

# EFFECTS OF A BASIC CLIMBING EDUCATION PROGRAM ON PHYSICAL FITNESS AND MACRONUTRIENT INTAKE IN NOVICE MOUNTAINEERS

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# Introduction



- Mazamas
  - Nonprofit mountaineering education
- Accommodates 900 hikes and 350 climbs to 13,000 participants annually
- Volunteers offer an estimated 80,000 hours time.

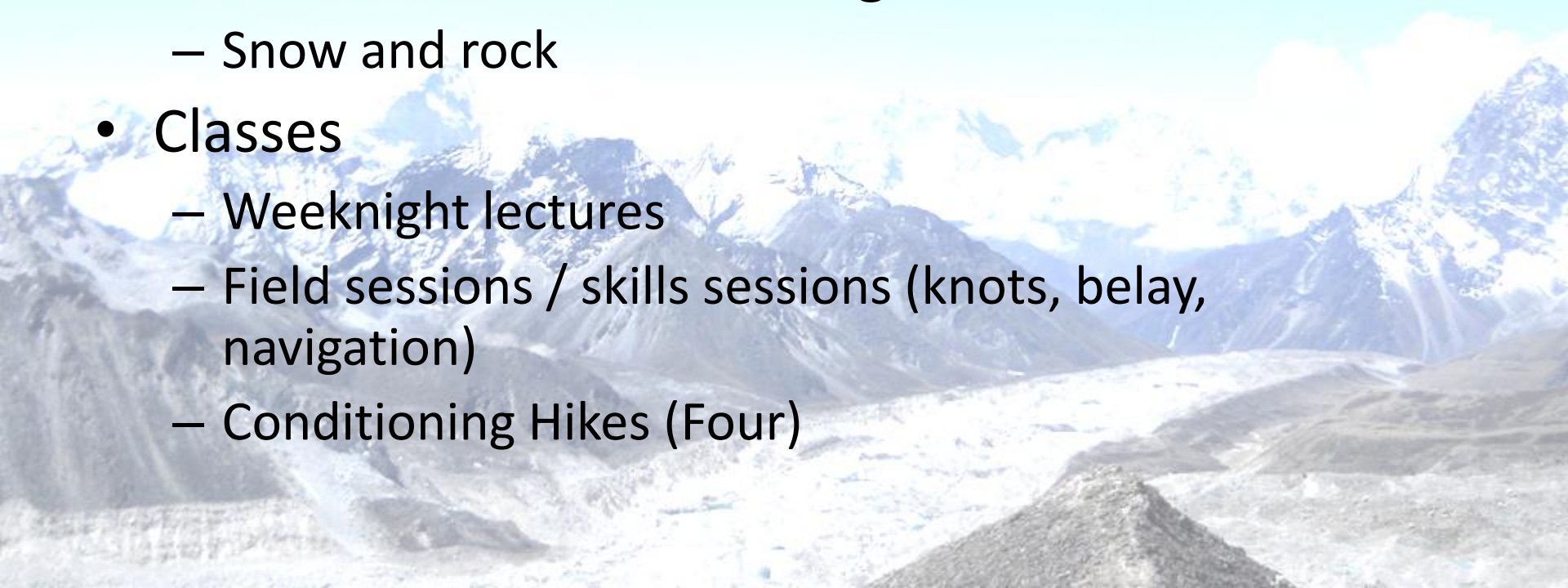
## ***Mazamas Mission***

***The Mazamas promotes mountaineering through education, climbing, hiking, fellowship, safety, and the protection of mountain environments.***

[www.mazamas.org](http://www.mazamas.org)

# Basic Climbing Education Program (BCEP)

- Prepare students physically and mentally for beginning climbs.
- 6-Weeks in duration
- Basics in mountain climbing
  - Snow and rock
- Classes
  - Weeknight lectures
  - Field sessions / skills sessions (knots, belay, navigation)
  - Conditioning Hikes (Four)



# Purpose

“These hikes are designed to make you fit enough for the physical challenges of mountain climbing.”

[www.mazamas.org](http://www.mazamas.org)

To determine if participation in the Basic Climbing Education Program effects fitness and nutrition in novice mountaineers.

This study was approved by the Linfield College Institutional Review Board

# Methods

- **70 Participants ( male = 36, female = 34)**
- **Data collected pre and post BCEP**
- **Blood Pressure**
- **Anthropometrics**
  - Height and Weight
  - Body Mass Index (BMI)
  - Basal Metabolic Rate, Body Fat Percentage, Muscle Percentage
    - BIA (OMRON HBF510)
- **Physical Fitness**
  - Forestry step test
  - Canadian curl ups
  - Push-ups
  - Handgrip strength
  - Sit and reach
  - Physical Activity History questionnaire



# Methods Cont'd

- Nutrition
  - 24-Hour Dietary Recall
    - Collected by interview
      - Food and beverage
    - Analyzed by Food Processor 2011
    - Macronutrients
      - Kcals, Carbohydrates, Protein, Fats
      - % Daily Intake
- Statistics
  - Paired samples t-test
  - $p < 0.05$
  - PASW v 18



# Intervention

- BCEP Program
  - 4 conditioning hikes (weekends)
  - Relevant Lectures
    - Basic Nutrition
    - Fitness and Training Overview
    - Mountaineering First Aid
  - 3 field sessions
    - Rock skill days (2)
      - indoor climbing wall
      - Outdoor day (Horsethief Butte)
    - Snow climbing skills (Mt. Hood)



# Results

	All (n = 70)	Male (n=36)	Female (n = 34)
<b>Age (Years)</b>	35.5 ± 10.5 (21.0-61.0)	35.4 ± 10.1 (24.0-61.0)	35.6 ± 11.1 (21.0-59.0)
<b>Height(In.)</b>	67.1 ± 3.39 (59.5-73.0)	69.3 ± 2.51 (60.5-73.0)	64.6 ± 2.30 (59.9-72.0)
<b>Weight (lbs)</b>	162.1 ± 31.3 (106.6-252.2)	184.0-24.1 (136-252.2)	139.2 ± 20.4 (106.6-194)
<b>BMI (kg/ m<sup>2</sup>)</b>	25.3 ± 3.8 (18.6-37.9)	26.9 ± 3.6 (22.3-37.9)	23.4 ± 3.1 (18.6-34.9)
<b>Body Fat (%)</b>	25.9 ± 7.32 (11.7-46.0)	22.7 ± 6.17 (11.7-36.0)	29.3 ± 6.9 (18.3-46.0)
<b>VO<sub>2</sub>-age adjusted (ml/kg/min)</b>	41.2 ± 6.97 (24.0-65.0)	42.4 ± 6.90 (32.0-65.0)	39.8 ± 6.89 (24.0-58.0)



# Results Continued

## Anthropometric /Clinical Measurements

<b>Variable</b>	<b>Pre</b>	<b>Post</b>	<b><i>p</i></b>
<b>Systolic BP (mm/Hg)</b>	123 ± 9	123 ± 9	.829
<b>Diastolic Blood Pressure (mm/Hg)</b>	75 ± 8	76 ± 6	.627
<b>Weight (lbs)</b>	160.2 ± 29.8	160.5 ± 29.6	.611
<b>Waist (cm)</b>	31.5 ± 3.8	30.0 ± 3.6	.000*
<b>BMI (kg/m<sup>2</sup>)</b>	24.9 ± 3.4	24.9 ± 3.3	.900
<b>Body Fat (%)</b>	25.9 ± 7.9	25.2 ± 8.1	.122
<b>Body Muscle (%)</b>	34.0 ± 5.2	34.4 ± 5.3	.169
<b>BMR (kcal)</b>	1575.14 ± 251.23	1577.24 ± 251.78	.712

Reported as Mean ± SD

\* Significant Difference

# Results Continued

## Fitness

Variable	Pre	Post	<i>P</i>
Curl Ups	18 ± 12	19 ± 15	.616
Push Ups	21 ± 10	23 ± 9	.025 *
Sit and Reach (cm)	31.3 ± 8.7	33.5 ± 7	.000 *
Right Hand Grip (kg)	43.4 ± 13.7	41.9 ± 12.3	.008 *
Left Hand Grip (kg)	40.6 ± 12.7	39.3 ± 11.5	.018 *
Step HR (bpm)	33 ± 4	32 ± 3	.105
VO <sub>2</sub> (ml/kg/min)	42.02 ± 5.14	43.83 ± 5.69	.099
VO <sub>2</sub> -Age Adj. (ml/kg/min)	39.91 ± 5.45	41.64 ± 6.1	.105

Reported as Mean ± SD

\* Significant Difference

# Results Continued

## Fitness:

Variable	Male			Female		
	Pre	Post	<i>p</i>	Pre	Post	<i>p</i>
Curl Ups	20 ± 13	21 ± 15	.652	17 ± 12	17 ± 16	.830
Push Ups	25 ± 10	25 ± 9	.550	18 ± 10	22 ± 8	.021*
Sit and Reach (cm)	27.5 ± 8.4	31 ± 7.1	.000 *	35.3 ± 7.3	36.3 ± 6.8	.207
Rt Hand Grip (kg)	54.3 ± 9.8	52.0 ± 8.2	.024 *	31.9 ± 4.8	31.3 ± 4.6	.165
Lt Hand Grip (kg)	51.0 ± 8.8	48.7 ± 7.4	.029 *	29.8 ± 4.2	29.4 ± 4.5	.353
Step HR (bpm)	35 ± 4	32 ± 4.6	.001 *	32 ± 4	33 ± 2	.553
VO <sub>2</sub> (ml/kg/min)	41.94 ± 5.5	46.4 ± 6.3	.009 *	42.11 ± 4.9	41.26 ± 3.5	.496
VO <sub>2</sub> (ml/kg/min) Age Adj.	39.82 ± 5.0	44.23 ± 6.5	.009 *	40.00 ± 6.0	39.05 ± 4.7	.428

Reported as Mean ± SD

\* Significant Difference

# Results Continued

## Nutrition

	Pre	Post	<i>P</i>
<b>Total kcals</b>	1940.6 ± 879.9	2315.8 ± 1203.7	.077
<b>Carbohydrate (g)</b>	255.4 ± 136.6	318.6 ± 208.3	.080
<b>Protein (g)</b>	76.1 ± 42.7	93.2 ± 51.0	.086
<b>Fats (g)</b>	68.2 ± 45.2	74.2 ± 46.0	.510
<b>Carbohydrate (%)</b>	52.4 ± 14.6	53.9 ± 12.8	.585
<b>Protein (%)</b>	15.8 ± 6.4	16.5 ± 5.7	.592
<b>Fats (%)</b>	31.6 ± 12.8	29.4 ± 12.1	.380
<b>Water (g)</b>	2195.2 ± 1196.5	2107.3 ± 955.4	.670

Reported as Meant ± SD

\* Significant Difference

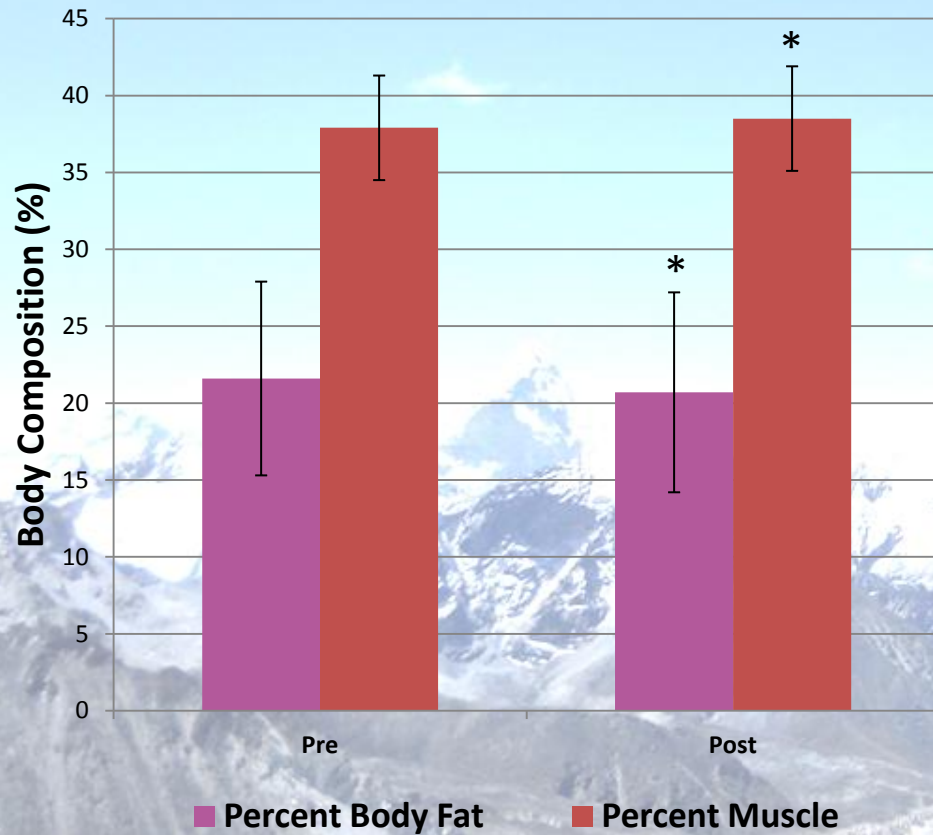
# Results Continued

## Nutrition

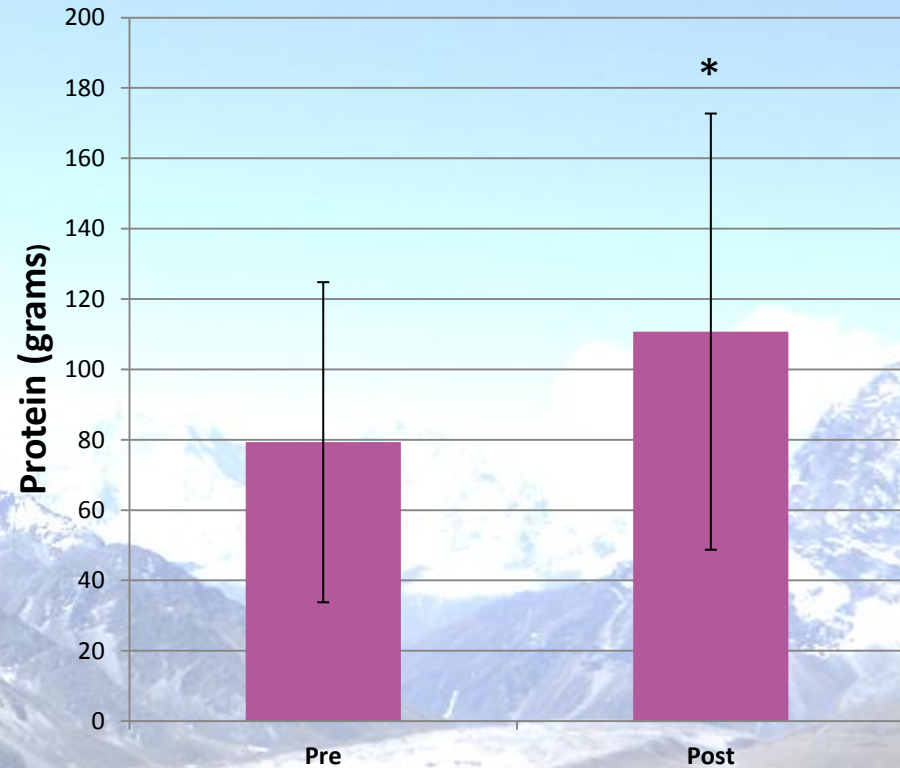
	Male			Female		
	Pre	Post	<i>p</i>	Pre	Post	<i>p</i>
<b>Total kcals</b>	2109.5 ± 889.9	2624.6 ± 1406.8	.105	1753.9 ± 853.0	1974.4 ± 840.1	.442
<b>carbs (g)</b>	298.2 ± 147.29	372.2 ± 250.3	.204	208.0 ± 108.8	259.2 ± 131.8	.236
<b>protien (g)</b>	79.33 ± 45.5	110.7 ± 62.0	.048 *	72.6 ± 40.3	74 ± 24.8	.909
<b>fats (g)</b>	66.5 ± 42.9	76.9 ± 49.0	.434	70.0 ± 48.6	71.2 ± 43.7	.928
<b>carbs (%)</b>	56.5 ± 13.8	55.8 ± 13.9	.244	47.8 ± 14.5	51.9 ± 11.54	.283
<b>protein (%)</b>	15.0 ± 6.2	17.2 ± 6.3	.879	16.8 ± 6.7	15.8 ± 5.1	.583
<b>fats (%)</b>	28.4 ± 13.5	26.8 ± 13.5	.715	35.2 ± 11.4	32.1 ± 9.9	.289
<b>water (g)</b>	2299.9 ± 1224.7	2084.0 ± 943.6	.490	2079.5 ± 1186.8	2133.0 ± 993.6	.845

# Results Continued (Males Only)

## Body Mass: Muscle, Fat



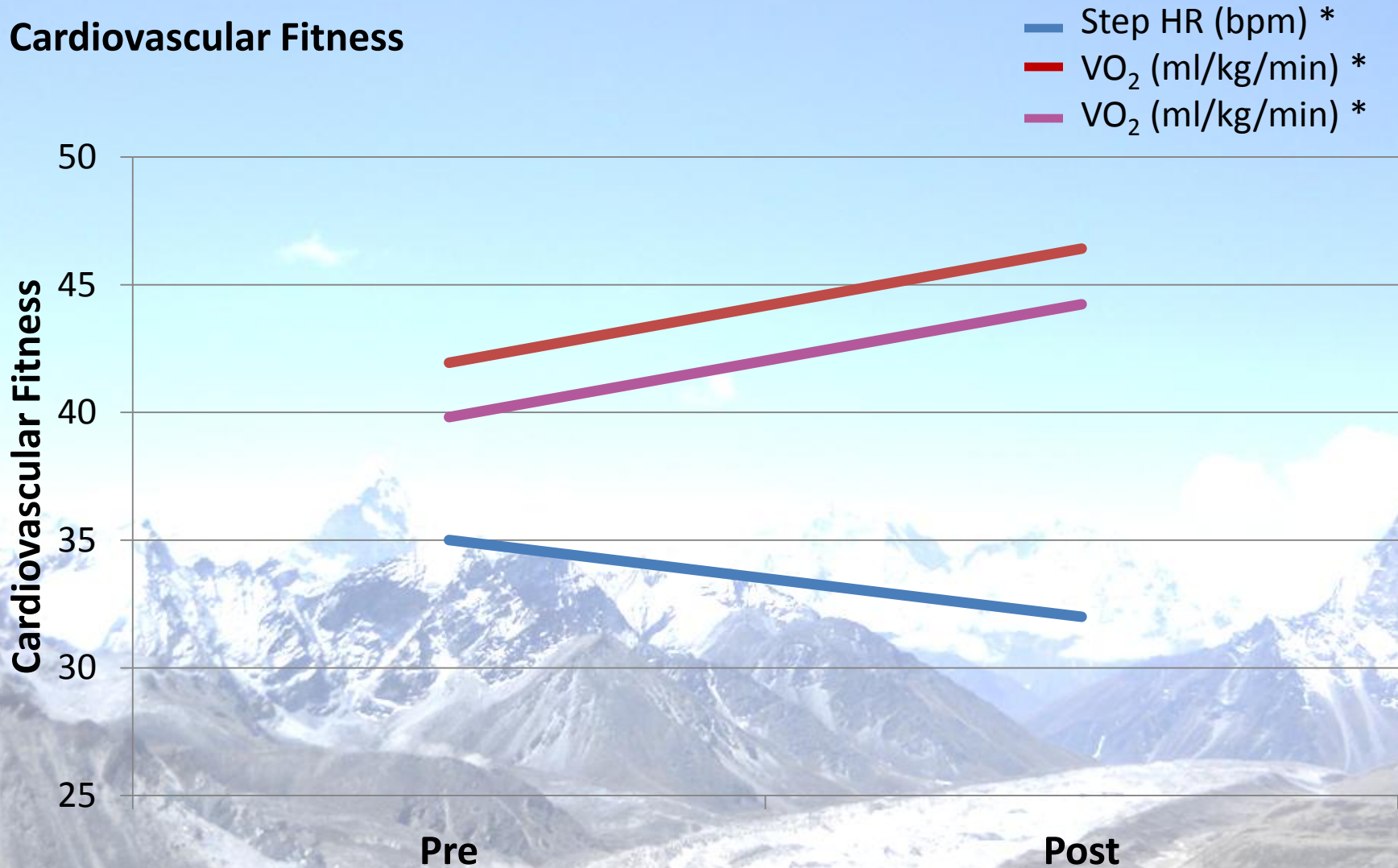
## Protein intake



\* Significant Difference

# Results Continued (Males Only)

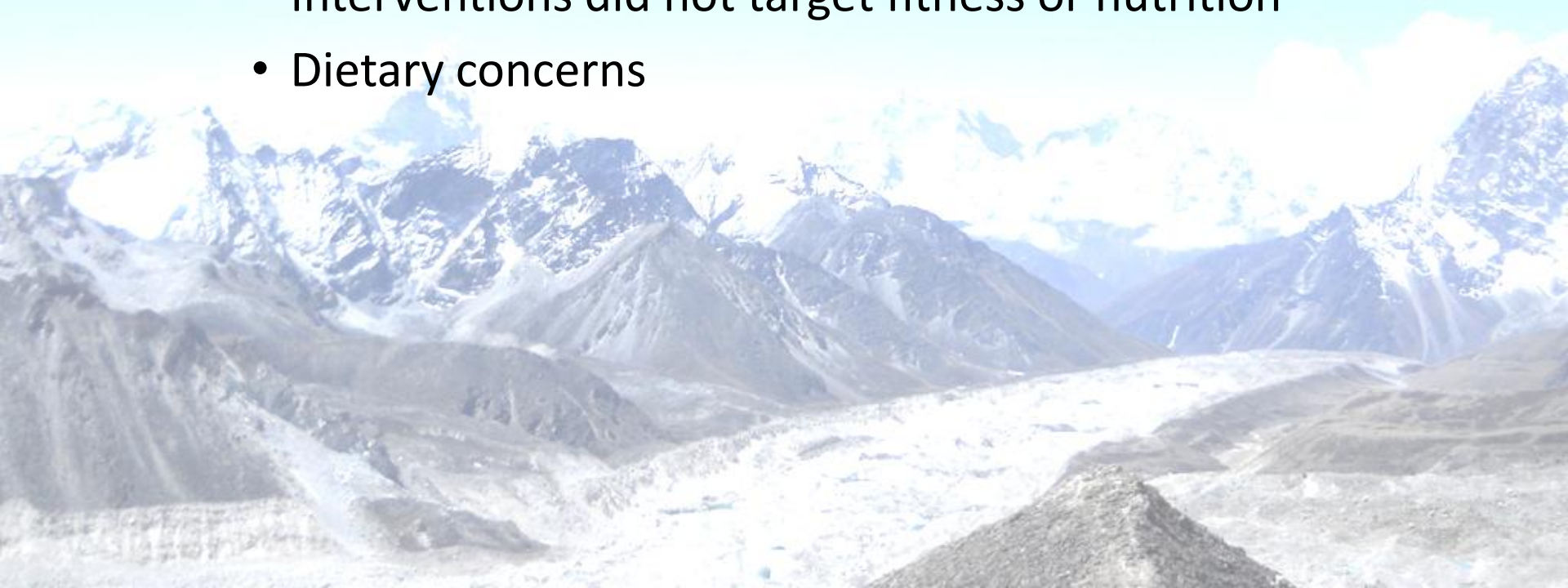
## Cardiovascular Fitness



\*  $P < 0.05$

# Discussion

- Males vs. Females
- Overall fitness did not improve
  - Program length (McArdle et al., Astrand, Pollock)
  - Interventions did not target fitness or nutrition
  - Dietary concerns





# Conclusion

- Evaluate gender differences in fitness response
- Evaluate overall BCEP curriculum tailored towards fitness



# Strengths/Weaknesses

- Understanding the population of novice climbers
  - Physical Fitness/Nutrition
- Fidelity of the BCEP towards significant findings
  - Physical activity questionnaires
- Extrapolating  $VO_2$  in older participants
- Large Samples (Strength)/Attrition (weakness)
- Test Familiarity
- Reliability of 24 hour diet recall.
  - (Johansson et al., Beaton et al.)

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# Key References

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# Thank you and Questions

