Life Style, Nutritional Habits, Body Composition and Respiratory Capacity as Fundamental Aspects of Risk Evaluation in Professional Divers

Maria Concetta D'Ovidio[1]*, Daniela Pigini[1], Maria Rosaria Marchetti[2], Paola Melis[1], Lucio Bertini[3], Massimo Spalletta[3], Tiziana Paola Baccolo[2], Giovanna Tranfo[1] and Enrico Marchetti[1]

[1]*Department of Occupational Medicine, Epidemiology and Hygiene, Italian Workers' Compensation Authority (INAIL), Monte Porzio Catone, Rome, Italy*

[2]*Department of Occupational Medicine, Epidemiology and Hygiene, Italian Workers' Compensation Authority (INAIL), Rome, Italy*

[3]*Department of Firefighters, Public Rescue and Civil Defense, Ufficio Sanitario per le Specialità del Corpo, Rome, Italy*

*Corresponding Author: Maria Concetta D'Ovidio, Department of Occupational Medicine, Epidemiology and Hygiene, Italian Workers' Compensation Authority (INAIL), Monte Porzio Catone, Rome, Italy.

Abstract

Exposure to hyperbaric atmospheres is an occupational risk for workers. The diver needs a good physical/mental performance, control of physical activity and nutrition. In this work the objective is to assess physical status of professional diver of Italian National Fire Department.

The study was conducted on 71 male divers of the National Fire Department subjected to annual medical examination. We utilized a questionnaire regarding work habits and lifestyles, bioimpedance and spirometric analysis.

Results of the questionnaire indicate that more than one half of workers practice a correct lifestyle and has varied and balanced consumption of food; 25 - 30% professional divers show a higher BMI respect to the ideal BMI value.

These results will be used to create a database on the different physiological parameters of these workers and to define the variations during the immersion phase.

Keywords: Professional Divers; Hyperbaric Risk; Nutrition; Bioimpedance; Spirometry; Occupational Medicine

Abbreviations

BCM: Body Cell Mass; ECM: Extracellular Mass; LBM: Lean Body Mass; FM: Fat Mass; BMI: Body Mass Index; BMR: Basal Metabolic Rate; ICW: Intracellular Water; ECW: Extracellular Water; TBW: Total Body Water; TW: Total Weight; FVC: Forced Vital Capacity; FEV_1: Forced Expiratory Volume in 1 second; FEF: Forced Expired Flow; $FEF_{25-75\%}$: Expiratory flow rate at 25% and 75%

Introduction

During exposure to hyperbaric atmosphere, the diver's body is subjected to an increased air pressure, which simulates the hydrostatic pressure of a real underwater dive. The hyperbaric effect depends on pressure, its dynamics and exposure time. A greater amount of body fat increases the risk of decompression sickness [1] because nitrogen accumulates in particular in adipose tissue; moreover, an increase in fat mass can also be accompanied by "in-

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sulin resistance", with a sudden and dangerous decline of blood glucose level during work. Oxygen can be toxic under hyperbaric conditions depending on its concentration, duration of exposure and individual susceptibility and exposure to hyperbaric atmospheres is recognized as an occupational risk for technical operators, fishermen, guides, instructors, sportsmen, researchers, hyperbaric therapy assistants, etc. but also for recreational/amateur activities [2].

In Italy, professional divers undergo an annual health surveillance procedure in order to determine their medical, physical and psychological fitness. For professional firefighters divers the health surveillance include personal medical history, physical examination, blood chemistry and hematology, pulmonary function tests, anthropometry, audiometry, electrocardiography, vision testing, psychological testing, The health effects derived by hyperbaric exposure can be investigated also by means of a questionnaire addressed to increase the knowledge of other risk factors in life and work environments.

The professional diver needs to have a perfect physical shape and to follow a diet that guarantees, thanks to the intake of adequate amounts of proteins, carbohydrates, fibers, fats, etc. a correct ratio of lean/fat body mass, to reduce the possibility of accidents and to avoid pathologies such as decompression sickness, traumas of the respiratory tract and the middle ear, hypoglycemic crisis, hypothermia and toxic effects of the gases [3-8]. In order to perform a complete occupational health analysis, other risks should be investigated, such as exposure to biological and chemical agents present in environmental conditions [9].

In occupational medicine, great importance is given to the knowledge of the potential risk factors in both living and working environment and, at this purpose, an integrated and multidisciplinary approach should be privileged, including also the acquisition of nutritional and life habits by means of the use of specific questionnaires [10-12]. In our preliminary studies, we utilized a questionnaire for investigating work and related risk factors in hyperbaric exposure, including nutritional information [13] with the assumption that nutritional recommendations need to apply in this peculiar and unique exposure environment [14-16].

In hyperbaric environment it is important evaluate other physiological conditions such as hydration status, that is crucial for the maintenance of optimal physiological functioning [17-19]. In the evaluation of hydration, it is possible to discern between intracellular, extracellular and total water using a frequency bioelectrical impedance method that permit also the differentiation of fat and lean body mass, contributing to the study of nutrition status [20,21]. Other variables as body mass index (BMI), height, age, gender, tobacco smoking, physical activity, ethnic origin, environmental conditions, altitude, and status of several apparatus and systems are important and among them the evaluation of lung function. In fact, studies of pulmonary effects before and after dives in healthy subjects have shown interesting changes in the lung function [22] confirming that respiratory system is affected by diving and that spirometry is one of the most important tools in this context. Diving activity is able to trigger damage to the airways producing small airway obstruction [23,24] with a significant decrease in some spirometry parameters [25]. Diagnosis of airflow obstruction is important as there are effective therapeutic interventions that improve outcomes for this kind of diseases, for example asthma and chronic obstructive pulmonary disease [26]. There is some indication that asthma may conduct at an increased risk of pulmonary barotrauma [27] and subjects with atopic sensitization and asymptomatic airway hyperresponsiveness could have more severe effects on pulmonary function [28].

The values of some clinical parameters in workers exposed to hyperbaric risk factor in rest conditions could be considered as reference values for the interpretation of the same parameters during the hyperbaric activity: for this purpose, one of the aims of this study is to collect these values in a database. We started from bioimpedance and spirometry parameters with the further objective to implement a data base with other variables involved in hydrosaline balance, immunological profile, sensitization reactivity versus food- and aero-allergens. Bioimpedance analysis is a measure of the body electrical impedance: it is a noninvasive, low cost and a commonly used approach for body composition measurements and assessment of clinical condition. When a weak, alternating current, which is well conducted by water and rich tissues such as blood and muscle and is poorly conducted by fat, bone, and air-filled spaces, passes through the body, voltage detected by the electrodes decreases; the impedance data are then recorded by the bioimpedance device. Three primary types of bioimpedance devices are commercially available: single and multiple frequency and spectroscopy. Research is increasing on the use of bioimpedance variables including phase angle and impedance ratio as potential markers of nutrition status and/or clinical outcomes; consensus

on reference cut-points for interpreting these markers has yet to be established [29]. Spirometry is the most reproducible, standardized, and objective way of measuring airflow obstruction in pulmonary disease; this clinical test allows to measure patients' maximum exhalations from total lung capacity. Spirometry is a physiological test that measures how an individual inhales or exhales volumes of air as a function of time. The primary signal measured in spirometry may be volume or flow. Our research is carried out on professional divers (firefighters) and other workers categories, always privileging a multidisciplinary and integrated approach.

Aim of the Study

The aim of this study is realize and implement a database on several physiological parameters in this group of professional divers in order to evaluate the variations during immersion phase with the further opportunity of extending this database at other workers exposed to hyperbaric risk.

Materials and Methods

Ethics statement

The approval of an ethic committee was not requested as this study was a non-interventional/observational study, on the basis of the definitions of the European Directive 2001/20/EC; it was conducted according to the declaration of Helsinki and followed the International Code of Ethics for Occupational Health Professionals [30].

Workers

The study was conducted on 71 male professional divers of the Italian National Fire Services Department, having a mean age of 39 years, 16.90% of which were smokers, subjected to annual medical examination, whose information on working activity are summarized in table 1.

Clinical-anamnestic questionnaire

A questionnaire entitled "Questionnaire for the assessment of the elements of risk related to the diving activity" (Supplementary Material) aimed at assessing work and life habits such as smoking, physical activity and food consumption at work, as risk factors related to the diving activity was carried out by the INAIL research group and utilized in hyperbaric risk assessment [13]. The areas investigated by the questionnaire were the following: working diving, training diving, work activity, lifestyle, correct nutrition

knowledge, eating habits, eating habits at work, exercise, assessment for risk of developing type 2 diabetes.

All subjects provided informed consent and the information were managed anonymously. General data were acquired including anthropometric data, waist circumference, body composition using bioimpedance, and spirometry. Collected information were used on aggregate health data of the group of workers with no possibility of individual identification.

Professional divers n. 71		
Age group (years)	**Subjects (%)**	
24 - 35	32 (45.07)	
36 - 45	21 (29.58)	
46 - 60	18 (25.35)	
Parameter	**Mean**	**Range**
Job seniority (years)	9	4 - 39
Shift work	94%	
Night work	87%	
Dives in the last 6 months	40	1 - 100
Diving frequency	2/week	1 - > 5
Immersion depth	23 meters	3 - 45
Immersion duration	39 minutes	10 - 90
Depth of training dives	32 meters	15 - 50
Duration of training dives	41 minutes	10 - 80

Table 1: Description of the working activity.

Bioimpedance analysis

The bioimpedance variables included resistance (R), reactance (X), phase angle (PA), body capacitance (C) and impedance (Z). In this study a Biodynamics bioimpedance analyzer, Model 450, single-frequency bioelectrical of 50 kHz (SF-BIA) has been used. A pair of electrodes are connected to the hand and to the right foot. Test results BIA-450 (Biodynamics Corporation, 14739 Aurora Ave N, #100 Shoreline, WA 98133 USA www.biodyncorp.com) are accurate within 0.1% for resistance, and 0.2% for regarding reactance and phase angle.

Spirometric analysis

The measured parameters have been forced vital capacity (FVC), the forced expiratory volume (FEV_1) in one second, the FEV_1/FVC ratios calculated and expressed as percentages, and the peak expiratory flow rate (PEF), i.e. the maximum expiratory flow achieved

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from a maximum forced expiration expiratory flow rates at 25%, 50%, and 75% ($FEF_{25\%}$, $FEF_{50\%}$ and $FEF_{75\%}$ respectively). Lung function was measured by spirometry using Minispir™ Spirometer (MIR - Medical International Research, USA).

Statistical analysis

Statistical analyses were performed using the Microsoft Office Excel. Prior to performing any other statistical analysis, the normality of the distribution of the data was evaluated. Statistical analyses were always performed using parametric methods (Pearson's correlation and t-test for independent variables).

Results and Discussion

Questionnaire

Results of the questionnaire evidenced that the 74% of divers walked for at least 30 minutes a day and 67% carried out regular physical activity at least 3 times a week.

With regards nutrition habits, 30% had regularly five meals a day (breakfast, lunch, dinner and two snacks) and 49% drank more than one litre of water a day; 71% of workers had a varied and balanced consumption of food, but milk, cheese, yogurt, eggs, vegetables and fruit were consumed less than the recommended by the Mediterranean diet (Figure 1A-1D).
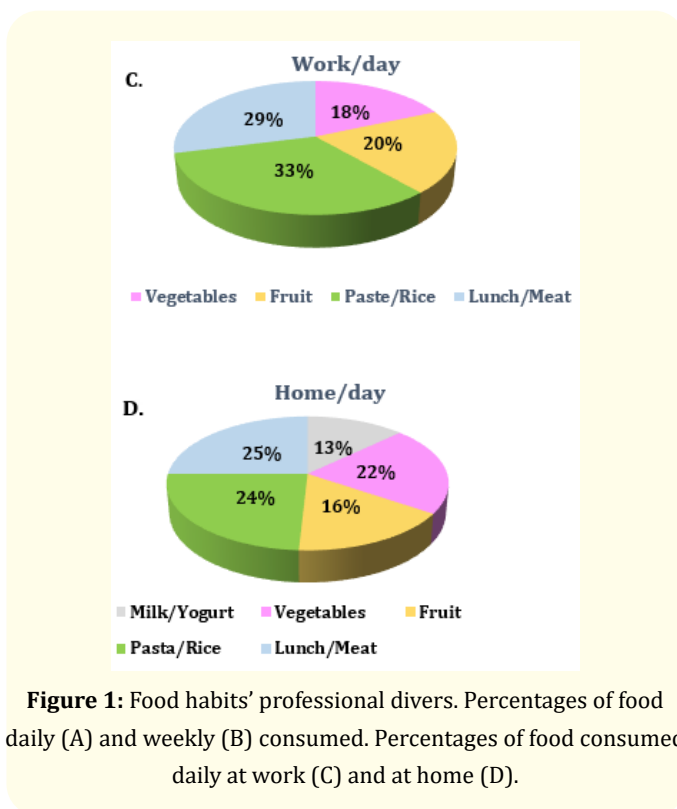
Figure 1: Food habits' professional divers. Percentages of food daily (A) and weekly (B) consumed. Percentages of food consumed daily at work (C) and at home (D).
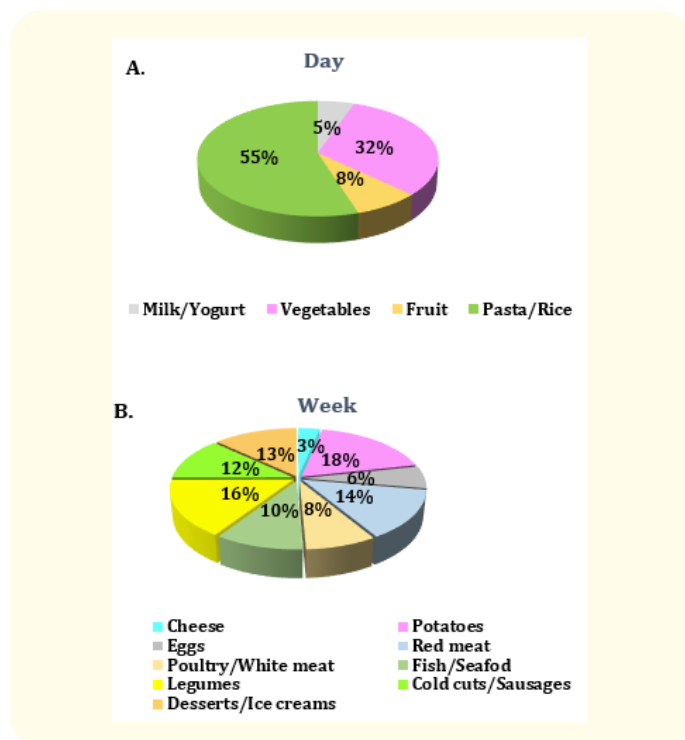
Bioimpedance and spirometric data

Bioimpedance results for all 71 subjects, expressed in terms of mean with the standard deviation, are reported in table 2. The mass distribution consisted of lean body mass and fat mass where the lean body mass is further broken down into its two key components - body cell mass and extracellular mass. The total water is divided into intracellular and extracellular water, that is the fluid contained within and outside the cell, an increase of which may indicate disturbance in the cellular membrane. The distribution of the BMI of the workers in three age groups is reported in figure 2.

This figure shows that most of the sample is overweight considering cut-off values proposed by World Health Organization (WHO/Europe): below 18.5 underweight, 18.5 - 24.9 normal weight, 25 - 29.9 pre-obesity, 30.0 - 34.9 obesity class I, 35.0 - 39.9 obesity class II and above 40 Obesity class III. In particular 30% (36 - 45 years) and 25% (46 - 60 years) professional divers show a higher BMI respect to ideal BMI value (Represented in figure 2 by the blue line). Figure 3 and 4 show the linear correlation between body fat and lean body mass respectively with BMI in the studied group. BMI correlates positively with body fat (r = 0.67), lean body mass (r = 0.61) and basal metabolic rate (r = 0.61).

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Bioimpedance analysis				
Subjects	71			**Mean (SD)** **(Max-Min)**
Sex	Male		Height (cm)	176.0 (5.8) (190.0 - 164.0)
Age	24 - 60		Weight (Kg)	79.9 (8.9) (103.0 - 58.0)
Measurements results **Mean (SD)** **(Max-Min)**				
Resistance (Ohm)	**Reactance (Ohm)**	**Phase angle (°)**	**Body Capacitance (pF)**	
408.8 (48.8) (501.1 - 227.5)	60.6 (10.0) (97.1 - 41.1)	8.6 (1.9) (17.3 - 5.8)	1182.3 (426.7) (3127.0 - 674.0)	
Mass Distribution **Mean (SD)** **(Max-Min)**				
	Kg	**Percent**		**Kg**
Body Cell Mass	37.9 (8.0) (71.5 - 29.3)	47.5 (8.4) (88.4 - 35.8)	ECM/BCM	0.80 (0.7)
Extracellular Mass	30.4 (5.3) (39.0 - 6.6)	38.3 (6.2) (45.9 - 8.6)	Body Mass Index	25.8 (2.4) (32.9 - 21.2)
	----------	------------	Basal Metabolic Rate (cal)	2131.9 (208.2) (2824.0 - 1688.0)
Lean Body Mass	68.3 (6.7) (90.5 - 54.1)	85.8 (5.1) (97.0 - 70.4)		
Fat Mass	11.6 (5.0) (28.4 - 2.3)	14.2 (5.1) (29.6 - 3.0)		
Total Weight	79.9 (8.9) (103.0 - 58.0)	100.0 (10.2)		
Water Compartments **Mean (SD)** **(Max-Min)**				
	Liters	**Percent**		
Intracellular Water	32.9 (7.7) (63.6 - 24.7)	64.1 (7.9) (100 - 52.9)		**Percent**
Extracellular Water	18.3 (3.7) (24.3 - 0.1)	35.9 (7.9) (47.1 - 0.0)	TBW/Lean Body Mass	74.5 (98.5)
Total Body Water	50.9 (6.6) (79.6 - 39.3)	100.0 (15.8)	TBW/Total Weight	63.7 (74.2)

Table 2: Bioimpedance variable in professional divers.

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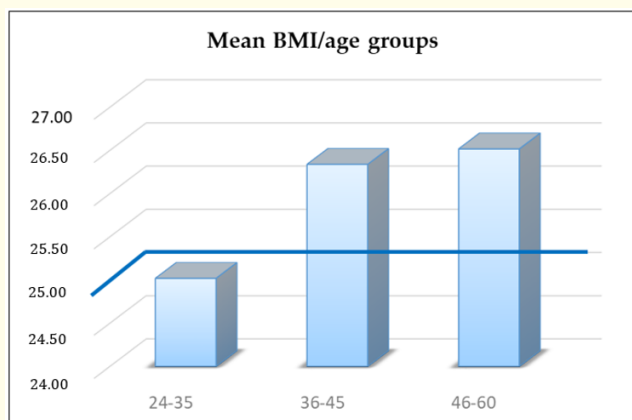
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Figure 2: Mean BMI in professional divers classified in age groups.
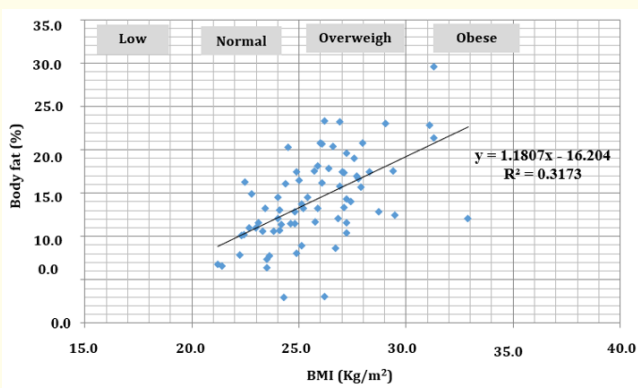
Figure 3: Linear correlation between body fat and BMI in professional divers.

$$y = 1.1807x - 16.204$$
$$R^2 = 0.3173$$

Results of the spirometry show that the PFE (L/s), FEV_1 (L), FVC (L), $FEF_{25-75\%}$ (L/s) and FEV_1/FVC (%) were not statistically differ-

ent (t-test) between smokers and non-smokers. The spirometry analysis results stratified by age class are reported in table 3, each variable expressed in mean and standard deviation. No significant differences were found among different age classes.

The comparison of the parameters of bioimpedance and spirometry between smokers and non-smokers are reported in figure 5, FVC and FEV_1 appear to be not correlated to BMI.

Hyperbaric exposure is a risk that deserves great consideration in occupational medicine. Professional divers belong to several categories of workers such as oil rig operators, fishermen, guides, instructors, sportsmen, researchers and civil/military divers. These last categories include firefighters' divers, a population that we investigated during the regular health surveillance in order to start the creation of a database containing several clinical and biochemical parameters, also finalized to assess the work suitability in hyperbaric exposure, in addition to others traditionally considered.
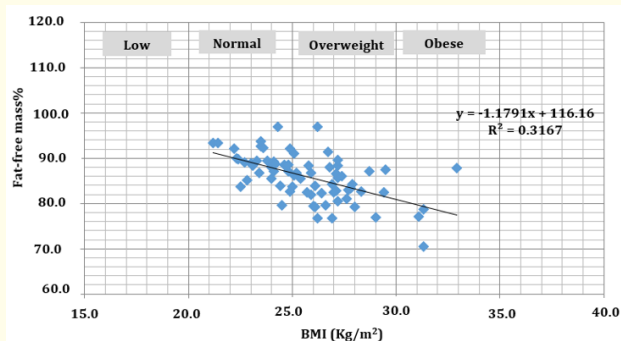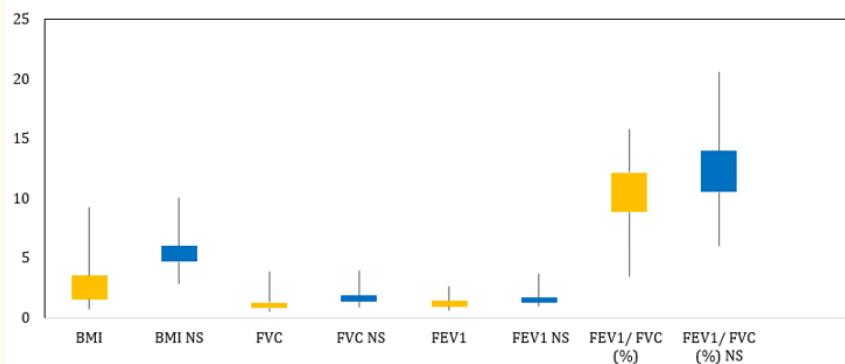

$$y = -1.1791x + 116.16$$
$$R^2 = 0.3167$$

Figure 4: Linear correlation between lean body mass and BMI in professional divers.

Subject (n)	Age (years)	Mean (SD) (Max-Min)			
		FVC (L)	FEV_1 (L)	FEV_1/FVC (%)	$FEF_{25-75\%}$ (L/s)
32	24 - 35	5.26 (0.96) (8.19 - 3.72)	4.28 (0.70) (6.04 - 2.95)	81.68 (5.50) (92.40 - 73.30)	4.28 (1.05) (6.77 - 2.63)
21	36 - 45	5.01 (0.51) (5.79 - 4.27)	4.24 (0.52) (5.39 - 3.40)	84.56 (4.65) (93.90 - 77.10)	4.69 (1.08) (6.48 - 2.99)
18	46 - 60	5.42 (1.09) (7.65 - 3.96)	4.49 (0.91) (6.62 - 3.16)	82.94 (5.18) (89.50 - 73.30)	4.67 (1.15) (7.25 - 2.45)

Table 3: Spirometry analysis in different age classes of professional divers.

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Figure 5: Comparison between smokers and non-smokers (NS) parameters in professional divers.

Our results, acquired by means of the questionnaire, showed that more than one half of the sample on 71 professional divers practices a correct lifestyle and has a varied and balanced consumption of food, but, at the same time, according to BMI values, most of the sample (55% of workers in the age range 36 - 60 years) was overweight. The questionnaire results on eating habits indicated that only 30% regularly made five meals/day (breakfast, lunch, dinner and two snacks). Data suggest the need for enhancing the importance to adopt nutritional recommendation, as the high-energy demand of diving requires an appropriate dietary intake of macronutrients [31]. The association of BMI with severity of decompression sickness events has been suggested [19]. Literature data indicate that scuba diving activity is not associated with an accelerated decline in FEV_1 [32]; our study does not show statistically significant differences in FEV_1 between smokers and non-smokers nor among different age classes. However, firefighters divers are a trained group of workers: due to the rapid growth of the non-professional diving sector, there is the is need that the physicians, not only occupational, have an appropriate knowledge on hyperbaric risk in order to provide the best cares for decompression sickness, cardiovascular problems, patent foramen ovale complications, immersion pulmonary edema, hypercapnia etc. [33,34]. The regular medical examination is a valid tool in professional divers that are screened for lung function tests, audiology, blood analysis and clinical tests with the support of specific clinical-anamnestic questionnaires that can contribute to detect significant health problems [35].

Conclusion

Hyperbaric exposure is a condition that can cause several diseases in professional divers and the firefighters represent elective workers' category for the possibility of screening during health surveillance. The results obtained in our study indicate that more than half of these workers practice a correct lifestyle, had generally varied and balanced consumption of food but is necessary to increase vegetables and fruit consumption. Education and training should be addressed to incentive the participation in research studies aimed at evidencing the variation of physiological parameters caused by hyperbaric exposure. In professional firefighters' divers, work suitability should include additional criteria in workers older than 45 years, having a high BMI, with bronchial asthma, and restrictive or obstructive respiratory deficit.

Further investigations should be aimed at acquiring reference range values of different parameters in blood and urine in firefighters' divers during the regular health surveillance to be compared with those measured during immersions also in other groups of divers. We also promote the use of proteomic [36-38] and metabolomics [39,40] as innovative methodologies aimed to define individual profiles taking into account physio-pathological characteristics of professional divers.

Conflict of Interest

All authors claim no competing or conflicts of interest.

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Supplementary Material

Life style, nutritional habits, body composition and respiratory capacity as fundamental aspects of risk evaluation in professional divers

Maria Concetta D'Ovidio, Daniela Pigini, Maria Rosaria Marchetti, Paola Melis, Lucio Bertini, Massimo Spalletta, Tiziana Paola Baccolo, Giovanna Tranfo and Enrico Marchetti

Questionnaire for the assessment of the element of risk related to the diving activity

ID Code: _____

Date: _____

Questionnaire for the assessment of the element of risk related to the diving activity

We offer you a series of multiple choice questions that will provide us with some information on your diving activities.

Data will be used for statistical and research purposes only in aggregate form (anonymous) and will be useful in planning interventions aimed at the psychophysical well-being of workers in the sector.

In thanking from now on for the collaboration, it is specified that:

- there are no right or wrong answers, the best answer is spontaneity;

- the questions are printed on both sides of the paper;

- the compilation takes very little time, we ask you to do it immediately;

- all questions must be fully answered

- for some questions it is possible to indicate more answers

ANAGRAPHY AND CERTIFICATIONS

TO BE COMPLETED BY THE PHYSICIAN

Age _____ years   Height_____cm   Weight_____ Kg

Waist circumference_____ cm (minimum circumference between the rib cage and the navel measured with a tape measure, standing, without holding the breath)

BMI:

1) Sex   r Male   r Female

2) Types of certification extra VV.F.

Nitrox	r Not certified	Year of certification	
Trimix	r Not certified	Year of certification	
Cave diving	r Not certified	Year of certification	
Other _____ _____ _____			

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WORK DIVES (excluding training and practice - see later)

3) How many years have you been working as a diver for the Fire National Fire Corps? _____

4) How many work dives have you done in the last six months _____

5a) How many in fresh water (last six months)? _____

5b) How many in salt water (last six months)? _____

6a) What is the average dive frequency?

❏ 4/week   ❏ 3/week   ❏ 2/week   ❏ 1/week   ❏ frequency higher than 5/week

6b) What was the maximum number of dives in your career? _____/week

6c) What was the maximum peak number of dives in the last 6 months? _____/week

7a) What is the average depth and duration of your work dives in the last 6 months?

Depth _____, Duration _____

7b) What is the maximum depth of your work dives in the last 6 months*?

Depth _____, (Duration _____)

7c) What is the minimum depth of your work dives in the last 6 months*?

Depth _____, (Duration _____)

7d) What is the maximum duration of your work dives in the last 6 months*?

Duration _____, (Depth _____)

7e) What is the minimum duration of your work dives in the last 6 months*?

Duration _____, (Depth _____)

8) How often do you make repeated dives within 12 hours?

❏ No   ❏ Yes   indicate how often _____

9) Have you suffered any traumas or accidents due to diving?

❏ No   ❏ Yes   indicate when _____

10) Have you ever been treated in a hyperbaric chamber?

❏ No   ❏ Yes   indicate when _____

11) What is the gear usually adopted for diving:

❏ Wet suit   ❏ Semidry suit   ❏ Dry suit

❏ Underwater mask   ❏ Full face mask (Kirby-Morgan)   ❏ Buoyancy jacket

❏ Harness   ❏ One regulator   ❏ Double regulator

❏ Dive computer   ❏ Decompression tables

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*(The data in brackets must refer to the same dive as in the requested data)

TRAINING DIVES (training and practice only)

12) Do you perform amateur underwater activity beside your work?

❒ No ❒ Yes

13) How many training/practice dives have you done in the last six months _____

14) What is the average frequency?

❒ 4/week ❒ 3/week ❒ 2/week ❒ 1/week ❒ frequency higher than 5/week

15) What was the maximum number of training/practice dives in your career? _____/week

16) What is the average depth and duration of your training/practice dives?

Depth _____, (Duration _____)

17) Have you suffered any trauma or accident due to training/practice diving?

❒ No ❒ Yes indicate when _____

BIOIMPEDANCE

18) In the last 24 hours have you taken

Alcohol ❒ No ❒ Si

Water (6-8 bicchieri) ❒ No ❒ Si

19) In the 4 hours before the test has

Eaten food ❒ No ❒ Si

Drunk caffeine ❒ No ❒ Si

Drunk water (2-4 glasses) ❒ No ❒ Si

Practiced exercise ❒ No ❒ Si

LIFESTYLE

20) At home with you have

❒ None

❒ Spouse/partner

❒ Children under the age of 18 indicate how many _____

❒ Adult children indicate how many _____

❒ Other people

21) Educational qualifications

❒ Degree high school

❒ Diploma middle school

❒ Lower secondary school license

❒ Primary school certificate

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22) Smokes

❏ No   ❏ Yes (number of sig./die: _____)   ❏ I have been a former smoker for _____ years

23) How many minutes you walk briskly per day, continuously (excluding work)

❏ Never   ❏ At least 30   ❏ Less than 30   ❏ More than 30

24) How many times do you practice sport (swimming, gymnastics, running, tennis, volleyball, ...) during the week

❏ Never   ❏ 1-2   ❏ More than 2   ❏ More than 4   ❏ Every day

25) Do you suffer/Has suffered from

  ❏ Arterial hypertension

❏ Myocardial infarction (ischemic heart disease)

❏ Hypercholesterolemia

❏ Hypertriglyceridemia

❏ Hyperglycemia/diabetes

❏ Celiac disease

Other (specify) _____

26) Do you suffers from some allergies   ❏ No   ❏ Si

If yes, which among fish, nuts, soy, peanut, egg, animals, dust mites, plants, drugs, etc.

(specify) _____

27) How do allergy occurs

❏ Skin: itching, erythema, urticaria, angioedema, swelling of the mouth, ...

❏ Nose: itching, nasal congestion, rhinorrhea, sneezing, ...

❏ Respiratory system: itching of the mouth and throat, swelling in the throat, dry cough, asthma, ...

❏ Gastrointestinal system: abdominal pain, vomiting, nausea, diarrhea, ...

❏ Hyperglycemia/diabetes

❏ Headache

Other (specify) _____

28) Do your parents suffer from allergies?

❏ None   ❏ Yes, father   ❏ Yes, mother

29) Suffers from some food intolerances   ❏ No   ❏ Yes

If yes, such as gluten, lactose, etc. _____

30) Do you take drugs with regularity   ❏ No   ❏ Yes

If yes, for what _____

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31) Are you currently pregnant ☐ No ☐ Yes

WORKING DATA

32) Year of employment with the current company _____

33) Work on shifts ☐ No ☐ Yes

34) Do you perform night work ☐ No ☐ Yes

35) Average weekly working hours: n ° _____

36) Which vehicle do you use to go to work

☐ Automobile

☐ Public transport

☐ Motorcycle

☐ Bicycle

☐ On foot

☐ Other (specify) _____

37) Is your work activity mainly characterized by physical activity?

☐ Poor, most of the time is spent sitting

☐ Moderate, most of the time is spent standing or walking

☐ Heavy, to the point of sweating

FOOD HABITS IN THE LIFE ENVIRONMENT

38) Generally, the foods you consume in a domestic environment are

☐ Prepared at home

☐ Buy ready-made (sandwiches, pizza, ready-to-eat, ...)

☐ Other (specify) _____

39) Have you ever followed a diet

☐ No

☐ Yes, not prescribed by a health professional

☐ Yes, prescribed by a health professional for (indicate the reason)

40) Are you currently on a diet to lose or maintain your weight?

☐ No ☐ Yes

41) Do you currently consider yourself to be?

☐ Under weight

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❐ Normal weight

❐ Light overweight

❐ Strong overweight

42) Usually you eat

❐ Breakfast

❐ Lunch

❐ Dinner

❐ Snacks n ° _____

43) If you consume snacks, more often you consume them:

❐ Mid-morning

❐ Mid-afternoon

❐ At night

44) What you prefer to eat at breakfast

❐ Nothing

❐ Coffee

❐ Cappuccino/milk/tea/barley/fruit juice

❐ Sweet snack

❐ Salted snack

❐ Fruit

❐ Yogurt

❐ Sandwich

❐ Other (specify) _____

45) What you eat most often at lunch

❐ Nothing

❐ First (pasta, rice, ...)

❐ Second (meat, fish)

❐ Cheese

❐ Eggs

❐ Vegetables

❐ Bread

❒ Pizza

❒ Sandwich

❒ Fruit

❒ Other (specify) _____

46) What you eat most often at dinner

❒ Nothing

❒ First (pasta, rice, ...)

❒ Second (meat, fish)

❒ Cheese

❒ Eggs

❒ Vegetables

❒ Bread

❒ Pizza

❒ Sandwich

❒ Fruit

❒ Other (specify) _____

47) What do you eat most often in snacks

❒ Nothing

❒ Cappuccino

❒ Coffee/tea

❒ Fruit juice

❒ Sweet snacks

❒ Savory snacks

❒ Fruit

❒ Yogurt

❒ Sandwich

❒ Other (specify) _____

48) Do you use more than one teaspoon of salt every day on raw food and cooking?

(a teaspoon is of about 5 grams)

❒ No

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❒ Yes

❒ I do not know

❒ I never use salt

49) How much oil do you consume every day?

(a tablespoon corresponds to three teaspoons)

❒ I do not use oil

❒ n. _____

50) How much Parmesan do you consume every day?

(consider a tablespoon as a measure)

❒ I do not use Parmesan cheese

❒ At lunch n. _____

❒ At dinner n. _____

51) How many teaspoons of sugar do you use each day?

❒ I do not use sugar

❒ n. _____

52) Do you drink at least one liter of water every day?

❒ No

❒ Yes

❒ Yes, even more

53) Do you consume sugar or no-light drinks daily (fruit juices, coca cola, orange juice, chinotto, energy drinks, … …)?

❒ No

❒ Yes

54) Indicate how many times the following foods are consumed:

Food	Number per day	Number per week	Number per month	Number per year	Never
Milk/yogurt (1 125 g glass of milk or yogurt)					
vegetables [salad 50 g (a 500 ml bowl) e vegetables 250 g (1 fennel, 1 pepper, 2 cucumbers, 2 hartichokes)]					
Fruit (average/150 g)					

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Pasta/Rice (80 g)					
Pizza (one slice)					
Bread 50 g (1 small bread loaf – 2 bread slices)					
Potatoes (200 g)					
Cheese (fresh 100 g; seasoned 50g) (excluded grinded parmesan)					
Egg (one egg)					
Dressing fat (excluded oil) (10 g/2 tespoon)					
Red meat (1 slice/70-100 g)					
#poultry and White meat (1 slice/70-100 g)					
fish, shellfish and croustacean (150 g/ 1 sole o ½ sea bass)					
Legumes (beans, chickpeas, lentils, peas) (dryed 30g; fresh 100 g; box 100-120 g)					
Seasoned meat/sausages (50 g/ 3 average slices of ham)					
Bakery products (20 g/ 3 rusks)					
Desserts/ice cream (1 slice/1 twinkie/1small ice cream)					
Alcoholic beverages (wine-beer/1 glass/can)					

55) Specify how many times the following foods are consumed:

Food	Indicate if more or less of 100 gr per day	Number of times per day	Number of times per week	Number of times per month	Number of times per year	Never
Garlic	❑ More ❑ Less					
Beet	❑ More ❑ Less					
Broccoli	❑ More ❑ Less					
Carrots	❑ More ❑ Less					
Bruxelles sprout	❑ More ❑ Less					
Cabbage	❑ More ❑ Less					
Onion	❑ More ❑ Less					
Lentils	❑ More ❑ Less					
Corn	❑ More ❑ Less					
Aubergine	❑ More ❑ Less					

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Red Pepperoni	❏ More ❏ Less					
Red Tomatoes	❏ More ❏ Less					
Spinach	❏ More ❏ Less					
Apricot	❏ More ❏ Less					
Orange	❏ More ❏ Less					
Banana	❏ More ❏ Less					
Cherry	❏ More ❏ Less					
Strawberry	❏ More ❏ Less					
Kiwi	❏ More ❏ Less					
Raspberry	❏ More ❏ Less					
Apple	❏ More ❏Less					
Pomegranate	❏ More ❏ Less					
Blueberry	❏ More ❏ Less					
Blue raspberry	❏ More ❏ Less					
Hazelnuts	❏ More ❏ Less					
Pear	❏ More ❏ Less					
Plum	❏ More ❏ Less					
Black/red Grapes	❏ More ❏ Less					
	❏ More ❏ Less					
Chiocolate (70% minimum of cocoa)	❏ More ❏ Less					

56) How many glasses/cans of wine/beer/alcohol/spirits have you been drinking, at most, on one occasion in the last week?

❏ None

❏ Up to three

❏ Up to six

❏ More than six

FOOD HABITS IN THE WORKING ENVIRONMENT

57) If you are not a shift worker, what meals you eat at work

❏ Breakfast

❏ Lunch

❏ Dinner

58) If shift worker (8.00-20.00), what meals he consumes at work

❏ Breakfast

❏ Lunch

❏ Dinner

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59) If shift worker (20.00-8.00), what meals he consumes at work

❒ Breakfast

❒ Lunch

❒ Dinner

60) More frequently the foods consumed at work are:

❒ Prepared at home/Eat at home

❒ Bought ready-made at the bar/snack bar/supermarket

❒ Grocery canteen/restaurant

❒ Vending machines

❒ Other (specify) _____

61) If you are following a diet to lose or maintain your weight, can you follow it also at work?

❒ No

❒ Yes

❒ Almost always

❒ Almost never

62) Do you have a company canteen at work?

❒ No

❒ Yes

63) If you use the canteen/restaurant, what you eat most frequently:

❒ First

❒ Second

❒ Side dish

❒ Bread

❒ Pizza

❒ Fruit

❒ Yogurt

❒ Sweet

❒ I do not enjoy the canteen/restaurant

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64) If you use the bar/cafeteria/supermarket/grocery store, what you eat most frequently:

❒ First

❒ Second

❒ Side dish

❒ Bread

❒ Pizza

❒ Sandwich

❒ Fruit

❒ Yogurt

❒ Dessert

❒ Do not enjoy bar/ snack bar/supermarket/food

65) If you bring food from home, what you eat most frequently:

❒ First

❒ Second

❒ Side dish

❒ Bread

❒ Pizza

❒ Sandwich

❒ Fruit

❒ Yogurt

❒ Dessert

❒ I do not bring food from home

66) From the distributor what consumes more frequently:

❒ Nothing

❒ Water

❒ Hot drinks

❒ Soft drinks

❒ Fruit juices

❒ Sweet snacks

❒ Savory snacks

❒ Yogurt

❒ Sandwiches

❒ Fruit

❒ Vegetables

❒ Other (specify) _____

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67) If vending machines are present, they also offer:

❒ Fruit juices

❒ Yogurt

❒ Fresh fruit

❒ Vegetables

❒ None of the mentioned

68) What would you add to the distributor _____

69) If you are allergic/intolerant to any food/ingredient, do you have a choice at the canteen/bar/ distributor?

❒ No

❒ Yes

70) Consider your diet

❒ Correct

❒ Incorrect

❒ I do not know

KNOWLEDGE ON FEEDING

71) Foods particularly rich in carbohydrates (sugars) are (even more than one answer)

❒ Bread	❒ Pasta	❒ Fish	❒ Cheese
❒ Rice	❒ Meat	❒ Legumes	❒ Eggs
❒ Cereals	❒ Vegetables	❒ Sweets	❒ Fruit

72) Foods particularly rich in lipids (fats) are (even more than one answer)

❒ Bread	❒ Pasta	❒ Fish	❒ Cheese
❒ Rice	❒ Meat	❒ Legumes	❒ Eggs
❒ Cereals	❒ Vegetables	❒ Sweets	❒ Fruit

73) Foods particularly rich in protein are (even more than one answer)

❒ Bread	❒ Pasta	❒ Fish	❒ Cheese
❒ Rice	❒ Meat	❒ Legumes	❒ Eggs
❒ Cereals	❒ Vegetables	❒ Sweets	❒ Fruit

74) Foods particularly rich in fiber are (even more than one answer)

❒ Bread	❒ Pasta	❒ Fish	❒ Cheese
❒ Rice	❒ Meat	❒ Legumes	❒ Eggs
❒ Cereals	❒ Vegetables	❒ Sweets	❒ Fruit

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75) Food allergy is an immune reaction triggered by the ingestion of a food or substance contained in it and is immediately manifested

❒ No

❒ Yes

❒ I do not know

76) Food intolerance is an unwanted reaction triggered by the ingestion of a food or substances contained in it and occurs even after hours or days

❒ No

❒ Yes

❒ I do not know

77) Food allergy / intolerance can occur with

❒ Gastrointestinal disorders

❒ Asma

❒ Dermatitis

❒ Rhinitis

❒ Respiratory difficulty

❒ I do not know

78) Anaphylactic shock can manifest itself with

❒ Breathing difficulty

❒ Pressure drop

❒ Loss of consciousness

❒ Death

❒ I do not know

79) Celiac disease or celiac disease is a gluten intolerance that does not allow ingestion

❒ Durum wheat

❒ Spelled

❒ Rye

❒ Kamut

❒ Barley

❒ Products containing gluten

❒ I do not know

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80) Are you aware of a test that, with a simple blood test, can simultaneously test 112 allergens

❒ No

❒ Yes

❒ I do not know

81) High salt consumption negatively affects (even more than one answer)

❒ Arterial pressure

❒ Cardio-circulatory system

❒ Renal system

❒ I do not know

82) Are you aware that, if you use salt, it is better to use iodized salt

❒ No

❒ Yes

❒ I do not know

83) How many times a day we should eat, also favoring snacks

❒ 2   ❒ 3   ❒ 4   ❒ 5

❒ Other (specify) _____

PERCEPTION OF FOOD RISK

84) If a canned food has a bulge on the cap

❒ Must not be consumed at all

❒ It can be consumed with tranquility

❒ I do not know

85) During the preparation of food, raw and cooked ones should be separated

❒ No

❒ Yes

❒ I do not know

86) During the preparation of food when touching raw food you should wash your hands

❒ No

❒ Yes

❒ I do not know

87) Botulism, caused by the bacterium Clostridium botulinum, can be transmitted from

❒ Canned food of domestic production

❒ Canned foods of industrial production

❒ Sausages

❒ I do not know

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88) Salmonellosis, caused by various Salmonella bacteria, can be transmitted from

❒ Raw or undercooked eggs

❒ Milk and raw derivatives (unpasteurized)

❒ Meat and derivatives especially undercooked

❒ Preparations for cakes, creams

❒ I do not know

89) The bacterium Escherichia coli can be transmitted from

❒ Uncooked meat

❒ Unpasteurized milk

❒ Sausages

❒ I do not know

90) Anisakis and Opistorchis parasites can be transmitted from

❒ Raw fish not heat-treated

❒ Fish consumed cooked

❒ I do not know

91) Those suffering from food allergies

❒ They can never eat the allergenic food

❒ They can eat the allergenic food from time to time

❒ I do not know

92) Are you aware that incorrect lifestyles (smoking, incorrect diet, sedentary lifestyle) can cause serious illnesses

❒ No

❒ Yes (which diseases) _____

93) If you answered "Yes" to the previous question, how did you learn about it

❒ Internet

❒ Television

❒ Friends

❒ Colleagues

❒ Relatives

❒ Healthcare personnel

❒ Magazines

❒ Other (specify) _____

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94) Someone has ever suggested you to improve your lifestyles (smoking, nutrition, physical activity)

❒ No

❒ Medical

❒ Friend/Family

❒ Personal trainer

❒ Company initiative

❒ Other (specify) _____

95) You would be interested in receiving information to improve your lifestyles (smoking, nutrition, physical activity)

❒ No

❒ Yes

❒ I do not know

SPECIFIC QUESTIONS FOR THE ASSESSMENT OF THE DIABETES RISK PERCENTAGE

96) Do you make physical activity during your free time or physically demanding jobs for at least 30 minutes almost every day?

❒ No

❒ Yes

97) How often do you eat vegetables and fruit?

❒ Every day

❒ Not every day

98) Have you ever used drugs for high blood pressure?

❒ No

❒ Yes

99) Have you ever been told by some doctor that you have too high blood sugar (glycaemia) (eg during a medical checkup or during a disease or pregnancy)?

❒ No

❒ Yes

100) There is any family member with diabetes in your family?

❒ No

❒ Yes: grandparents, uncles or cousins

❒ Yes: biological father or mother, brothers or children

Thank you for completing the questionnaire and for the time spent on it

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