interpretations, comments, final considerations on the research and development theme approached by the CPSA laboratory, along with future developments within the area of research*

**Keywords:** diver's feeding regime/diet, effort, weight index, improper nutrition

### 1. Introduction

There is an increasing tendency of modern man to opt for a sedentary life. The nowadays profoundly changed lifestyle and the multitude of possibilities we have at our disposal to feed ourselves are wholly inadequate, and undoubtedly affect human health.

Based on these assumptions and given that the abundance of information on the lifestyle, may not always choose consciously the path to health, this paper aims to raise awareness of professional divers on the dangers that can adversely affect their health on short, medium or long term periods. Therefore, we consider that the present theme concerning the influence of the hyperbaric environment and the feeding style on the underwater worker's body can be of real interest, taking into account that there have been almost 50 years since this profession – diving – exists. The training of a good professional military or civilian dive, be them deep sea, EOD, incursion, river, or on board divers) extends over a period of 4 to 5 years. The period

may go up to 7 to 10 years. Consequently, it has been observed that if the divers' diet is not correlated with their daily physical effort, in time, this can lead to overweight. Adding weight may also lead to cardiovascular changes, which are high-risk factors for the health of underwater workers. In modern society, in general, health is greatly affected by improper nutrition.

Starting from this assumption the Diving Center together with the Naval Medical Center initiated a study on a group of divers to highlight, within a certain period of time, the tendencies and possible problems that may appear and the way they can be prevented.

A number of divers was selected after they had undergone, for three years, a series of medical checks and measurements. The subjects were selected on the following criteria: age, sex, tendencies to gain weight, or well balanced and perfectly fit subjects. They had been closely monitored and offered food according to the medical norms and standards, under specialized medical assistance, both during their working hours, and their free time periods.

The modern man does not eat healthy, and in addition to this, he eats badly and much, although he is more and more aware of the fact that the saying "what nourishes me destroys me" is true. For this reason it is estimated that one person out of two is overweight (exceeding by more than 10% the normal weight). Food is the domain in which the most serious errors are made.

In contemporary society, the man has profoundly altered his lifestyle, once the possibilities of feeding, of spending free time, or getting informed changed.

However, the richness of information on lifestyle does not always lead us to select the right and safe path towards a good health. Eating occupies one of the three places on the stage of human existence, besides air and water. Thus, health will be deeply affected by improper nutrition.

Consequently, starting from the assumptions mentioned, the objectives and the work plan were established.

This study is intended to help divers understand how important the specific calorie diet is, and how this should be continuously adjusted to the physical effort, to hard work, and to the time spent underwater. In order to get good results in their work, and also stay healthy divers should be fed on high quality food cooked in appropriate conditions.

## **2. Hypotheses, objectives and work plan**

### **2.1. Hypotheses**

A military or civilian diver (EOD, river, etc) is formed in about 4 or 5 years. This period can be extended up to 7 years. Consequently, it has been observed that a diet which is not correlated with the physical effort necessary for an underwater worker, in time, leads to overweight. The growth in the weight index, associated with the changes which occur at the cardiovascular level increase the risks in the health of underwater workers. In modern contemporary society people's health is affected mostly by improper nutrition.

Based on the above mentioned assumptions, the specialists of the Diving

Center - Research and water plunging (CPSA) Laboratory together with the specialists of the Center of Naval Medicine (CMN), and nutritionists from specialized department of the Faculty of Medicine of the Ovidius University - Constanta initiated a study on a group of divers in order to examine, for a certain period of time, which the trends are, and how the problem concerning weight gaining can be solved.

### **2.2. Specific objectives**

The specific objectives of this research and development study are:

- permanent correlation of the diet with the daily effort,
- development of a comprehensive scheme for a correct nutrition according to modern studies,
  - introducing special menus tailored to the specific needs of hyperbaric workers and also menus for their days off in compliance with the law in force, and with the research in the field,
- brief studies on water consumption considered a source of life and health,
- selection of volunteer subjects, on the following criteria: age, sex, weight gain tendency, and also a batch of subjects who were very well balanced in terms of weight,
- thorough documentation on quantity, methods and food preparation facilities,
- determining the advantages and disadvantages of the methods used for preparation of food and the currently used facilities,
- more efficient work done by the team that prepare the food for personnel.

### **2.3. Work plan**

For the smooth running of operations a work plan was established.

This is as follows:

- selecting the batch of divers participating in the study, according to, sex, tendency to gain weight,
- signing the agreement to participate,
- checking the weight and the waist measurement of divers,
- taking blood samples for the divers' initial status,

- designing and implementation of a questionnaire on the daily diet of divers
- setting the current food ratio based on records of existing food,
- the calculation of specific food ratio according to the physical activity performed by a diver daily,
- changing the daily diet according to the one that was previously established,
- taking blood samples for the analysis of biological indices (made 3 times, i.e. before changing eating habits, after 2 months of doing so, and after another 18 months),
- processing data and discussions based on these data,
- conclusions.

It was concluded that the regular daily intake of about more than 6000 calories is inadequate. Besides the fact that the caloric intake is high and inconsistent with the requirements of the physical activity, which normally varies from day to day and from one individual to another (more active or less active, with a more active or lazy metabolism, younger or older individuals, etc.), food combination is often inappropriate, often indigestible, and with negative metabolic effects for the evolution of their biological and weight status. Finally it should be noted that there are not enough fruit and vegetables in the divers' daily menu. Instead, chocolate and fat meats (Sibiu salami, cheese, butter, fried foods of all kinds) were a common presence in their

daily menu. Concerning the drinks, the preponderant ones were mineral water, and sodas of the Coco-Cola or Fanta type.

The kitchen facilities are as old as the ones acquired in the early '80s. Meat, sausages, eggs and other foods fried in oil (like onions) and especially potatoes was highly fashionable. Margarine was also highly used; as a sweetener nothing more than sugar was used. Food preparation was based on different supplements such as "Vegeta" or "Delikat", or roux, which were supposed to offer the best taste. The bread used was the white one, along with the one that stayed fresh for a long time. This was the situation when we started our research and development theme.

### 3. Case Study

Twenty divers were selected on a voluntary basis and they went through different sets of tests and measurements periodically during three years. The subjects were chosen according to the following criteria: age, sex, fattening trends and very well balanced subjects. Observations were made and, together with professional dietitians, healthy menus were drawn up for a two-week interval, when the subjects were at work (in accordance with the legally established caloric norms) and when the subjects were on holiday (CO, permits, days off as the result of shift work, etc.). During this period of time, the divers' group was carefully monitored.

*Table 1 The number of persons for chosen study typologies*

Weight		Age		Sex	
Overweight	Normal weight	Sample 25÷40	Sample 40÷55	Men	Women
OW	NW	Y	O	M	W
10	10	10	10	19	1

Table 2 Medical test results obtained for a normal weight subject and an overweight one

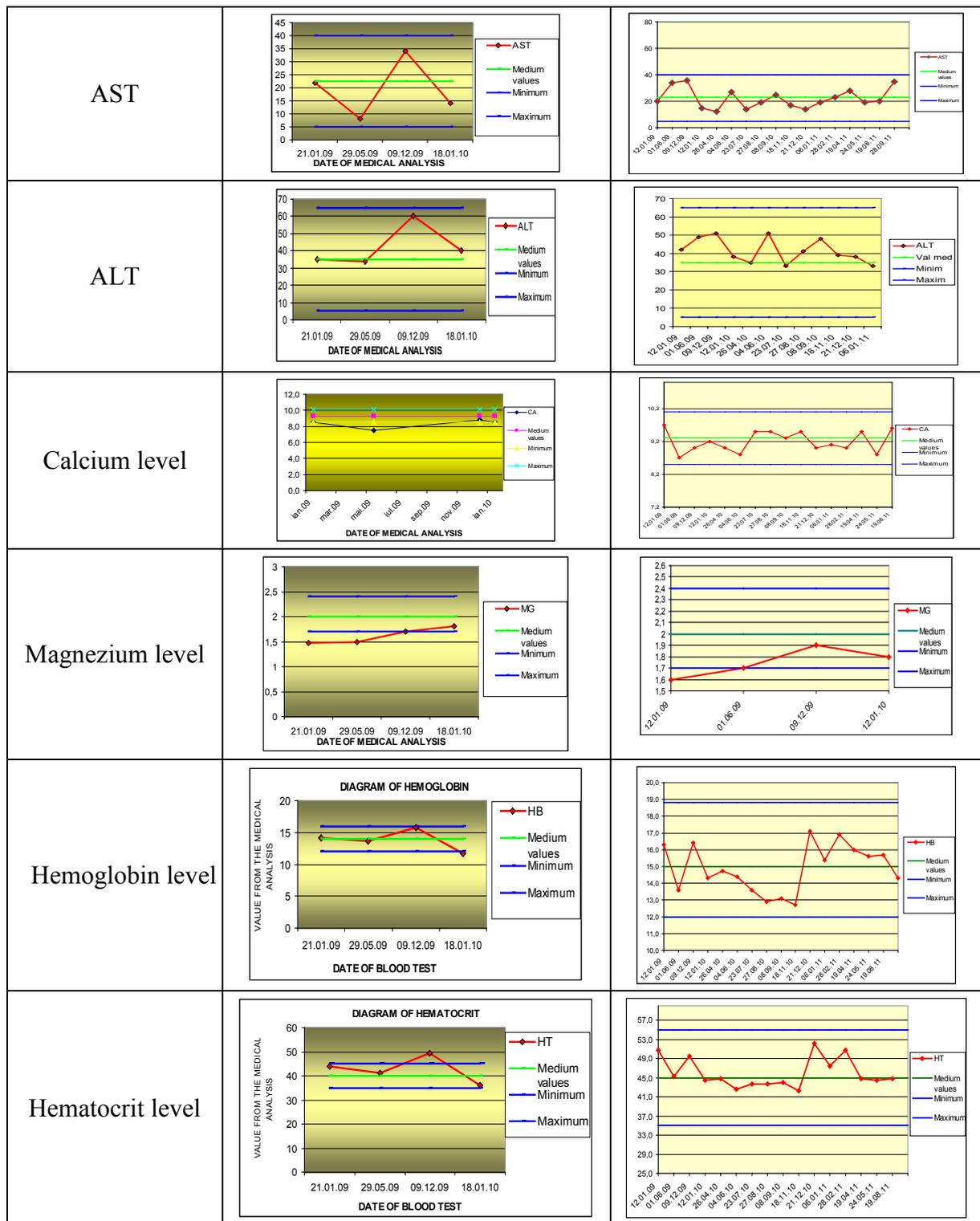
Medical analysis	Subject NW	Subject OW
Cholesterol level		
Tryglicerides		

Table 3 Medical test results obtained for youngsters and for workers close to the retirement age

Medical analysis	Subject Y	Subject O1	Subject O2
Tryglicerides			
Cholesterol level			

Table 4 Medical test results obtained for a man and for a woman

Medical analysis	Subject W	Subject M
Tryglicerides		
Glycemia		
Cholesterol level		



The process of monitoring the divers was done by studying their blood tests included in the annual medical record of those selected and specific health tests carried out under the program this study dealt with (see the table below). It is to be mentioned that during two years a total of 96 sets of health tests were carried out during 37 days.

During the mentioned time span, the staff of the Medical Analysis Laboratory of CNM carried out blood tests to determine: cholesterol, glucose, triglycerides, AST, ALT, calcium, magnesium and the complete blood count in the group of divers, as agreed between the two military bases.

The selection was made according to the following criteria: the subjects should be professional divers, the selected group included over and normal weight people, young and mature, men and women.

Follow up the blood tests and the results, ongoing awareness of the need for a proper feeding regimen was raised, continuously promoted at the divers' department by hyperbaric medicine practitioners and by specialists belonging to CMN, who managed to convince the centre's staff to feed and hydrate themselves properly.

The existing menu – the one at the mess and the one used by the staff to prepare food; daily menus were prepared for an interval of two weeks, as indicated by a physician, PhD nutritionist from the Faculty of Medicine, Ovidius University of Constanța – was analyzed from a nutritional point of view. The menus, which meet the current research results of the specialists in nutrition, were weighed in terms of quantity (caloric) in relation to the current rules intended for learner divers (who take part in special training, both daytime / nighttime).

There have been attempts to develop a new healthy menu based on dissociation of food at each meal, on healthy combinations from fish meat, chicken, turkey, beef and pork, fresh and cooked vegetables, dairy, grains, fresh fruit, dried or as compote and juices, very diversified salads etc. These foods, beside the minerals and vitamins they offer the body, energizing it in this way, contain the enzymes necessary for the biochemical reactions that occur during normal digestion. Fresh fruit and vegetables have been introduced, including during winter time (they were missing in the previous menu). The amount of fat has been significantly reduced, eliminating certain foods and replacing them with new ones.

Food rich in vegetable protein has been added and animal proteins are low. At the same time, the quality of animal protein has been increased through the menu choices.

The way in which food will be prepared will have to be different: not fried, roasted inboil or fat. Processes such as boiling,

cooking in steam, oven or steam grill will be used.

We have totally removed carbonated soft drinks – which absolutely bring no benefit to the body, on the contrary it spoliates its minerals – replacing them with natural juices made from fresh fruit.

The new menu that we like to call “the healthy one” brings, beside satiety, the necessary nutrients for the body, which are easily absorbed and used; this menu sustains the desideratum “we are what we eat”, respectively, we are the people, actually the military people, who are continuously concerned about their health.

The menu resulted from the collaboration of the specialists belonging to the Diving Center, CMN and Ovidius University of Constanța has been exposed in the divers' compartments and handed in to the Center's management.

### **3.1. Recommendations for improving the divers' diet**

#### **Breakfast**

- preferably dark or brown bread, rich in fiber and minerals;
- potassium-rich foods should be consumed: citrus, bananas. They have hypotensive effect;
- preferably fresh fruits instead of bottled juice (ready-made);
- combination of nutrients, such as yoghurt, wheat germ, pears, strawberries should be consumed;
- preferably poultry sausage, not pork;
- avoid eating eggs, not more than 4 per week;
- butter, margarine, jam should be avoided;
- low-fat milk, sweetened with honey should be consumed.

#### **Lunch**

- choose low-fat products;
- use of brown bread;
- choose pizza with tomatoes, mushrooms, instead of hamburger or sausages;
- salad and spices (if the stomach allows) should not miss when eating steak;
- do not add Parmesan cheese or cream, choose broth;

- avoid mayonnaise or too much oil.

Dinner

- use ketchup, broth, yogurt or lemon with salads instead of oil or mayonnaise;
- go for boiled or baked potatoes with olive oil, pepper, greens instead of fries;
- eat raw carrots or mixed with spaghetti, sauce or vegetables;
- choose fish instead of any type of salami;
- add spices or basil, thyme, dill, parsley etc. instead of salt;
- use wheat germ, whole brown rice;
- for mashed potatoes possibly use skimmed milk, sauce, broth, but no butter.

Daily use of fresh fruits and vegetables maintain a healthy body.

Vegetables and fruits provide the body with necessary vitamins, minerals, antioxidants and carbohydrates and water properly hydrates the body tissues.

A proper nutrition helps the body recover, maintain a high tone and keep mentally balanced. Health, each person's most valuable thing, is maintained by feeding ourselves in a correct, rational and balanced style.

### **3.2. Considerations upon the Case Study**

Managing a correct diet in terms of quantity and quality of food, permanently associated with physical effort and drawing up a right weekly menu in terms of all nutritional components (proteins, glucides, lipids, fiber) correlated with the type of activities (combat missions, intense physical activities, research assignments, work on board ship / at the office, study leave / rest etc.) carried out daily by the divers are some of the problems that lead to increasing the diving safety. Currently, the existence of a great number of possibilities regarding correct, rapid and almost complete information has emphasized the toxicity degree of many foods, mainly due to the great desire of food industry tycoons to enrich themselves, dominating the food trade in this way. Another reason that caused the incorrect feeding of troops was when the military base's budget imposed the acquisition of most products at the

lowest prices on the market, as a result of centralized auction, action which proved itself negative, beyond doubt, as the food offered to the personnel was one of poor quality and even toxic.

Improving food standards and correcting / completing the present legislation allow now the purchase of healthier products, fresh fruit and vegetables specific to each season, raisins or other dried or frozen fruit, seeds, spices, etc. and replacing sugar (the main sweetener which appears in the norms) with honey – all these lead to a more healthful diet.

### **3.3. Proposals for the Future**

In the future the military base suggests:

- changing the divers' diet by using new healthy menus made in accordance with the current scientific requirements by physicians, nutritionists and university professors;
- determining the advantages and disadvantages of methods for the food preparation;
- changing old and obsolete plants, used for over 40 years, with new and modern ones;
- annually establishing the necessary new installations and modern appliances for cooking in the military base;
- permanent optimization of using resources within activities related to preparation and serving of food, carried out by the specialized personnel belonging to the logistics department of the military base.

We intend to apply this type of menu, prepared in accordance with the new nutritional studies on a group of divers, following the consumers' tolerance level, their eventual objections, critics or suggestions being adapted during the course of the study.

The biological and physical development of the divers will be examined by studying the biological status and by performing the anthropometric measurements.

The menu will be adapted according to the diving activity carried out in certain circumstances.

In the future the aim is to be able to change the norm of food, which is exceeded from a

nutritional point of view, hoping in this way that this will help divers to have a good health, preventing much of effects arising from the growth index of body weight.

Experimental programs, statistics and comparative studies, including the one referring to the caloric diet of the underwater worker, the subject of the present theme – carried out for the first time in our country – open multiple approaches for further research on any dive.

#### **4. Conclusions of the Present Research**

##### **4.1. Discussions, Interpretations and Comments**

Specific measures taken by the our base:

- Restoring the kitchen and its equipment to current standards, namely the hall where the food is prepared, the reception and dishwashing areas, toilets, cloakrooms belonging to the logistics personnel, etc.
  - Redecorating and outfitting the dining room with new equipment;
  - Replacing pork with beef, chicken or turkey at least twice a week, buying good quality meat, boneless, defatted etc.;
  - Preparing a meal of fish at least once a week;
  - Radical changing of the ways in which food is prepared (no more fried foods, roux, etc.);
  - By introducing of specific procedures, the personnel of the logistic compartment should be empowered and warned upon tasks while setting menus and preparing food;
  - Serving salads and fruit, compote or fruit juices at lunch;
  - Gradually introducing plain water (on demand) in place of mineral one, etc.;
- Still unrepaired shortcomings:
- Building a new runway, according to current standards, for training the military personnel;
  - Replacement of UHT milk – milk that can withstand a very large period of time; the composition according to the document on the milk box rating it as the cheapest milk in the market; it is a mixture of substances: among the ingredients mentioned, there are

cow milk, proteins from milk and cream; it is a product with a very low biological value and therefore the most degraded on the milk market;

- Another drawback is the problem of centralized mandatory acquisitions obtained at the lowest price.

##### **4.2. Final Considerations**

The divers' awareness has been raised regarding the necessity of healthy and proper feeding, according to current studies conducted worldwide, made with food which can be stocked in accordance with "The Instructions on feeding within MAPN during peacetime L – 4 / 1" [3].

There have been set menus based on meat, fish, chicken and beef, salads with fresh vegetables assorted with seeds, lemon, etc., pickles, fresh or dried fruit, compotes, milk. There have been set menus in accordance with the hyperbaric work and to the requirements regarding the days off, menus developed by the nutrition specialist of CMN, menus approved by hyperbaric medicine practitioners of the Diving Center, menus made with foods that help to keep the staff healthy.

In the dining room there have been placed, in a favourable position so that they could be daily seen while eating, suggestive images and posters which have been meant to have an important on the person who sits at the table, such as "we are what we eat", "how toxic we eat", "killing food", "how to stay young", "cherish your health", "do not let the brain idle", "the only person who accompanies us throughout life – is myself", "let's live life to its fullest – with joy, pleasure, love, health", "if you value your life be careful about WHAT, HOW and HOW MUCH you consume", etc.

The bread used was exclusively white, sliced, the cheapest and the one who could be kept fresh for a longer interval. Wholemeal bread is served at meals, which is much better for the body.

The divers can now choose the water used for consumption, because there is now the possibility to request plain water and not only mineral – the one used until recently.

A database was successfully created, by registering within the archive of the military base of data resulted from the studies delivered by CPSA laboratory belonging to the Diving Center together with the doctors from CNM and those of the Faculty of Medicine from Ovidius University of Constanța. The present database may underlie other future studies.

The quality of the food served at the mess of the military base was increased, as well as the establishment of new procedures and processes concerning the acquisition of modern facilities for the food preparation.

Finally we proudly mention that by means of real efforts, the kitchen, the lockers, the dining room and a gym inside the military base were refurbished.

#### **4.3. Conclusions**

The balance drawn up at the end of the studies leads to the conclusion that the experiments carried out by our team have achieved their purpose, the established goals being largely met.

An important role in order to successfully perform the work duties is held by maintaining the personal security of all employees and especially the one of the professional divers. Compliance with a diet, appropriate to each person's work style and organism is important, leading to prevention of many shortcomings which may in time harm the underwater worker's organism.

Prevention can be achieved through counselling. In conclusion we will continue to give great importance to the measures taken to prevent the daily food excesses of divers.

The care towards divers and respectively towards the young people of this nation by

permanent warning regarding the ways in which the body maintains its health and youth, by banning the consumption of deadly or toxic food and beverages found within reach of anyone, should be everybody's goal. This goal highlights the medical slogan: "it's easier and effective to prevent than to cure".

Please note that the future belongs to young people and through the efficient labour of military and civilian divers from our military base, through the one of young people belonging to special operations forces who serve our homeland under the flag by means of their skills, discipline, discretion and professionalism, the Romanian seaside, the EU border and not only develop safely.

Starting from the assumptions listed initially, the correct and complete awareness of military and civilian divers was raised, as well as the one of policy makers on these issues that may, in time, have a negative impact on health; finally the prevention measures imposed by the carried out studies have been taken.

In conclusion the objectives set by the research-development theme were largely achieved so the hereby study has fulfilled its purpose.

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#### **Abbreviations and acronyms**

**abs.** = absolute;

**ACTH** = adenohipophysis hormone corticotrophin;

**ADH** = antidiuretic hormone;

**AgHBs** = HBs antigen;

**atm.** = atmosphere;

**B** = old/aged man;

**bact** = bacteria;

**$\beta$**  = beta;  
**CMN** = Navy Healthcare Center;  
**CNFPA** = National Council for Adult Vocational Training;  
**CO** = vacation;  
**CPSA** = Research and water plunging Laboratory;  
**DC** = Diving Center;  
**DG** = diving group;  
**DNS** = Squadron for Divers;  
**Cursul PAS** = Diving Training Course;  
**DNFOS** = Naval Special Operation Forces;  
**ECHM** = European Committee for Hyperbaric Medicine;  
**EOD** = Explosive Ordnance Disposal,  
**g** = weight in kg;  
**h** = height in cm;  
**HDL** = high-density lipoprotein (popularly is known as good cholesterol);  
**HG** = Governmental Decision;  
**HGR** = Romanian Government Decision;  
**HBO** = Hyperbaric Oxygen Therapy;  
**LDL** cholesterol = low-density lipoprotein (popular is called bad cholesterol)  
**LH** = Hyperbaric Laboratory;  
**m** = metre;  
**M** = man;  
**MApN** = Ministry of Defence;  
**MB** = basal metabolism;  
**mg** = milligram;  
**ml** = millilitre;  
**N** = Normal weight;  
**NW** = Normalweight;  
**ORL** = otorhinolaryngology;  
**OZU** = Daily Military Journal;  
**PAS** = Preparing and Training Divers;  
**OW** = Overweight;  
**SCAFS** = Research Department, Advising and Training activities diving Diving;  
**SMFN** = Staff of the Navy;  
**s** = second;  
**SOF = FOS** = Special Operation Forces;  
**UDWG** = Underwater Diving Working Group;  
**T** = young man;  
**TNR** = recommended nutritional tolerances  
**v** = age in years;  
**W** = woman.

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