

# Obesity continues to be a major health risk for Danish seafarers and fishermen

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## ABSTRACT

**Background.** In addition to the well-known medical consequences of overweight, severe obesity may also constitute a safety problem on board a ship in case of an emergency. The purpose of this study was to determine the current extent of the problem of overweight among Danish seafarers and fishermen and to follow-up the situation since a previous survey. The aim was to identify the main target groups and determine the need for continuous intervention.

**Material and methods.** Data on height and weight were obtained from the mandatory health examinations of seafarers and fishermen. A total of 2,101 seafarers were included in the study. Body Mass Index (BMI) was calculated for each individual seafarer. Data from two other surveys were used as reference.

**Results.** A total of 1,379 (66%) of all tested subjects were overweight. Among the male officers and ratings, the relative risk of being overweight was 1.33 (1.25–1.38) and 1.30 (1.22–1.38), respectively. The relative risk for fishermen was 1.45 (1.25–1.66) and for maritime students and trainees 1.44 (1.25–1.66). The female seafarers had a relative risk of being overweight of 1.42 (1.23–1.65). There were a statistical significantly increased number of overweight merchant seafarers since 2001/2002.

**Discussion.** The study shows that Danish merchant seafarers have a major and significantly increasing overweight problem. Among fishermen, overweight was even more frequent. Overweight constitutes a threat not only to their health, but also to their career at sea. The larger than expected incidence of overweight among new employees in the industry provides particular cause for concern. The causes of the problem are complex and interventions need to be broad.

(Int Marit Health 2011; 62, 2: 98–103)

**Key words:** seafarers, obesity, body mass index

## INTRODUCTION

Overweight has become a major health problem in many parts of the world. The consequences of overweight are well known and include an increased risk of, e.g. cardiovascular disease, stroke, diabetes, and poor mental health [1] as well as an increased risk of sick leave [2]. On board a ship, severe obesity may interfere with the performance of daily duties and also constitute a safety issue in case of an emergency [3]. In addition, the increased risk of acute

disease or acute complications to a chronic condition on board a ship without access to professional medical assistance may become a problem, not only for the individual, but also for the other crew on board.

Previous research indicates that overweight is of major importance in some sectors of the maritime industry [3, 4]. Among the possible explanations are the easy access to abundant quantities of food, which goes back to the days when seafaring was hard work

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and required high caloric intake. Today most of the work is sedentary. However, the traditions with regard to food have not necessarily changed and the risk of an excess intake is likely.

The aim of this study was to determine the current magnitude of overweight among Danish seafarers, follow-up the development by comparing the results with a previous study [3], identify the main target groups, and finally, evaluate the need for continuous intervention.

## MATERIAL AND METHODS

The measures of height and weight used in this study were derived from health examinations performed by authorized seafarers' physicians in Denmark that were reported electronically via the internet to the Danish Maritime Authority. The health examinations were conducted from 4 January 2010 to 21 April 2010 and were performed according to Danish standards.

A total of 2,396 recordings were extracted from the register in the Danish Maritime Authority. From these, 260 were excluded. Causes for exclusion were lack of job category recorded by the medical doctor in 186 of the cases and 84 had no personal identification number. In an additional nine cases, the examined persons were recorded as relatives to seafarers, and in eight cases no nationality was noted. Five seafarers had been through more than one examination or for other reasons were recorded more than once. Only the first examination was included. Finally, in three cases, the height or weight was obviously not recorded correctly or not recorded at all. A total of 2,101 seafarers (87.8%), 247 women and 1,854 men, were included in the analysis. Results from a recent survey among Danes from all over the country and from a previous Danish study among seafarers performed in 2001/2002 were used as references [3, 5]. Only the 1,996 seafarers between 18 and 64 years of age were included in the comparison between seafarers and the shore based reference population.

The measurements of height and weight were used to calculate the Body Mass Index (BMI) for each individual seafarer. The calculated BMI values were divided into three levels of weight according to definitions made by the WHO [1]: (1) underweight and normal weight (below 25), (2) overweight (25.0–29.9), and (3) obese (> 30.0). In this paper severe obesity was additionally defined as a BMI of or exceeding 35. The seafarers were divided into three age groups

in order to make the data comparable with the reference.

The seafarers were divided into four groups based on their recorded job title. Officers in the merchant marine include all navigation officers and marine engineers. Ratings include all non-officers on deck and engine departments and all kinds of catering crew. Fishermen include skippers and crew together, and maritime students include all students and trainees in the maritime sector. Some of the maritime students may not have worked at sea at all at the time of the examination. Others, especially those in the higher age groups, may have spent years at sea and may have begun on a new maritime training course at a late stage. This group also includes students at the special schools for fishermen.

The differences between the seafarers and the reference group, and between the present study and the study from 2001/2002, are presented as age-adjusted relative risks with 95% confidence intervals and were calculated using EpiSheet [6]. The proportion of overweight individuals (a BMI of 25 or above) was compared with the shore-based reference group and with data from the previous study [3], respectively. The age groups presented in Tables 1, 2, and 3 were used in the calculations.

## RESULTS

In total, 1,379 (66%) of all subjects included in the study were overweight. Among male seafarers from the merchant fleet, 70.8% were overweight and among fishermen, 73.3% were overweight. The male maritime students were overweight in 52.8% of cases. In the Danish reference population a total of 47.6% were overweight [5]. The degree of overweight and obesity distributed by age groups can be seen in Table 1 (males) and in Table 2 (females). Severe obesity among seafarers from the merchant fleet varied between 6.0% and 9.8%, with the highest percentage among officers in the age group 45–64 years.

Comparison of the proportion of overweight seafarers in each job category with the data from the reference population showed that among the officers and ratings the age-adjusted relative risk of being overweight was 1.33 (1.26–1.39) and 1.30 (1.22–1.38), respectively. The relative risk for fishermen was 1.45 (1.35–1.57) and for maritime students 1.44 (1.25–1.66). The relative risk of overweight for female officers and ratings aboard merchant ships was 1.41 (1.22–1.65). Female students and trainees had a relative risk of 1.19 (0.79–1.81).

**Table 1.** Body mass indices among male seafarers below 65 years of age in comparison with a shore-based population

<b>Males</b>	<b>BMI &lt; 25.0</b>	<b>BMI 25-30</b>	<b>BMI ≥ 30</b>	<b>Number of participants</b>
<b>Officers, merchant marine (n = 677)</b>				
18-24 years	72.7%	9.1%	18.2%	11
25-44 years	31.1%	44.1%	24.7%	299
45-64 years	18.5%	48.5%	33.0%	367
<b>Ratings, merchant marine (n = 632)</b>				
18-24 years	67.5%	20.8%	11.7%	77
25-44 years	34.0%	41.9%	24.1%	344
45-64 years	21.8%	45.5%	32.7%	211
<b>Fishermen (n = 217)</b>				
18-24 years	46.4%	28.6%	25.0%	28
25-44 years	18.5%	46.9%	34.6%	81
45-64 years	20.4%	42.6%	37.0%	108
<b>Maritime students (n = 228)</b>				
18-24 years	55.0%	27.5%	17.6%	131
25-44 years	40.0%	37.3%	22.7%	75
45-64 years	22.7%	59.1%	18.2%	22
<b>Reference population (n = 5,532)</b>				
18-24 years	78.4%	18.2%	3.4%	192
25-44 years	50.5%	39.8%	9.7%	1,789
45-64 years	36.8%	47.8%	15.4%	3,551

**Table 2.** Body mass indices among female seafarers (excluding two females recorded as working in a fishing fleet) in comparison with a shore-based population

<b>Females</b>	<b>BMI &lt; 25.0</b>	<b>BMI 25-30</b>	<b>BMI ≥ 30</b>	<b>Number of participants</b>
<b>All female seafarers (n = 207)</b>				
18-24 years	79.9%	11.9%	8.5%	57
25-44 years	54.3%	26.1%	19.6%	92
45-64 years	33.9%	39.3%	26.8%	56
<b>Female maritime students (n = 33)</b>				
18-24 years	74.1%	18.5%	7.4%	27
25-44 years	50.0%	33.3%	16.7%	6
<b>Reference population (n = 8,710)</b>				
18-24 years	78.8%	17.6%	3.6%	314
25-44 years	67.5%	23.0%	9.5%	2,972
45-64 years	59.9%	28.8%	11.3%	5,424

**Table 3.** Comparison of body mass indices between the survey in 2001/2002 and the present survey from 2010. The table includes male seafarers only

Period of study	BMI < 25.0		BMI 25–30		BMI ≥ 30		Number of participants	
	2001/ /2002	2010	2001/ /2002	2010	2001/ /2002	2010	2001/ /2002	2010
<b>Officers, merchant marine</b>								
Below 25 years	71.4%	72.7%	28.6%	9.1%	0.0%	18.2%	7	11
25–44 years	38.4%	31.1%	41.4%	44.1%	20.1%	24.7%	333	299
45–66 years	24.5%	18.5%	45.8%	48.3%	29.7%	33.2%	330	383
<b>Ratings, merchant marine</b>								
Below 25 years	59.6%	69.1%	31.3%	19.8%	9.1%	11.1%	99	81
25–44 years	47.8%	34.0%	35.7%	41.9%	16.4%	24.1%	280	344
45–66 years	21.6%	22.7%	45.7%	45.4%	32.7%	31.9%	208	216

In 2001/2002, 64.0% of all male seafarers between 16–66 years of age in the merchant fleet were overweight [3]. In 2010, the comparable figure was 70.5%. The relative risk of being overweight in 2010 compared to the risk in 2001/2002 was 1.08 (1.03–1.15),  $p = 0.002$ .

## DISCUSSION

This study is based on a large random sample of seafarers who attended the statutory pre-employment health examinations. The data can be assumed to be representative for people employed in the Danish maritime industry. The data for seafarers as well as for the reference population are both measured by health professionals. As the health examinations of seafarers are mandatory, no major selection bias is likely to be present. The reference data, however, is based on voluntary participation in a Danish National health survey and therefore may be biased [5] as there was a clear skewed distribution with regard to age, gender, and social status. The participants also had a longer education than the general Danish population. Still, the overall trend is the same as seen in other Danish surveys based on self-reported data [7].

The overweight problem seems to have increased since the first Danish survey, which was based on data from 2001/2002 (Table 3). The same trend is seen ashore with an increased frequency of overweight in Denmark over the last decade [7]. However, the comparison with previous figures should be made with some caution. The observed increased frequency of overweight may not fully represent an increase since 2001/2002 as the composition of the

two study groups may have changed. Due to the employment of foreign labour the number of Danish seafarers working on cargo ships in overseas trade has diminished during the period. Simultaneously, a relatively larger fraction of the Danish seafarers work on passenger ships and other ships employed in domestic and regional trades. This may have influenced the results.

As clearly shown, overweight among seafarers is considerably more frequent than in the reference population. A point of concern in this context is the high frequency of overweight among maritime students. Although some may have been sailing previously and then taken up further training later, the influence of life at sea on the overweight frequency is likely to be limited in this relatively young population. The larger proportion than expected of overweight subject at entry into the maritime industry indicates that factors other than the shipboard environment may influence overweight, and thus a selection bias among the students, especially the males, might be present.

As a part of the mandatory biennial pre-employment health examinations of Danish seafarers, weight and height are measured and BMI calculated. According to the Danish regulations, a concrete evaluation of whether “the fat and muscle distribution is a severe limitation for mobility” should take place if the calculated BMI is 40 or above [8]. As few seafarers have a BMI of 40 or above, the health examinations are unlikely to have a major influence on the prevalence of obesity in this group.

The magnitude of overweight observed in this study is of concern. The well-known consequences

of overweight, such as an increased risk of diabetes and cardiovascular diseases, may be a special problem to seafarers and fishermen as these diseases may eventually end up making the seafarers unfit for a job at sea. Therefore, overweight may turn into a major social problem for seafarers and fishermen. To meet the safety demands on board, new international standards in the STCW convention have addressed the requirements with regard to seafarers' physical performance. Consequently, the adverse social consequences of overweight are likely to increase, as some seafarers are likely to be forced to leave the maritime business [9]. The problem with overweight in the Danish maritime industry is likely to be one of the explanations for the high mortality and morbidity due to lifestyle-related diseases observed earlier in this population [10, 11]. The morbidity pattern of Danish seafarers may have a competitive impact as the business becomes more and more internationalized. Danish seafarers have to compete with a foreign workforce which has passed selection procedures that only allow the healthy to get through.

The percentages of officers and ratings in the merchant fleet with a so-called normal BMI (below 25) are almost equal although slightly more officers above 25 years of age are overweight or obese compared to ratings. This is somewhat surprising as there are major differences in the frequency of overweight between different social classes in Denmark, with overweight being more widespread in the less privileged strata. Furthermore, evidence shows that the shorter the education (both school and vocational training) the greater the incidence of overweight [12]. This is also evident in the reference population survey where twice as many men with less than ten years of education were obese compared to those with more than 15 years of education [5]. There may be several explanations for the association between BMI and education. A stronger social pressure for a slim figure may apply among higher social classes, especially among women [13]. In addition, the higher social classes are likely to have more focus on the problem and to adapt healthier dietary behaviours and more physical activity [14].

Fishermen have the same problem with overweight as merchant seamen. Most Danish fishermen are away from home for relative short periods of time and thus spend a large proportion of their time at home. Very few are involved in long-distance fishing. Almost all Danish fishing vessels are small and the crew prepares their own food. Social heritage may

play a special role among fishermen, who tend to stay in the environment where they grew up [15].

Some attempts have been made to change the traditional cooking on board ships [16]. The initiatives have included the production of a special cookbook for use on board offering special courses for cooks and others in charge of cooking. These initiatives, however, are only likely to have an effect in settings where the whole shipping organisation is involved and provides, for example, more appropriate, and sometimes more expensive, supplies. Traditional food at sea does not favour a low caloric diet, and special efforts have to be made for the crews to obtain access to and consume more vegetables and fresh fruit. Organized sports activities among seafarers have become rare due to shorter stays in ports and reduced crews.

Work environment factors such as sleep deprivation and sleep patterns steered by watch schedules may have an impact although the influence of these work-related circumstances is unknown [17-19]. A higher percentage of seafarers live alone without a family and this has been shown to be a risk factor for overweight. The overweight problem among seafarers and fishermen is complex in nature. Interventions should to be broad and longstanding to have any significant impact.

In conclusion, this study shows that the obesity problem among Danish seafarers still seems to be increasing. It is of a magnitude which it is of major concern because of the negative impact on the health of seafarers and on their future career at sea. Obesity among seafarers seems to be present early in life and often before entering the maritime business. This has to be taken into account when preventive measures are initiated. Finally, poor health is likely to be a competitive factor for the globalized seafarer.

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