Research Article

ISSN 2639-944X

Journal of Medical - Clinical Research & Reviews

Addressing Obesity in the Oceanic Population: Challenges, Solutions, and Pathways to Health

Thomas E. Barnett*

Professor of Exercise and Sport Science, Doctor of Health Science Student, Keiser University.

***Correspondence:**

Thomas E. Barnett, Professor of Exercise and Sport Science; Doctor of Health Science Student - Keiser University, 2874 SE Rawlings Rd Port St Lucie, Florida, USA, Tel: (443) 856 – 9544.

Received: 11 Dec 2023; **Accepted:** 14 Jan 2024; **Published:** 20 Jan 2024

Citation: Barnett TE. Addressing Obesity in the Oceanic Population: Challenges, Solutions, and Pathways to Health. J Med - Clin Res & Rev. 2024; 8(1): 1-10.

ABSTRACT

This study is a triphasic exploration of the Oceania region's disproportionate obesity rates and access to obesity-related clinical trials. To accomplish this, this study investigated the prevalence of obesity clinical trials compared to the worldwide population proportion, the validation of existing obesity data for this population, and the application of exercise and non-exercise-based clinical trials. No statistically significant relationship was noted between the regional population and obesity clinical trial proportions. Simply, the size of a regional population did not directly influence the number of clinical trials. However, findings did validate that Oceanic populations exhibit higher Body Mass Index (BMI) values compared to the global population, in alignment with previous literature. One-sample t-tests revealed a statistically significant difference (p <.001) difference between mean BMI, obesity rate (BMI >30), and morbid obesity rate (BMI >40) in Oceanic populations compared to worldwide rates. Despite the disproportionate obesity rates in this demographic, a negligible number of clinical trials, especially those including exercise interventions, have been made available to this population. Finally, exercise-based clinical trials were used infrequently worldwide, a rate that was exceptionally low amongst studies conducted in the Oceania region. Of note, emerging literature suggests that Oceanic populations, specifically Polynesians, exhibit a genetic anomaly that increases body mass without necessarily increasing fat mass via allele rs373863828. Thus, while the existing BMI data expresses significantly higher obesity rates, more comprehensive research is needed on this population to understand this demographic's typical body composition. Otherwise, some areas within the Oceania region continue to exhibit obesity rates exceeding five times that of the world average, yet are rarely provided with obesity clinical trials to mitigate obesity-related disease and comorbidities. These findings suggest a need for more equitable allocation of research resources to address the unique challenges posed by obesity in the Oceanic population.

Keywords

Allele rs373863828, Body Mass Index (BMI), exercise interventions, Oceania, Obesity clinical trials.

Introduction

Obesity is an ongoing worldwide health issue that affects different populations to varying degrees. Obesity is generally associated with an inactive or sedentary lifestyle in combination with indulgent dietary patterns [1]. Moreover, obesity is commonly associated with comorbidities such as diabetes mellitus, cardiovascular disease, osteoarthritis, and a variety of other conditions [2]. Despite the largely controllable nature of obesity, millions of individuals fail to establish a lifestyle change that mitigates the risk of obesity and its associated complications.

Given its relationship with legitimate and serious medical conditions, obesity has been a focal point of the medical community for many years, including within clinical trials. Obesity clinical trials and the overall body of obesity research have investigated the effects of pharmacotherapy (drugs and dietary supplements), education, nutritional strategies, motivational strategies, and exercise interventions [3-12]. The dispersion of such clinical trials has been relatively centralized to areas such as North America and Europe, providing little opportunity for improvement in other regions suffering from high rates of obesity, such as Oceania. This study aims to review and compare the prevalence of obesity and availability of obesity-related clinical trials in Oceania compared to other notable regions.

Oceania and Obesity

Oceania is a geopolitical region that includes a myriad of sovereign states and dependent territories in the southern Pacific region. Oceania includes the likes of Australia, Papua New Guinea, Western New Guinea, New Zealand, Hawaii, Fiji, Solomon Islands, Vanuatu, French Polynesia, New Caledonia, Samoa, Guam, Kiribati, Tonga, Northern Mariana Islands, American Samoa, Marshall Islands, Palau, Cook Islands, Nauru, Wallis and Futuna, Tuvalu, Niue, Tokelau, Pitcairn Islands, and the Federated States of Micronesia. These territories are collectively a part of larger countries like the United States, the United Kingdom, France, and Indonesia to supplement the included countries (IE Australia, New Zealand).

Oceania's territories are generally associated with excessively high rates of obesity. For example, these territories account for each of the top 13 countries for obesity percentage among adult males, followed by the United States at number 14 [13]. Given this data, it is important to address the regional obesity epidemic in Oceania.

Need for Obesity Clinical Trials

Obesity is generally classified using body mass index (BMI). Any BMI exceeding 30 would be classified as obese and any BMI exceeding 40 would be considered morbidly obese. Since obesity is often considered preventable and is also associated with other serious comorbidities, it is important to address this systemic issue [1,2]. Not only is obesity associated with diseases that may detract from the quality of life, but it also typically decreases lifespan. In fact, Tam et al. noted that obesity is associated with lifespan reductions of 5.8 years and 7.1 years in males and females after the age of 40 [14]. Moreover, Tam et al. indicate that obesity reduces nuclear and mitochondrial DNA integrity, modifies DNA methylation patterns, shortens telomeres, decreases functional capacity, and increases systemic inflammation. Ultimately, these factors exemplify the need to mitigate the incidence of obesity far beyond the scope of aesthetics.

Cause of Obesity in Oceania

To better understand the needs of the Oceanic population, it is important to identify the causes of obesity and any relationship to specific comorbidities in this demographic. Many Oceanic people, including Pacific Islanders, are considered Polynesian, Micronesian, Melanesian, or Marianas. According to Hanson et al., Polynesian populations commonly had CREBRF gene variants that were associated with increased BMI. The incidence of these gene variants, namely the A allele at rs373863828, was identified in Polynesians 9.6 – 25.9% compared to the global frequency of 0.004%. Interestingly, the A allele was associated with a higher BMI but had the opposite effect on diabetes. Moreover, this allele was also found in Marianas and Micronesian populations at notably higher rates than the global frequency (1.1% and 5.4%, respectively) while exhibiting the same relationships with increased BMI and decreased risk of diabetes [15].

In short, the A allele at rs373863828 has shown an increase in lipid accumulation and decreased cellular energy expenditure, ultimately reducing caloric expenditure which could further exacerbate weight gain. Ultimately, it is fair to say that some Oceanic populations are genetically predisposed to a greater risk of obesity according to BMI, especially Polynesians. Interestingly, further research suggests that, despite the higher BMI exhibited in Polynesians, the A allele of the rs373863828 variant is significantly associated with decreased myostatin levels and resultantly, decreased fat mass. Thus, it's possible that this hereditary gene variant may effectively increase Polynesian lean body mass rather than fat mass [16]. Contrarily, these individuals likely have a decreased risk of diabetes, though the prevalence of other comorbidities is currently unknown [15].

Cultural and Environmental Implications

A recent study conducted on families living on Lifou Island, a remote atoll (small, detached island) considered a part of New Caledonia, investigated food frequency, movement, and BMI in forty farming families. This research found that diet was a primary driver of adult obesity on Lifou Island. More specifically, diets high in fruit, cheese, red meat, and pork were associated with overweight and obese classifications. Similarly, diets high in protein, likely from the aforementioned red meat and pork, were associated with low physical activity. Moreover, this study found that moderate and vigorous physical activity effectively prevented the development of obesity in Lifou Island children. Noteworthy, most adults only engaged in low-intensity physical activity, a trend that increased with age. These results suggest that physical activity and nutrition are key determinants of obesity in at least one Oceanic region [17].

Attempts to combat childhood obesity have been made in some Oceanic areas.

Littlewood et al. reviewed the effectiveness of three different interventions aimed at treating childhood obesity in Maori and Pacific Islanders. Of note, all participants in the compared studies exercised fewer than two times per week and were also classified as obese, displaying a clear relationship between childhood activity levels and body mass [18]. Of the three interventions compared, the two direct exercise-related interventions yielded favorable and significant improvements in health outcomes while the third, which monitored screen time, yielded no favorable or significant improvements [18]. Of the three interventions, Anderson et al. yielded the most favorable results pertaining to BMI. This research used a multi-faceted approach to increase physical activity levels (under supervision), health literacy, and psychological perceptions of healthy lifestyles/habits. Resultantly, those that attended at least 70% of sessions experienced significant reductions in BMI [19].

The Oceanic region is unique because most of its constituents are islands separated by oceans. Moreover, these islands vary in size, with smaller islands offering fewer amenities and being considered remote atolls. Given the general lack of amenities on these remote atolls, many inhabitants become transitional residents that live part-time both on a main island (i.e., New Caledonia, Pohnpei) and a remote atoll (i.e., Lifou Island, Pingelap). Research has shown differences in health-based behaviors between inhabitants of main islands, remote atolls, and transitional populations. More specifically, transitional populations exhibited notably worse health habits including a significantly reduced likeliness to exercise. However, in this study, the intensity of exercise was not measured, so it is unclear whether there were any trends regarding exercise intensity that could help facilitate BMI or disease risk [20].

The research provided by Balick et al. supported that of Galy et al., indicating that nutrition was a contributing factor to the high obesity rates in the Oceanic region. This has evidently become a more pressing issue in recent years as nutrition has slowly transitioned away from traditional foods (i.e., fruits, vegetables, etc.) and towards more modern foods (i.e.,, processed foods, artificial beverages, etc.). In fact, such changes have created public health challenges for Oceanic regions like Pohnpei because of persistent macronutrient and micronutrient deficiencies or malnutrition. Supplementing the obesity problem, Pohnpeians were surveyed in 2002, finding that 52.6% were at a high risk (3-5 factors) for non-communicable diseases [17,20].

Need for Support

Obesity is a worldwide challenge that affects nearly 700 million people across the globe.

While the absolute populations of Oceania countries are relatively low, their obesity rates are staggering when compared to other countries. For example, 61% of Nauru citizens are considered obese. More concerning, there is currently no notable obesity research occurring in this region. Generally, obesity research has been considered transcontinental, with countries like the United States and Australia leading research initiatives, yet the Oceania countries have not been beneficiaries of such partnerships [21]. Considering the proximity, it would be reasonable for Oceania countries to establish partnerships and obesity research opportunities with Australian researchers or institutions.

Many questions remain regarding the causative and preventative factors related to obesity in Oceanic populations. For example, education level has a direct positive relationship with BMI in many demographics (i.e., non-Hispanic white women/men) which does not appear to be the case for other demographics (i.e., Hispanic men) [22]. The effect of education and health literacy is relatively understudied in Oceanic populations; however, some literature supports that parental education directly relates to child BMI in these regions [23]. Additional research supports this notion but insists that education and hunting production are covariates to BMI [17]. Moreover, a greater understanding of obesity attributions would be beneficial to interpreting and administering optimal resolutions, prompting the need for further research on obesity in Oceanic populations.

Obesity Measuring Accuracy

To date, very few studies exist that analyze the true body composition of Oceanic populations. Rather, the available studies generally use BMI as a means of measurement to classify individuals as overweight or obese. BMI and other anthropometric measures offer limited insight into the true distribution of body mass and whether that mass is fat-related and ultimately disease contributing. Moreover, BMI is not always considered an applicable tool for children because biological maturation must be considered [23]. For example, the World Health Organization established that BMI was not appropriate for Asian and Pacific Island children. Interestingly, one of the few studies that measured body fat percentage (BF%) rather than BMI in Oceanic populations did so in Samoan children, finding that these children did indeed have a higher BF% but a lower trunk-to-peripheral fat ratio compared to other ethnic groups [24,25]. Considering the potential implications of heredity differences among Oceanic populations, a more definitive interpretation of body composition is warranted for this demographic beyond the capabilities of BMI [15,16,23].

Existing Obesity Research

The current literature available regarding obesity clinical trials and research suggests that pharmacotherapy has a positive outlook, however, existing treatment options are somewhat limited. In short, promising drugs are in development stages but further evidence is needed to understand the longitudinal effects, dose responses, and side effects related to concomitant drug use or general physiological function [6]. Obesity research has also targeted health literacy as a means of weight management, yielding some positive results [4]. Motivational strategies have also established favorable BMI reductions in some clinical trials. Importantly, both professional- provided and family-provided motivation techniques and autonomy appear to have positive outcomes. However, the long-term effects and practicality of these techniques are relatively unknown [12].

Nutrition and physical activity are primary contributors to obesity, as noted by Balick et al. and Galy et al. Nutritional strategies have established significant BMI reductions in clinical trials, which have been exacerbated, in some cases, with the use of dietary supplements, such as zinc. Such studies typically rely on a modest caloric restriction, ideally around 300 kilocalories below the estimated energy requirement to maximize sustainability [7]. Interestingly, many clinical trials investigate the effects of specific dietary patterns, such as time- restricted feeding, on body composition. Such interventions have yielded mixed results, which may be partly due to a high rate of attrition in such studies [10].

Exercise and physical activity interventions have yielded some of the most dramatic positive effects on obesity in clinical trials and obesity research. For example, Lee et al. found that different exercise programs (aerobic, resistance, or combined) all increased insulin- stimulated glucose disposal and intermuscular adipose tissue. Additionally, aerobic and combined exercise programs reduced liver fat significantly, though resistance training did elicit non-significant reductions. Similarly, Christensen et al. found that aerobic and resistance training each significantly reduced epicardial adipose tissue while increasing left ventricular mass. Additionally, resistance training reduced pericardial adipose tissue in this study targeting individuals with abdominal obesity. These studies exemplify the resounding effects of exercise and physical activity not only on body mass, but specifically on body fat. More importantly, exercise interventions propagate visceral fat loss, helping to reduce the incidence of obesity- related comorbidities [26].

Realistically, obesity should be addressed with multifaceted interventions that include exercise as at least one component to maximize health outcomes. For example, Cadenas-Sanchez et al. noted significantly greater reductions in visceral body fat using exercise combined with a psychoeducation program (PP) compared to the PP alone, though both groups established noteworthy effects. Similarly, a comprehensive multi-phase health literacy program, supplemented with physical activity and accountability check-ins, established greater initial weight loss and better post-intervention weight maintenance in rural United States communities [9]. Long-term accountability is a concept worth noting since many obesity interventions produce short-term benefits that are reversed post-intervention. For example, Rhee et al. used self-guided management strategies resulting in BMI decreases in an obese pediatric population, however, some of those reductions were negated between post treatment and follow- up, indicating that these may not be sufficient long-term obesity management techniques without further evaluation or accountability [11]. Thus, even exercise interventions for obesity may require periodic monitoring post-intervention to establish meaningful long-term benefits. Overall, evidence suggests that more obesity clinical trials are needed, specifically those using exercise interventions and/or a combination of interventions. As it stands, it appears that exercise intervention-based obesity clinical trials consistently yield the most positive health outcomes. The forthcoming analysis aims to validate the lack of exercise intervention obesity clinical trials, specifically in the Oceanic region.

Methods

This study included three primary analyses. First, clinical trial data was collected from ClinicalTrials.Gov in two stages. All completed worldwide obesity clinical trials were recorded. Subsequently, all completed worldwide obesity clinical trials using exercise interventions were recorded. The ClinicalTrials.Gov website provides all study data via Microsoft Excel documents alongside tables and maps displaying the distribution of trials worldwide. This study recorded all data for further analysis via Microsoft Excel and IBM SPSS Statistics. Prior to data analysis, Microsoft Excel was used to eliminate duplicate studies. To compare the cleaned data, this study conducted an intergroup analysis of variance (ANOVA) between the "All Obesity Clinical Trials" (AOC) group and the "Exercise Intervention Obesity Clinical Trials" (EIC) group.

Second, this study collected population data provided by the United Nations to interpret the proportional distributions between regional populations in comparison to the same proportions of clinical trials. Data were collected and manually sorted to minimize ambiguity caused by coding/grouping differences from data sources. For example, ClinicalTrials.Gov separated Asia into five groups (East Asia, Middle East, North Asia, South Asia, and Southeast Asia) while the United Nations data grouped all of these into one group (Asia) despite some Middle East countries technically falling within African jurisdiction. Similarly, ClinicalTrials.Gov provided data for Central America and South America while the United Nations condensed these regions into one, Latin America and the Caribbean. Thus, all groups and their associated populations, EIC proportions, and AOC proportions were subsequently matched, congregated, and analyzed using both Microsoft Excel and IBM SPSS to identify relationships, or a lack thereof, between groups. Statistical analyses including Chi-Square, Pearson Correlation, and ANOVA tests.

Lastly, this study investigated the statistical significance of BMI in Oceanic populations compared to worldwide data. This data was made available by Abarca-Gomez et al. and included BMI data for both males and females from 1975 to 2016 [27]. Collected data was analyzed to understand historical differences between Oceania and all other regions. Thus, descriptive statistics were recorded to determine the mean BMI, prevalence of obesity (BMI >30), and prevalence of morbid obesity (BMI >40). Collected means were used as test values for subsequent one-sample t-tests in each respective category using IBM SPSS software.

Results

The distribution of clinical trials defined by ClinicalTrials.Gov for EIC and AOC is displayed via Table 1, which exemplifies that, of all obesity clinical trials worldwide, a relatively small proportion (22.54%) of those trials include exercise interventions. Regional data were considered highly correlated via Pearson Correlation test, establishing statistical significance ($p < .001$), shown in Figure 1. Analysis of variance (ANOVA) test further validated the relationship between the proportion of AOC and EIC groups, shown in Figure 2.

Table 1: Comparison of Exercise Intervention Obesity Clinical Trials and All Obesity Clinical Trials.

Country/ Region	Exercise Intervention Obesity (EIC) Clinical Trials	All Obesity (AOC) Clinical Trials
Africa	11	128
Oceania	7	74
Latin America	41	237
Asia	98	668
Europe	313	1734
North America	960	3504
Total	***1430 (22.54%)***	***6345***

Symmetric Measures					
Value			Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Interval by Interval	Pearson's R	.986	.012	11.912	<.001[c]
Ordinal by Ordinal	Spearman Correlation	1.000	.000[c]		
N of Valid Cases		6			
a. Not assuming the null hypothesis.					
b. Using the asymptotic standard error assuming the null hypothesis.					
c. Based on normal approximation.					

Figure 1: Pearson Correlation of EIC and AOC Distributions.

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.220	1	.220	141.873	<.001[b]
	Residual	.006	4	.002		
	Total	.226	5			
[a]Dependent Variable: AllObesityTrials						
[b]Predictors: (Constant), EITrials						

Figure 2: ANOVA of AOC and EIC Groups.

This study also investigated the proportional distribution of clinical trials compared to regional population proportions. In theory, the number and proportion of clinical trials should relate to the regional population. In layman's terms, larger demographics should have more clinical trials available. Table 2 represents the respective population, EIC, and AOC proportions of each worldwide country or region. Upon initial observation, it is clear that the proportional relationship between each country/region is not consistent in this regard. For example, Asia accounts for nearly 60% of the world's population but just over 10% of the obesity clinical trials, and even fewer obesity clinical trials that use exercise interventions. This relationship was further examined via Pearson Chi-Square, ANOVA, and Pearson Correlation tests.

Table 2: Proportional representation of world population, EIC, and AOC.

Country/Region	% World Population	Obesity Trials - EIC	Obesity Trials - AOC
Oceania	0.54%	0.490%	1.166%
Africa	17.20%	0.769%	2.017%
Latin America	8.40%	2.867%	3.735%
Asia	59.50%	6.853%	10.528%
Europe	9.60%	21.888%	27.329%
North America	4.70%	67.133%	55.225%

The World Populations did not establish statistically significant relationships with either AOC or EIC groups. Pearson Correlations were -.246 and -.195 for EIC and AOC, respectively (Figure 4). Pearson Chi-Square tests were also statistically insignificant for both EIC and AOC (p = .224). Lastly, no statistical significance was noted via ANOVA for EIC (p = .638) or AOC (p = .711). Collectively, these analyses suggest that no clear relationship exists between regional populations and obesity clinical trial proportions although the Oceania population did exhibit only modest differences in these proportions.

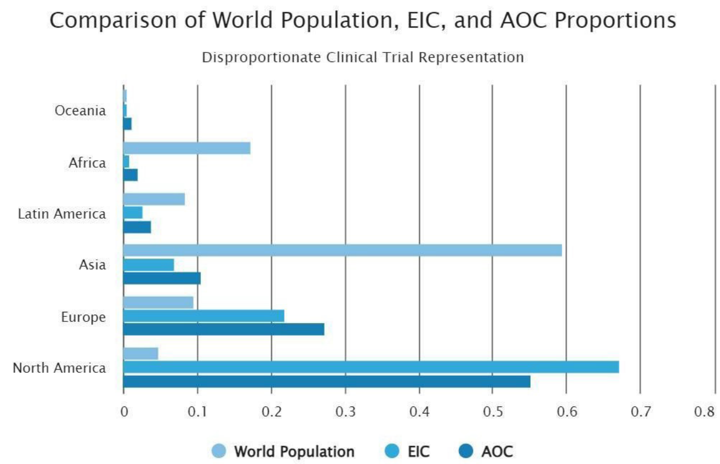

Figure 3: World Population, EIC, and AOC Proportions.

Correlations						
				Statistic		
Variable	Group	Correlation	Count	Lower C.I.	Upper C.I.	Notes
WorldPop	EIC	-.246	6	-.882	.706	Normality assumption is not accurate
	AOC	-.195	6	-.869	.732	Normality assumption is not accurate
C.I. Level: 95.0						

Figure 4: Pearson Correlation for World Population vs. EIC and AOC Groups.

The tertiary analysis identified significant differences between the BMI of Oceanic populations compared to all populations. One-sample t-tests identified that Oceanic populations yielded a greater BMI (24.403) compared to all populations (23.749). Similarly, one-sample t- test identified that Oceanic populations had a higher prevalence of obese (.15562) and morbidly obese (.01121) persons when compared to all populations (.107577 and .007221, respectively). All recorded values established statistical significance (p < .001) via one- and two-sided t-tests.

Figure 5 shows the statistical values resulting from an analysis of BMI data between Oceanic and world populations. Finally, Figures 6 and 7 display the comprehensive t-test results which established statistical significance between Oceanic and world populations for obesity and morbid obesity classifications by BMI.

Discussion

This study aimed to determine if the Oceanic population had been represented fairly within obesity clinical trials, but more specifically, exercise intervention obesity clinical trials. This data collectively indicates numerous key points. First, the Oceania region has established very few obesity clinical trials despite being identified as a disproportionately obese population, which this study validated. Moreover, this region has been associated with a negligible number of obesity clinical trials using exercise interventions despite consistent significant positive health outcomes from such trials [5,8,26]. Considering the geographic and cultural limitations experienced in Oceania, exercise is not only a strong method to facilitate body mass, but it is likely one of the most practical.

Clinical Trial Insufficiency

The results established that this demographic is underrepresented in obesity clinical trials despite a disproportionately high obesity rate. The analysis identified first that the Oceanic region has not been fairly represented and worldwide obesity clinical trials. The insufficient representation of the oceanic region and obesity clinical trials includes trials with exercise interventions. Ultimately, the Oceanic region makes up a relatively small proportion of the world, which is somewhat proportionately reflected in its clinical trial presence. The Oceanic region, which included Australia and New Zealand in this study, accounted for roughly half a percent of the world population and exercise intervention obesity clinical trials. Interestingly, the proportionate reflection of regional populations and exercise intervention obesity clinical trials was not exemplified by all regions analyzed in this study such as North America and Asia.

As a whole, obesity clinical trials used exercise interventions at a modest rate considering the well-documented benefits of such interventions. Of 6345 obesity clinical trials, only 1430 (22.54%) included exercise interventions. This rate fluctuated between worldwide regions, and in the case of the Oceanic region, was substantially lower. In the Oceanic region, there were 74 obesity clinical trials, and only seven used exercise interventions, establishing a rate of 9.46%. Thus, not only did the Oceanic region exhibit a meager proportion of overall obesity clinical trials, but this region also had a notably lower incidence of exercise intervention clinical trials for obesity. While it is easy to suggest that the number of obesity clinical trials, with and without exercise interventions, is due to the minute world population in the Oceania region, other regions outproduced their world population proportions significantly with respect to obesity clinical trials. For example, North America accounts for only 4.70% of the world population but accounts for over 67% of the exercise intervention obesity clinical trials worldwide. Such scenarios, combined with other regions that underproduced clinical trials compared to their world population proportions, are the cause for the insignificant correlations between the world pop and EIC and AOC groups. Ultimately, the Oceania region could and should benefit from a greater number of obesity clinical trials.

Disproportionate Obesity Rates

A secondary purpose of this study was to attempt to validate the existing obesity data for the Oceanic population. This analysis identified a clear significant difference ($p < .001$) between oceanic populations and the overall worldwide population with respect to obesity. The analysis investigated the mean BMI, prevalence of obesity (>30 BMI), and morbid obesity (>40 BMI), to better understand the distribution of BMI data in the Oceania region. All BMI data established statistical significance with $p < .001$, indicating that this population is more likely to be obese or morbidly obese than other worldwide populations according to BMI. Thus, while additional research is necessary to better understand the body composition of Oceanic populations, the significantly higher prevalence of morbid obesity suggests that this population still likely exhibits greater BF% despite potential genetic anomalies related to the A allele at rs373863828 that potentially reduce fat mass in this group [15,16].

This study identifies that the Oceania region is not receiving the necessary support or interventions for obesity despite establishing the highest rates of obesity (by BMI) worldwide. This population has inherent genetic and cultural differences that are nearly exclusive to this demographic, prompting the need for research on this group specifically [15-17,22,23]. A continued lack of obesity research and intervention on this demographic simply means that this region will continue to exhibit disproportionately high rates of obesity which generally increases the risk of life-altering comorbidities [2]. Noteworthy, the worldwide obesity rate by country established an average of 10.76% from 1975 to 2016. Ten Oceanic countries exhibit obesity rates more than three times that average and three of those countries have obesity rates more than five times that average, as shown in Table 3 [28]. Thus, this population has a clear need for obesity- related interventions.

Table 3: Comparison of country-specific obesity rates versus the average national obesity rate worldwide, not adjusted for country size.

Rank	Country	Obesity Rate (%)	Difference from Worldwide Obesity Rate (%)
1	Nauru	61	41.12
2	Cook Islands	55.9	36.02
3	Palau	55.3	35.42
4	Marshall Islands	52.9	33.02
5	Tuvalu	51.6	31.72
6	Niue	50	30.12
7	Tonga	48.2	28.32
8	Samoa	47.3	27.42
9	Kiribati	46	26.12
10	Federated States Of Micronesia	45.8	25.92
22	New Zealand	30.8	10.92
24	Fiji	30.2	10.32
27	Australia	29	9.12
52	Vanuatu	25.2	5.32
91	Papua New Guinea	21.3	1.42

Unique Considerations

While it's evident that Oceania populations exhibit greater rates of obesity than most worldwide regions, it's worth noting that many of its constituents are smaller countries isolated by water. Additionally, these islands have relatively small populations, with four of the top five most obese countries having populations under 25,000 people [29]. Thus, not only do these islands present geographic barriers to research and intervention from practitioners who may not reside on the islands, the fact that these islands have relatively few inhabitants may deter transcontinental partnerships from developing given the lack of available participants and data compared to larger landlocked countries. These limitations, combined with technological limitations on some remote atolls, do

One-Sample Test							
Test Value = 23.749							
t		df	Significance		Mean Difference	95% Confidence Interval of the Difference	
			One-Sided p	Two-Sided p		Lower	Upper
Mean BMI	4.338	83	<.001	<.001	.65365249988	.3539420318	.9533629680

Figure 5: One-sample Test for Mean BMI between World and Oceanic Populations.

One-Sample Statistics				
N		Mean	Std. Deviation	Std. Error Mean
Prevalence of BMI 30 kg mobesity	84	.15561761004	.066530453078	.007259067554

One-Sample Test							
Test Value = .107577							
t		df	Significance		Mean Difference	95% Confidence Interval of the Difference	
			One- Sided p	Two- Sided p		Lower	Upper
Prevalence of BMI 30 kg mobesity	6.618	83	<.001	<.001	.048040610036	.03360261663	.06247860344

One-Sample Effect Sizes					
Standardizer[a]			Point Estimate	95% Confidence Interval	
				Lower	Upper
Prevalence of BMI 30 kg mobesity	Cohen's d	.066530453078	.722	.480	.961
	Hedges' correction	.067139273382	.716	.476	.952

a. The denominator used in estimating the effect sizes. Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

Figure 6: Full one-sample analysis of BMI >30 (obesity) between Oceanic and world populations.

One-Sample Statistics				
N		Mean	Std. Deviation	Std. Error Mean
Prevalence of BMI 40 kg morbid obesity	84	1.121200E-002	9.4533000E-003	1.0314000E-003

One-Sample Test							
Test Value = .007221							
t		df	Significance		Mean Difference	95% Confidence Interval of the Difference	
			One-Sided p	Two-Sided p		Lower	Upper
Prevalence of BMI 40 kg morbid obesity	3.870	83	<.001	<.001	3.9914000E-003	1.940000E-003	6.043000E-003

One-Sample Effect Sizes					
Standardizer[a]			Point Estimate	95% Confidence Interval	
				Lower	Upper
Prevalence of BMI 40 kg morbid obesity	Cohen's d	9.4533000E-003	.422	.198	.644
	Hedges' correction	9.5398000E-003	.418	.196	.638

a. The denominator used in estimating the effect sizes. Cohen's d uses the sample standard deviation.
Hedges' correction uses the sample standard deviation, plus a correction factor.

Figure 7: Full one-sample analysis of BMI >40 (morbid obesity) between Oceanic and world populations.

present some challenges regarding body composition measurement possibilities to supplement or replace BMI in future studies.

Of note, body composition appears to be unique in Oceanic populations, aligning with research provided by Thompson et al. The World Health Organization previously reported that overweight and obese classifications should be modified for Pacific Islanders to 26 and 32, respectively. Given the rs373863828 gene variant, it is possible that the higher BMI of Oceania populations is boosted by greater lean mass as opposed to fat mass, thus overestimating the risk of disease in this population [30]. Considering the genetic variations and lifestyle of many Oceania families revolving around manual farming and demanding sports, such as rugby, it is plausible that BMI does overestimate BF% in this group. Thus, while BMI is often considered the most practical measurement tool for public health research, standard values may need to be formally adjusted for this population or supplemented with a secondary measurement technique that more accurately determines BF% [31].

Further research on these populations, with specific regional considerations, is necessary to utterly understand the factors contributing to obesity. Unfortunately, given the geographic breadth of this region, no generalizations can be made regarding nationwide development or income level. For example, Kiribati has a gross domestic product (GDP) under 2,000 per capita, making it a lower-middle income country. Comparatively, the

Cook Islands has a GDP near 20,000 per capita, making it a high-income country [32]. Interestingly, Kiribati (~125,000) has a substantially larger population than the Cook Islands (~17,500) [29]. Ultimately, given the vast differences between national resources, and further differences between intranational resources with remote atolls/primary islands, researchers would be better served by interventions that target other common culture-specific factors contributing to obesity, such as physical inactivity.

Researchers have sampled various Oceania populations, finding a common trend that generally includes a lack of regular physical activity amongst these individuals and that these individuals are responsive to exercise interventions [17-20,33]. More recently, Lee et al. found that Pacific Islanders/Native Hawaiians not only exhibited disproportionately high rates of overweight and obesity (78% collectively), but also staggering diabetes rates (29%) [34]. Previous interventions have attempted a broader approach toward combatting obesity in Pacific Island populations, however, these studies have apparently elicited a small overall effect and had major limitations. For example, the Pacific Obesity Prevention in Communities connected with 18,000 Pacific Island children, primarily measuring (via anthropometry and survey) and educating children on healthy lifestyle choices, such as limiting sugary beverages. This initiative, while valuable in some regards, targeted four of the largest Oceania countries (Fiji, Tonga, New Zealand, and Australia), disregarding the unique differences and needs of smaller islands/countries which concomitantly have the highest obesity rates [35].

Applying Exercise Interventions

Based on the available research, it appears that exercise interventions for obesity must be multi-faceted, aiming to overcome cultural beliefs and interpretations of these populations. For example, Hardin et al. proposed that obesity interventions failed in Oceania countries like Nauru and Samoa because of the abrupt reconceptualization of body image norms. Such psychological factors may influence these populations uniquely considering that, for some regions, the majority is considered obese, so obesity is more "normal" than not [36]. Ultimately, this means that effective interventions will likely need to promote exercise guidelines while simultaneously providing educational and/or psychological support for participants to better understand and accept behavioral change.

Considering the resounding benefits of exercise, applications of the Health Belief Model are likely in order. Psychologically, this model supports the idea that if individuals honestly believe a behavior will have positive health benefits, they will be more likely to undergo the necessary steps toward that behavioral change. Kaholokula et al. previously surveyed Pacific Islanders with heart failure to better understand factors contributing to successful care of this major condition. Prospective heart failure patients were heavily reliant on informational and tangible social support, citing deterrents to heart failure care as a lack of heart failure knowledge, lacking patient-physician relations, required dietary changes, and time limitations [37]. This information is extremely useful in the context of obesity interventions for this population.

The benefits of exercise on body mass and disease risk are well-documented. However, if exercise or physical activity is not consistent or sufficient, it provides little benefit. Thus, practitioners must provide reasonable and sufficient exercise interventions while simultaneously considering the factors outlined by Kaholokula et al. For example, this demographic relies on ample social support, aligning with research by Perri et al. that suggests accountability check-ins help facilitate greater weight loss and improved weight maintenance post-intervention. Ideally, family members or other community members could provide this support, but this is an important consideration to help facilitate the application of exercise-based interventions regardless.

Health literacy is generally considered low among the Oceanic populations, which is anecdotally evidenced by the unwillingness to make dietary changes in the research conducted by Kaholokula et al. [38]. Thus, health literacy must be addressed in this population, but it may need to come in non-traditional formats. If practitioners prefer traditional health literacy applications, it would be valuable to provide case studies exemplifying the benefits of exercise on overall health. For example, Lee et al. found that Pacific Islanders/Native Hawaiians that reached sufficient physical activity levels were less likely to experience memory problems, psychological distress, and poor levels of self-rated health. Such data would be invaluable to this demographic, though it would be best presented by a community member who could testify to those effects.

The final two limitations identified by Kaholokula et al. were relatively common problems for health and wellness professionals. It is worth noting that dietary patterns can vary drastically within Oceania depending on the availability of food, farming status, and other common factors (i.e., income level) [17,20]. Given the cultural influence on diet and the identification of farming as a covariate to obesity status in some Oceania countries, dietary patterns should be considered regionally [17]. If possible, education interventions supplementing the primary exercise intervention could address the importance of adequate nutrition, specifically targeting malnutrition and micronutrient deficiencies noted by Balick et al. Theoretically, emphasizing the value of micronutrient-dense foods will help redirect Oceanic individuals to foods with more micronutrients and a lower caloric density.

Time constraints are another consideration that may or may not present as a problem in Oceanic populations. For example, Galy et al. noted that many individuals did participate in exercise semi-regularly, however, that exercise was performed at a relatively low intensity.

Such instances could be more easily corrected by facilitating exercise intensity within the usual exercise/physical activity time, assuming it reaches sufficient criteria. Galy et al. also provided usable data regarding the additional benefits of moderate or vigorous-intensity exercise on health outcomes. In this case, vigorous intensity exercise could be beneficial to overcome time-related challenges since exercise intensity and duration generally have an inverse relationship for programming purposes. This information can be used to help provide time- restricted individuals with an actionable option while simultaneously reinforcing the positive benefits of such activity/exercise.

Conclusion

This study highlights the significant underrepresentation of the Oceanic population in obesity clinical trials, particularly those involving exercise interventions. Despite the disproportionately high obesity rates in this region, the number of clinical trials conducted for obesity, both with and without exercise interventions, is remarkably low. The lack of research and intervention in the Oceanic region perpetuates the high prevalence of obesity and increases the risk of associated comorbidities.

The study also emphasizes the unique considerations that need to be considered when addressing obesity in the Oceanic population. These considerations include the geographic isolation of smaller island nations, limited resources, and technological challenges in remote areas [17]. Additionally, the study suggests that the commonly used body mass index (BMI) may overestimate body fat percentage in this population, necessitating the exploration of alternative measurement techniques or adjustments to standard values [30].

To effectively combat obesity in the Oceanic population, multi-faceted interventions are required. These interventions should not only focus on promoting exercise guidelines but also addressing cultural beliefs and psychological factors surrounding body image norms [36]. The Health Belief Model can serve as a valuable framework for designing interventions that consider the unique needs and challenges of this population. Key factors to consider include providing informational and tangible social support, addressing low health literacy through non-traditional formats, emphasizing the importance of adequate nutrition, and overcoming time constraints by promoting moderate to vigorous intensity exercise within limited timeframes [37].

Given the significant health benefits of exercise and the responsiveness of Oceanic populations to exercise interventions, it is crucial to increase the number of obesity clinical trials in this region. By providing targeted research and interventions that address the specific needs and challenges of the Oceanic population, it is possible to reduce obesity rates and improve overall health outcomes in this otherwise underserved population. Continued research is necessary to gain a deeper understanding of the factors contributing to obesity in this population and to develop effective strategies for intervention.

References

1. Asghar A, Shah AM, Hussain AA, et al. Frequency of pre-obesity and obesity in medical students of Karachi and the predisposing lifestyle habits. Cureus. 2019; 11: e3948.
2. Afolabi HA, bin Zakariya Z, Shokri A, et al. The relationship between obesity and other medical comorbidities. Obesity Medicine. 2020; 17: 100164.
3. Cadenas Sanchez C, Cabeza R, Idoate F, et al. Effects of a Family-Based Lifestyle Intervention Plus Supervised Exercise Training on Abdominal Fat Depots in Children With Overweight or Obesity: A Secondary Analysis of a Nonrandomized Clinical Trial. JAMA Network Open. 2022; 5: e2243864- 2243864.
4. Chrissini MK, Panagiotakos DB. Health literacy as a determinant of childhood and adult obesity: a systematic review. Int J Adolesc Med Health. 2021; 33: 9-39.
5. Christensen RH, Wedell-Neergaard AS, Lehrskov LL, et al. Effect of aerobic and resistance exercise on cardiac adipose tissues secondary analyses from a randomized clinical trial. JAMA Cardiol. 2019; 4: 778-787.
6. Cignarella A, Busetto L, Vettor R. Pharmacotherapy of obesity an update. Pharmacological Research. 2021; 169: 105649.
7. Khorsandi H, Nikpayam O, Yousefi R, et al. Zinc supplementation improves body weight management inflammatory biomarkers and insulin resistance in individuals with obesity a randomized placebo controlled double-blind trial. Diabetol Metab Syndr. 2019; 11: 1-10.
8. Lee S, Libman I, Hugha K, et al. Effects of exercise modality on insulin resistance and ectopic fat in adolescents with overweight and obesity a randomized clinical trial. J Pediatr. 2019; 206: 91-98.
9. Perri MG, Shankar MN, Daniels MJ, et al. Effect of telehealth extended care for maintenance of weight loss in rural US communities a randomized clinical trial. JAMA Network Open. 2020; 3: e206764-206764.
10. Pureza IRDOM, da Silva Junior AE, Praxedes DRS, et al. Effects of time-restricted feeding on body weight body composition and vital signs in low-income women with obesity A 12-month randomized clinical trial. Clin Nutr. 2021; 40: 759-766.
11. Rhee KE, Herrera L, Strong D, et al. Guided self-help for pediatric obesity in primary care a randomized clinical trial. Pediatrics. 2022; 150: e2021055366.
12. Saelens BE, Lozano P, Scholz K. A randomized clinical trial comparing delivery of behavioral pediatric obesity treatment using standard and enhanced motivational approaches. J Pediatr Psychol. 2013; 38: 954-964.
13. Ranking % obesity by country. World Obesity Federation Global Obesity Observatory. https://data.worldobesity.org/rankings/?age=a&sex=m
14. Tam BT, Morais JA, Santosa S. Obesity and ageing Two sides of the same coin. Obesity Reviews. 2020; 21: e12991.
15. Hanson RL, Safabakhsh S, Curtis JM, et al. Association of CREBRF variants with obesity and diabetes in Pacific Islanders from Guam and Saipan. Diabetologia. 2019; 62: 1647-1652.
16. Lee K, Vakili S, Burden HJ, et al. The minor allele of the CREBRF rs373863828 p. R457Q coding variant is associated with reduced levels of myostatin in males Implications for body composition. Mol Metab. 2022; 59: 101464.

17. Galy O, Frayon S, Goldin M, et al. Generational issues in linking family farming production, traditional food in diet physical activity and obesity in Pacific Islands countries and territories: the case of the Melanesian population on Lifou Island. Open Research Europe. 2022; 1: 135.
18. Littlewood R, Canfell OJ, Walker JL. Interventions to prevent or treat childhood obesity in Māori Pacific Islanders a systematic review. BMC Public Health. 2020; 20: 1-14.
19. Anderson YC, Wynter LE, Grant CC, et al. A novel home-based intervention for child and adolescent obesity The results of the Whānau Pakari randomized controlled trial. Obesity. 2017; 25: 1965-1973.
20. Balick MJ, Lee RA, De Gezelle JM, et al. Traditional lifestyles transition and implications for healthy aging An Example from the remote island of Pohnpei Micronesia. Plos One. 2019; 14: e0213567.
21. Onjewu AK, Sadraei R, Jafari-Sadeghi V. A bibliometric analysis of obesity in marketing research. EuroMed Journal of Business. 2022; 1450-2194.
22. Ogden CL, Fakhouri TH, Carroll MD, et al. Prevalence of obesity among adults, by household income and education United States 2011-2014. MMWR Morb Mortal Wkly Rep. 2017; 66: 1369.
23. Bertrand Protat S, Chen J, Jonquoy A. et al. Causes and contexts of childhood overweight and obesity in the Pacific region a scoping review. Open Research Europe. 2023; 3: 52.
24. World Health Organization. The Asia-Pacific perspective redefining obesity and its treatment. Report. 2000.
25. Thompson AA, Duckham RL, Desai MM, et al. Sex differences in the associations of physical activity and macronutrient intake with child body composition A cross-sectional study of 3-to 7-year-olds in Samoa. Pediatr Obes. 2020; 15: e12603.
26. Neeland IJ, Ross R, Després JP. et al. Visceral and ectopic fat atherosclerosis, and cardiometabolic disease a position statement. Lancet Diabetes Endocrinol. 2019; 7: 715-725.
27. Abarca Gómez L, Abdeen ZA, Hamid ZA. et al. Worldwide trends in bodymass index underweight overweight and obesity from 1975 to 2016 a pooled analysis of 2416 population based measurement studies in 128.9 million children adolescents and adults. The Lancet. 2017; 390: 2627-2642.
28. Country Comparison Obesity Adult Prevalence Rate. The World Factbook – Central Intelligence Agency. https://web.archive.org/web/20200802220913/https://www.cia.gov/library/publications/th
29. e-world-factbook/rankorder/2228rank.html
30. Databank. DataBank. https://databank.worldbank.org/source/population-estimatesand-projections
31. Burden HJ. Understanding the metabolic effects of the Māori and Pacific enriched gene variant CREBRF rs373863828. Thesis.
32. Duncan E, Schofield G, Duncan S, et al. Ethnicity and body fatness in New Zealanders. N Z Med J. 2004; 117: u913.
33. United Nations. GDP Per Capita. United Nations. https://unstats.un.org/unsd/snaama/Basic
34. Adams IKR, Okoli CT, Krok Schoen JL, et al. Physical activity among Native Hawaiians and Pacific Islanders A systematic review and meta analysis. J Nutr Educ Behav. 2019; 51: 245-258.
35. Lee YJ, Braun KL, Wu YY, et al. Physical activity and health among Native Hawaiian and other Pacific Islander older adults. J Aging Health. 2022; 34: 120-129.
36. Swinburn BA, Millar L, Utter J, et al. The Pacific Obesity Prevention in Communities project: project overview and methods. Obesity Reviews. 2011; 12: 3-11.
37. Hardin J, McLennan AK, Brewis A. Body size, body norms and some unintended consequences of obesity intervention in the Pacific islands. Ann Hum Biol. 2018; 45: 285-294.
38. Kaholokula JKA, Saito E, Mau MK, et al. Pacific Islanders' perspectives on heart failure management. Patient Educ Couns. 2008; 70: 281-291.
39. Rodriguez L, George JR. Is Genetic Labeling of Risk Related to Obesity Contributing to Resistance and Fatalism in Polynesian Communities? The Contemporary Pacific. 2014; 26: 65-93.