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The Body Mass Index of San Francisco Cold-water Swimmers: Comparisons to U.S. National and Local Populations, and Pool Swimmers

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ABSTRACT

International Journal of Exercise Science 10(8): 1250-1262, 2017. To determine if cold-water swimmers have substantial differences in BMI, which might have a protective effect against heat loss during swims in cold water without wetsuits, and to determine if obesity is more or less prevalent in cold-water swimmers, we compared the body mass index (BMI) values of 103 recreational open-water swimmers (mean age 54.3 ±10.8 years) to data from various population groups. Swimmers swam consistently throughout the winter months, in the San Francisco Bay (water temperature range: 9.6° C [49.3 ° F] to 12.6° C [54.7 ° F]), without wetsuits. After matching for age and sex, the average BMI of cold-water swimmers (25.9 kg/m^2) was lower than the corresponding predicted U.S. average BMI (29.2 kg/m^2; p<.001), the predicted California state average BMI (28.0 kg/m^2; p<.001), and the predicted San Francisco city average BMI (26.6 kg/m^2; p=.047). The average BMI value for cold-water swimmers (25.9 kg/m^2) was not significantly different from values of North American masters pool swimmers (25.1 kg/m^2; p=.15) or international masters pool swimmers (25.3 kg/m^2; p=.16). 10.7% of cold-water swimmers were classified as obese (BMI $\geq$ 30 kg/m^2) vs. 35.7%, 25.8%, and 11.8% of the U.S., California, and San Francisco populations, respectively. The lower or similar BMI values of our swimmers suggest that successful recreational swimming in cold water is influenced by factors other than body habitus, such as acclimatization, heat production while swimming, and most importantly, limiting immersion time. The relatively low prevalence of obesity in our swimmers suggests that cold-water swimming could contribute to a healthy lifestyle.

KEY WORDS: Open-water swimming, hypothermia, body composition, obesity

INTRODUCTION

Swimming in cold, open water without a wetsuit is growing in popularity (2, 11, 20, 30, 31). Once considered to be the domain of elite athletes, often with elevated levels of body fat (34, 35), cold-water swimming is now attracting individuals with a wide variety of athletic backgrounds (30). Few large studies, however, have reported the body mass index (BMI) of modern cold-water swimmers, or compared the BMI of cold-water swimmers to others.

BMI is a potentially important variable in cold-water swimmers for several reasons. Traditionally, increased body fat has been associated with protection against core hypothermia related to immersion (19, 20, 37, 41). However, measurement of body fat is more difficult and more complex than measurement of BMI (33, 40), and despite its many limitations (23, 33, 40, 50), BMI is recognized nationally and internationally as a marker of obesity and adiposity (3, 12, 40, 48, 50). In a prior study, we found significant and positive correlations between % body fat and BMI in recreational cold-water swimmers (31). Similar correlations or trends are apparent in the data from other studies of cold-water swimmers (11, 20, 28). Further, core cooling has been related not only to adiposity, but also to overall body size or mass (28, 29, 39), with larger individuals cooling more slowly than smaller individuals. Even though BMI may not accurately reflect adiposity in those athletes with increased muscle mass (33, 40), prior studies have suggested that a high BMI itself, (whether reflecting greater body fat, increased muscle mass, or simply increased overall size) is associated with slower temperature decrease during cold-water swimming or immersion (2, 28, 29, 51). Thus, an increase in BMI could indicate a protective advantage regardless of a swimmer's exact body composition. Lastly, BMI has been used extensively to reflect obesity and health both generally (3, 12, 48, 50) and more specifically in sports medicine (10, 18, 31, 40, 47) – measurement of BMI could lead to further insights regarding the health and body habitus of athletes in a particular sport.

Previously, we measured BMI in a large group of swimmers who swam consistently in the San Francisco Bay, during the winter months, without wetsuits (30, 31). However, in those prior studies, BMI values from cold-water swimmers were assessed descriptively (without statistical analysis) and only in relation to broad BMI categories (obese, overweight, normal, underweight) (40). New data available from the United States National Health and Nutrition Examination Survey (NHANES) (12, 13), the California Health Information Survey (CHIS) (3, 45), and other recent studies (10, 47) now allow us to directly compare the BMI of our swimmers to national and regional BMI averages and to BMI averages from pool swimmers.

Our goals with these new comparisons are two-fold. First, we hope to determine if, when directly compared to others, cold-water swimmers have substantially higher BMI values, which might provide a protective effect against heat loss during swims in cold water without wetsuits. Second, we wish to determine if obesity is more or less prevalent in recreational cold-water swimmers, and by extension, whether or not cold-water swimming is a potentially healthy and beneficial activity. Both goals have implications to the safety and future development of the sport of open-water swimming without wetsuits.

METHODS

Participants

We measured the BMI of 103 swimmers (76 men and 27 women) who participated in the annual San Francisco Dolphin Club Polar Bear Swim. Swimmers were typically in a middle-aged category (mean age: 54.3±10.8 years; range 24-79 years). The majority of swimmers (N=64 [62.1%]) described their swim background as being recreational; 5 swimmers were in an elite category and had previously completed a solo English Channel swim, and the remaining swimmers reported an intermediate swimming background, typically with prior college or high school competition experience. As outlined below, the swim event used for this study was recreational in nature.

In other parts of the country, polar bear events often involve a brief immersion or plunge into cold water (36, 49). The San Francisco event in our study was notably different, with a focus on consistent recreational swimming in the San Francisco Bay throughout the winter months. Over a 3-month period (December 21, 2010 - March 21, 2011), participants in the Dolphin Club Polar Bear Swim swam in the San Francisco Bay without wetsuits or swim aids, with a goal of reaching a minimum 40 cumulative miles (64.4 km) for the winter. Swimmers swam at an individual pace and self-recorded their daily mileage on a chart posted in a common area of the San Francisco Dolphin Club. Swimmers who were 60 years of age or older had the option either to swim the full 40 miles or to participate in a special senior category, which required a minimum of only 20 cumulative miles (32.2 km) spread over the same 3-month period. Per the rules of the polar bear event, swimmers were allowed to voluntarily exceed the 20 or 40 mile minimums; the average cumulative 3-month winter swim distance for all 103 swimmers in our study was 46.4 ±18.8 miles (74.7 ±30.3 km) with a range of 20 to 154 miles (32.2 to 247.8 km). Swimmers generally swam between 4 and 5 times per week, with a mean reported swim time of 31.6 ±8.2 minutes per swim.

The water temperature of the San Francisco Bay during the 3-month winter swim period ranged from 9.6° C (49.3 ° F) to 12.6° C (54.7 ° F) (26). Warm showers and saunas were available to all participants both before and after swimming. Although wetsuits were prohibited, insulating neoprene caps were permitted. Swimmers were also asked to complete a written survey with questions about their swimming background and swim patterns. Additional details pertaining to the survey, the cold-water swim event, and the characteristics of our swimmers can be found in prior publications (30, 31). The California Pacific Medical Center Institutional Review Board approved the study and written consent was obtained from all participants prior to participation.

Protocol

A total of 125 swimmers participated in the 2010/2011 San Francisco Dolphin Club Polar Bear Swim. Within 15 days of the completion of the event (which ended on March 21, 2011) 103 of the 125 event swimmers consented to height and weight measurements. Height was measured using a portable stadiometer (Secca Corp.). Weight was measured using a calibrated balance beam scale (Detecto; Cardinal Scale Manufacturing Co.). BMI was calculated by dividing each subject's weight in kilograms by the square of his or her height in meters. The prevalence of obesity and the prevalence of overweight/obesity status in our swimmers were calculated based on categories used by NHANES (12). Accordingly, obesity for our study was defined by a BMI ≥ 30 kg/m^2 and overweight/obesity status was defined by a BMI ≥ 25 kg/m^2.

We compared the average BMI values and the prevalence of obesity categories in our subjects to data from several populations of adults (20 years and older). Comparisons to the United States general population were done using data published in 2012 from the National Health and Nutrition Examination Survey (NHANES) program of the National Center for Health Statistics (NCHS) (12, 13). Comparisons to the general California state population and to the general population of the city of San Francisco were done using data from the 2011-2012 California Health Information Survey (3, 45). Comparisons to international pool swimmers and North American pool swimmers were done using data from the 2009 Sydney World Masters Games (10, 47). For North American pool swimmers, additional data needed for comparisons to our swimmers (including subgroup sample sizes and standard deviations) were provided directly by the authors of a prior study (10).

Statistical Analysis

Unpaired t-tests were used to compare the average BMI of men in our study to the average BMI of women in our study. Fisher exact tests were used to compare the prevalence of obesity categories in men in our study to the prevalence of obesity categories in women in our study.

In comparisons of our swimmers to other groups, we analyzed men and women together. However, results from detailed analyses of men and women separately can be found in the Supplemental Appendix. As we outline further below, matching of our data to predicted BMI values based on sex and age also accounted for differences between our swimmers and the relative comparison groups.

We initially compared the mean BMI values of San Francisco cold-water swimmers from our study to the unadjusted mean BMI values of U.S., California State, and San Francisco city populations, using one-sample t-tests, and we compared the prevalence of obesity categories using Fisher's exact tests. However, the average age of our San Francisco cold-water swimmers was 54.3 years. While the average age of the U.S. general population was not specifically reported by NHANES, the age-distribution of the NHANES data suggests that the average age was younger than the average age of our San Francisco cold-water swimmers (12, 13). Additionally, from CHIS data, the average age of the California population sampled was 45.4 years and the average age of the San Francisco population was 44.0 years (3). Because BMI typically increases with age, these comparisons were arguably unfair to our swimmers who were being compared to younger and likely leaner populations. Differences in BMI values for men and women (Supplemental Appendix) could also have also affected these comparisons.

To further and more accurately compare our swimmers to other population groups, we matched each swimmer in our study to his or her predicted BMI value based on the mean BMI for the corresponding 10-year age and sex group from either NHANES or CHIS data. We then used paired t-tests to compare our swimmers to their own predicted values. To test the sensitivity of our results to distributional assumptions, we repeated the matched analysis using Wilcoxon signed rank tests of the 50th percentile of BMI values from NHANES or CHIS (instead of the mean).

Data from international pool swimmers and North American pool swimmers included sample sizes, means, and standard deviations. Thus, we used unpaired t-tests for the comparisons of our swimmers to these groups. As in the comparisons to U.S. and regional populations, we used Fisher's exact tests to compare the prevalence of obesity categories in our swimmers to those of pool swimmers. The mean ages of the groups were very similar (see Results section); thus, adjustments or stratification based on age were not done. As mentioned above, results from detailed analyses of men and women separately can be found in the Supplemental Appendix.

RESULTS

For descriptive statistics, we report means and standard deviations unless otherwise specified. The mean BMI of all 103 of our cold-water swimmers was 25.9 ±3.6 kg/m^2 with a range of 19.0 to 39.1 kg/m^2. BMI data stratified by sex and the prevalence of obesity categories are shown in Table 1.

Table 1. San Francisco cold-water swimmers: Body Mass Index (A) and prevalence of obesity categories (B)

A. Body Mass Index Values

	Total Group (N=103) Mean ±SD (range)	Men (N=76)* Mean ±SD (range)	Women (N=27)* Mean ±SD (range)
BMI kg/m^2	25.9 ±3.6 (19.0-39.1)	26.4 ±3.3 (20.7-37.1)	24.6 ±4.2 (19.0 -39.1)

*The average BMI of men was significantly higher than women (p=.024).

B. Prevalence of Obesity and Overweight/Obesity Categories

	Total Group (N=103)	Men (N=76)*	Women (N=27)*
Obesity %	10.7%	11.8%	7.4%
Overweight/Obesity %	53.4%	59.2%	37.0%

*Prevalence of obesity (BMI ≥ 30 kg/m^2) was not significantly different in men vs. women (p=0.34); Prevalence of overweight/obesity (BMI ≥ 25 kg/m^2) was significantly higher in men compared to women (p=0.003).

The average BMI of men (mean 26.4 ±3.3) in our study was significantly higher than the average BMI of women (mean 24.6 ±4.2) in our study (unpaired t-test; p=.024). Fifteen of the 103 swimmers (6 men and 9 women), all of whom were 60 years of age or older, opted to participate in the senior category, which required a cumulative swim distance during the winter of 20 miles rather than 40 miles. The average BMI of swimmers who swam a cumulative minimum distance of 40 miles during the winter months was not significantly different from the BMI of senior category swimmers, who were required to swim a cumulative minimum of 20 miles (25.8 ±3.4 [N=88] vs. 26.6 ±4.7 [N=15], p=.46).

Unadjusted comparisons of our swimmers to the U.S. General Population (12) and the California and San Francisco Populations (3, 45) are outlined in Table 2.

Table 2. Unadjusted comparisons of San Francisco cold-water swimmers to U.S., state, and local populations: Body Mass Index (BMI) and prevalence of obesity categories*.

	San Francisco Cold-water Swimmers (total group; N=103)	U.S. General Population (NHANES)	California State Population (CHIS)	San Francisco City Population (CHIS)
BMI kg/m^2 (mean)	25.9	28.7 (*p<0.001*)	27.2 (*p<0.001*)	25.0 (*p=0.01*)
Obesity %	10.7	35.7 (*p<0.001*)	25.8 (*p=0.010*)	11.8 (*p=1.0*)
Overweight/Obesity %	53.4	68.8 (*p=0.029*)	61.6 (*p=0.25*)	43.6 (*p=0.26*)

*BMI and obesity category values from men and women together; see the Supplemental Appendix for results for men and women separately. P-values are from direct comparisons of San Francisco cold-water swimmers to each other population group (one-sample t-tests used for comparisons of BMI means; Fisher exact tests used for comparisons of obesity categories). Obesity corresponds to BMI ≥ 30 kg/m^2, and overweight/obesity corresponds to BMI ≥ 25 kg/m^2.

The data presented in Table 2 show comparisons of our swimmers to general populations at large, without accounting for the older age of our swimmers. Although overall our swimmers compared favorably in this analysis, these comparisons were arguably unfair to our swimmers who were being compared to younger and possibly leaner general populations.

To more specifically assess the BMI of our swimmers, we matched each swimmer in our study to his or her predicted BMI value based on age and sex from either NHANES (13) or CHIS (3, 45) and then did paired-sample testing to compare our swimmers to their own predicted values (Table 3).

Table 3. Matched* comparisons of San Francisco cold-water swimmers to U.S., state, and local populations: Body Mass Index (BMI)

	San Francisco Cold-water Swimmers (total group; N=103)	U.S. General Population (NHANES) Corresponding Age/Sex -matched values	California State Population (CHIS) Corresponding Age/Sex -matched values	San Francisco City Population (CHIS) Corresponding Age/Sex -matched values
BMI kg/m^2 (mean (median))	25.9 (25.4)	29.2 (28.2) *p<0.001*	28.0 (27.2) *p<0.001*	26.6 (25.7) *p=0.047*

*P-values are from paired t-tests using corresponding age/sex matched mean values. See text for results from non-parametric Wilcoxon signed rank tests using corresponding age/sex matched median values.

From this matched analysis, the average BMI of our swimmers was (as in the unadjusted comparisons presented Table 2) lower than corresponding predicted BMI averages for either U.S. or California populations, with a high degree of statistical significance. Notably (unlike the unadjusted results presented in Table 2), after appropriate matching for age and sex, our swimmers did not have a statistically higher average BMI than San Franciscans. Figure 1 is a graphical representation of our matched results comparing the mean BMI of San Francisco cold-water swimmers to the means of their corresponding predicted BMI values based on sex and 10-year age category for U.S., California, and San Francisco populations.

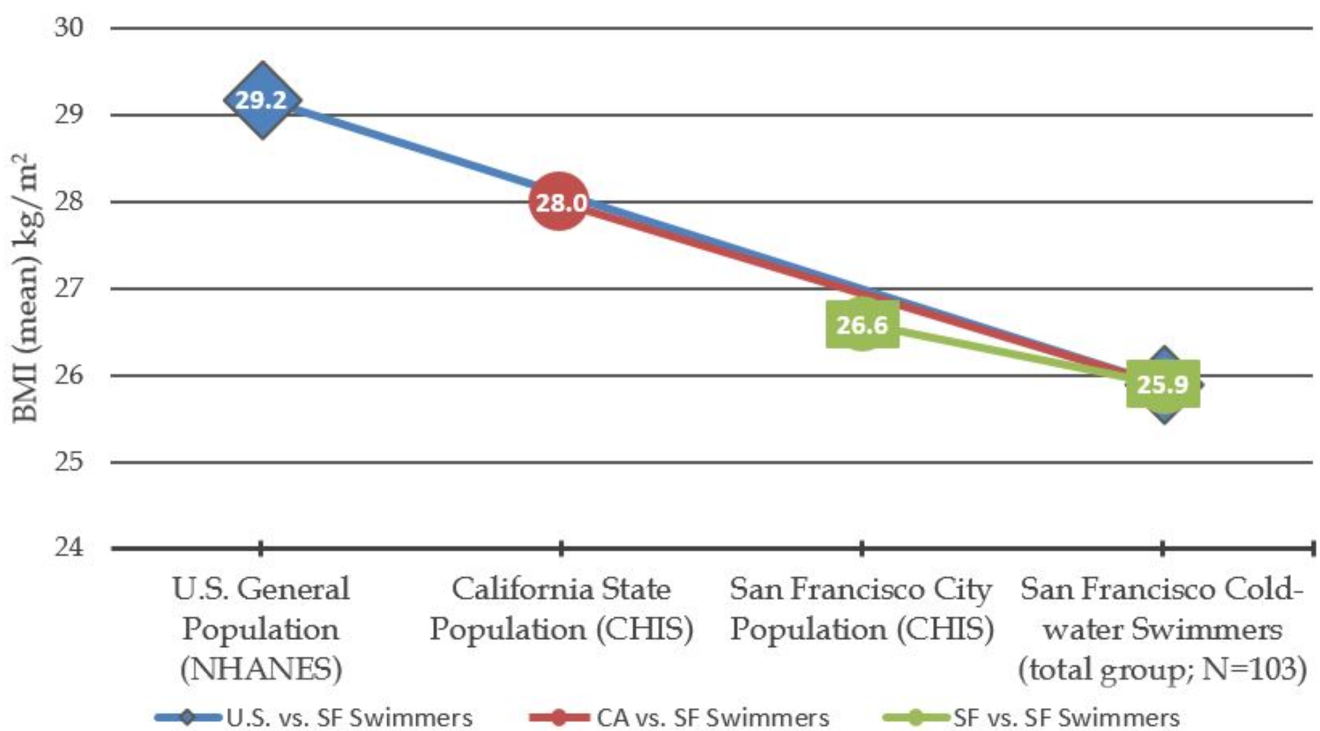

Figure 1. Graphical representations comparing the mean BMI of San Francisco cold-water swimmers to the means of their corresponding predicted BMI values based on sex and 10-year age category for U.S., California, and San Francisco populations.

The p-values shown in Table 3 are from paired t-tests, which were used to compare means. In a sensitivity analysis, which used non-parametric Wilcoxon signed rank tests to compare median values, differences remained highly significant for comparisons to corresponding U.S. and California BMI values (p-values remained <0.001 for both). However, in the repeat analysis the median BMI value of our swimmers (25.4 kg/m^2) was lower than the corresponding predicated median value in San Franciscans (25.7 kg/m^2), but the result from the non-parametric Wilcoxon signed rank test was not significant (p=0.5).

Results comparing the average BMI and prevalence of obesity categories of San Francisco cold-water swimmers to those of international (47) and North American pool swimmers (10) are presented in Table 4.

The mean ages of the groups were very similar; San Francisco cold-water swimmers: 54.3 ±10.8 years; international pool swimmers: 54.3 ±12.2; North American masters pool swimmers: 57.2 ±12.9 years. Thus, adjustments or stratifications based on age were not done. The average BMI values and prevalence of obesity categories in San Francisco cold-water swimmers were similar to those in both international and North American pool swimmers; no significant differences were found in any statistical comparison.

Table 4. Comparison of San Francisco Cold-water Swimmers to International and North American Pool Swimmers*

	San Francisco Cold-water Swimmers (total group; N=103)	International Masters Pool Swimmers (total group; N=527)	North American Masters Pool Swimmers (total group; N=64)
BMI kg/m² (mean ±SD)	25.9 ±3.6	25.3 ±4.0 (*p=0.16*)	25.1 ±3.2 (*p=0.15*)
Obesity %	10.7	9.1 (*p=0.81*)	9.4 (*p=0.81*)
Overweight/Obesity %	53.4	45.2 (*p=0.32*)	51.6 (*p=1.0*)

*BMI and obesity category values are from men and women together; see the Supplemental Appendix for results for men and women separately. P-values are from direct comparisons of San Francisco cold-water swimmers to each other group (unpaired t-tests used for comparisons of BMI means; Fisher exact tests used for comparisons of obesity categories). Obesity corresponds to BMI ≥ 30 kg/m², and overweight/obesity corresponds to BMI ≥ 25 kg/m².

DISCUSSION

Two important findings are apparent from this study. First, in direct comparisons, the average BMI of our swimmers was lower than or similar to the BMI averages of U.S., California, and San Francisco populations and similar to the BMI averages of pool swimmers. Thus, in comparison, our swimmers did not appear to have increased protection from cold water based on a common measure of body habitus. Second, the prevalence of obesity in our swimmers was substantially lower than that of the U.S. general population. This suggests that cold-water swimming is a potentially beneficial activity that may contribute to a healthy lifestyle. As we outline below, both of these findings have important implications toward the sport of open-water swimming without wetsuits.

It is important to consider why our swimmers were successful at swimming in cold water even though they did not have increased BMI values, especially when compared to pool swimmers. Although body composition variables, including BMI, are highly important for protection from cold exposure, other variables contribute to successful swimming in cold water. Prior literature suggests that acclimatization (1, 4-7, 14, 19, 21, 42-44), heat production while swimming (9, 24, 25, 42), and perhaps most importantly, limiting time in cold water (17, 32, 39, 41, 51) could all improve the likelihood of a successful cold-water swim. However, both acclimatization and heat production have limits (4-7, 15, 19, 24, 25, 28, 37, 38, 42), and longer time in cold water has been clearly associated with an increased risk of hypothermia. Thus, not surprisingly, the average time in the water per swim of our swimmers was relatively brief (average 31.6 minutes).

In a prior study (31), we did not find a significant correlation between BMI and time per swim, but cold-water swim times in that study were also relatively brief (average 32.5 minutes). Future studies with a larger range of swim times may show a significant association between BMI and time spent swimming in cold water. Further, although definitive algorithms for swimming time based on water temperature and BMI have not been formulated, one prior study in cold-water swimmers has suggested a 43% reduction in hypothermia rate for every whole unit increase in BMI (2). Even though the specific relationships between BMI and immersion time or hypothermia are potentially important, our view is that regardless of body habitus, limiting time in cold water remains a key safety factor that should be stressed whenever cold-water swims are done without wetsuits.

While our swimmers overall were not obese, they were not overly thin either. Although not more protected against cold on the basis of BMI than U.S. or regional populations, or pool swimmers, the average BMI of our swimmers was higher than the BMI values seen in other athletes. Middle-aged ultramarathon runners, for example, typically have low BMI values (18), and our swimmers would be expected to have comparatively greater protection from hypothermia. Thus, the relative importance of BMI in our swimmers depends to some extent on the population used for comparison.

In general, the BMI and obesity category values of our swimmers compared favorably to those from U.S. and regional populations. Comparisons to the U.S. general population were particularly striking, with our swimmers having a dramatically lower prevalence of obesity than the national average. This suggests that regular cold-water swimming, like many forms of exercise, may help individuals establish and maintain a lower BMI. On the other hand, the average BMI of our swimmers, while not in an obese category, was in an overweight category (12, 40). Others have commented about the obesity epidemic facing our nation (48), and some might argue that the BMI of our swimmers, while better than U.S. averages, should have been lower. Further longitudinal studies would be needed to more fully determine the health benefits of cold-water swimming and the relationship between BMI and health in cold-water swimmers.

In terms of BMI and obesity prevalence, our swimmers were more similar to the local San Francisco population than to either U.S. or California populations. Data from CHIS generally suggests that San Franciscans are on average leaner than the U.S. general population (3, 45). Lower BMI values have been reported in Asian populations (50), and higher ethnic diversity in San Francisco may partially account for the lower BMI in the San Francisco population. We did not adjust for ethnicity in our study and cannot comment further on the role ethnicity may have played. Prior data also suggest that San Franciscans enjoy a more active lifestyle than those in other parts of the nation (8). Thus, the BMI similarities of our swimmers to other San Franciscans, again lends support to our swimmers being active – like their local population.

We used BMI in this study because it is easy to measure (40) and practical when studying large groups of athletes (2, 10, 18, 47). Because we did not analyze body fat, we cannot be certain of the correlation between BMI and adiposity in our swimmers. However, because BMI typically overestimates adiposity in athletes (33, 40), our findings are likely conservative – it is likely that a higher muscle mass (with proportionally lower body fat) contributed to the BMI of some of our swimmers, and possible that our swimmers as a group may have been even leaner and less obese when compared to U.S. or regional general populations. Regardless of whether BMI in our swimmers reflected adiposity, muscle mass, or overall size, BMI values were not increased relative to others, and substantial protection from hypothermia cannot be implied. The studies of pool swimmers we used for comparison (10, 47) similarly measured BMI but did not analyze body fat. Future studies, with detailed comparisons of body fat, muscle mass, and other biophysical parameters, could yield further insights into the body composition and performance of cold-water swimmers, pool swimmers, or other athletes.

CHIS data (3, 45) and data from studies on pool swimmers (10, 47) relied on reported rather than measured height and weight data for the calculation of BMI. Reported values may underestimate BMI (23) and thus may have favored other groups over our swimmers – again lending support to our findings being conservative. We did not measure potentially beneficial and thermogenic brown fat (brown adipose tissue) (16); measurement of brown fat requires sophisticated equipment and radiation and was beyond the scope of this study. Unlike other studies (11, 22, 24, 27, 46), our study focused primarily on recreational rather than elite cold-water swimmers, and results should be interpreted accordingly

In summary, our study found that the average BMI of a dedicated group of recreational cold-water swimmers was lower than or similar to the BMI averages of U.S., California, and San Francisco populations and similar to the BMI averages of pool swimmers. The lower or similar BMI values of our swimmers suggest that successful recreational swimming in cold water is influenced by factors other than body habitus, such as acclimatization, heat production while swimming, and most importantly, limiting immersion time. The prevalence of obesity in our swimmers was substantially lower than that of the U.S. general population. This suggests that cold-water swimming is a potentially beneficial activity that may contribute to a healthy lifestyle.

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Original Research

The Body Mass Index of San Francisco Cold-water Swimmers
Comparisons to U.S. National and Local Populations, and Pool Swimmers

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Supplemental Appendix

Appendix Table 1. Further Unadjusted Comparison of San Francisco Cold-water Swimmers to U.S. National, California, and San Francisco Populations: Body Mass Index and Prevalence of Obesity (including breakdown by sub-populations of men and women).

A. San Francisco Cold-water Swimmers vs. U.S. General Population

	SF Cold-water Swimmers BMI Mean	U.S. Population BMI Mean	p-value	**SF Cold-water Swimmers Obesity (%)**	U.S. Population Obesity (%)	p-value	**SF Cold-water Swimmers Obesity/Overweight (%)**	U.S. Population Obesity/Overweight (%)	p-value
Total	**25.9**	28.7	<.001	**10.7**	35.7	<.001	**53.4**	68.8	.029
Men	**26.4**	28.7	<.001	**11.8**	35.5	<.001	**59.2**	73.9	.036
Women	**24.6**	28.7	<.001	**7.4**	35.8	<.001	**37.0**	63.7	<.001

B. San Francisco Cold-water Swimmers vs. California State General Population

	SF Cold-water Swimmers BMI Mean	CA Population BMI Mean	p-value	**SF Cold-water Swimmers Obesity (%)**	CA Population Obesity (%)	p-value	**SF Cold-water Swimmers Obesity/Overweight (%)**	CA Population Obesity/Overweight (%)	p-value
Total	**25.9**	27.2	<.001	**10.7**	25.8	.010	**53.4**	61.6	.25
Men	**26.4**	27.6	.003	**11.8**	26.8	.012	**59.2**	68.4	.24
Women	**24.6**	26.8	.011	**7.4**	24.8	.001	**37.0**	55.0	.016

C. San Francisco Cold-water Swimmers vs. San Francisco City General Population

	SF Cold-water Swimmers BMI Mean	SF Population BMI Mean	p-value	**SF Cold-water Swimmers Obesity (%)**	SF Population Obesity (%)	p-value	**SF Cold-water Swimmers Obesity/Overweight (%)**	SF Population Obesity/Overweight (%)	p-value
Total	**25.9**	25.0	.01	**10.7**	11.8	1.0	**53.4**	43.6	.26
Men	**26.4**	25.5	.017	**11.8**	11.7	1.0	**59.2**	48.5	.20
Women	**24.6**	24.5	.91	**7.4**	12.0	.34	**37.0**	37.7	1.0

Appendix Table 2. Further Comparison of San Francisco Cold-water Swimmers to International and North American Masters Pool Swimmers: Body Mass Index and Prevalence of Obesity (including breakdown by sub-populations of men and women).

A. International Pool Swimmers

	SF Cold-water Swimmers BMI Mean (N)	Internat Pool Swimmers BMI Mean (N)	p-value	**SF Cold-water Swimmers Obesity (%)**	Internat Pool Swimmers Obesity (%)	p-value	**SF Cold-water Swimmers Obesity/Overweight (%)**	Internat Pool Swimmers Obesity/Overweight (%)	p-value
Total	**25.9 ±3.6 (103)**	25.3 ±4.0 (527)	.16	**10.7**	9.1	.81	**53.4**	45.2	.32
Men	**26.4 ±3.3 (76)**	25.9 ±3.2 (262)	.23	**11.8**	9.2	.65	**59.2**	55.0	.67
Women	**24.6 ±4.2 (27)**	24.6 ±4.5 (265)	1.0	**7.4**	9.1	.80	**37.0**	35.5	1.0

B. North American Pool Swimmers

	SF Cold-water Swimmers BMI Mean (N)	NA Pool Swimmers BMI Mean (N)	p-value	**SF Cold-water Swimmers Obesity (%)**	NA Pool Swimmers Obesity (%)	p-value	**SF Cold-water Swimmers Obesity/Overweight (%)**	NA Pool Swimmers Obesity/Overweight (%)	p-value
Total	**25.9 ±3.6 (103)**	25.1 ±3.2 (64)	.15	**10.7**	9.4	.81	**53.4**	51.6	1.0
Men	**26.4 ±3.3 (76)**	25.8 ±2.8 (20)	.46	**11.8**	10.0	.82	**59.2**	60	1.0
Women	**24.6 ±4.2 (27)**	24.8 ±3.3 (44)	.82	**7.4**	9.1	.80	**37.0**	47.7	.15