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Training, Diet and Supplement Regimen of an Elite Female Standup Paddler in Preparation for an Ultra-distance Event: a Case Study

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Abstract

PURPOSE: Standup paddleboard (SUP) racing is the quintessential power-endurance sport that requires a combination of skill, aerobic power as well as muscular strength and endurance. The purpose of this case study was to examine the training, diet and supplement regimen of an elite paddler in preparation for an ultra-distance Standup paddleboard race (i.e., Molokai to Oahu [M2O) 32-mile open ocean SUP race).

METHODS: The physical characteristics of the paddler are as follows: 32-year old female, 167.6 cm height, 62.7 kg weight and 19% body fat (Bod Pod®). During the six-month training program, the athlete's daily average intake of the macronutrients was as follows: protein 151 g/d, carbohydrate 122 g/d and fat 62 g/d. Through this time the athlete incorporated more protein-based supplements pre-and post-training as well as supplementing with beta-hydroxy methylbutyrate (HMB) and beta-alanine. The athlete also incorporated a periodized training plan over the 6 months prior to the race. This included an average distance of run training of 24 miles/month as well paddle training 74 miles/month. Paddling training increased from 64 miles in the first month, eventually working up to 105 miles for the fifth month followed by a taper. The periodized plan was designed to increase paddling mileage 15 to 25% every four weeks and included a mix of various training types such as high intensity interval training, steady state cardio, and sprint training.

RESULTS: The interventions listed above, along with a periodization training program resulted in an increase of 2.2 kg body mass and a decrease of 2% body fat.

CONCLUSION: The nutritional strategies undertaken included an increased daily protein intake, as well as supplementation with HMB and beta-alanine. Together, these strategies resulted in a 3.16 kg gain in LBM as well as a 2% decrease in body fat. In addition, the prescribed strategies lead to a successful finish of 6th place overall female with a time of 6:37:36 at the M2O Stand-up Paddleboard Championship.

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Diet and Supplement Regimen of an Elite Female Standup Paddler in Preparation for an Ultra-distance Event: a Case Study

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ABSTRACT

Purpose: Standup paddleboard (SUP) racing is a quintessential power-endurance sport that requires a combination of skill, aerobic power as well as muscular strength and endurance. The purpose of this case study was to examine the training, diet, and supplement regimen of an elite paddler in preparation for an ultra-distance SUP race (i.e., Molokai to Oahu [M2O] 32-mile open ocean SUP race). **Methods:** The physical characteristics of the paddler are as follows: 32-year old female, 167.6 cm height, 62.7 kg weight, and 19% body fat (Bod Pod®). During the six-month training program, the athlete's daily average intake of macronutrients was as follows: protein 151 grams/day (g/d), carbohydrate 122 g/d, and fat 62 g/d. Through this time, the athlete incorporated more protein-based supplements pre-and post-training as well as supplementing with beta-hydroxy methylbutyrate (HMB) and beta-alanine. The athlete also incorporated a periodized training plan over the six months prior to the race. The training included distance running (24 miles/month) as well as paddle training. Paddle training increased from 64 miles in the first month, eventually working up to 105 miles for the fifth month followed by a taper. The periodized plan was designed to increase paddling mileage 15 to 25% every four weeks and included a mix of various training types such as high intensity interval training, steady state cardio, and sprint training. **Results:** The interventions listed above, along with a periodization training program resulted in an increase of 2.3 kg total body mass and a decrease of 2% body fat. **Conclusion:** The nutritional strategies undertaken included an increased daily protein intake as well as supplementation with HMB and beta-alanine. Together, these strategies resulted in a 3.2 kg gain in LBM as well as a 2% decrease in body fat. In addition, the prescribed strategies lead to a successful finish of 6th place overall female with a time of 6:37:36 at the M2O Stand-up Paddleboard Championship.

Keywords: high protein, cross training, supplementation, paddling, sports nutrition, paddle boarding

INTRODUCTION

This case study is on a 32-year old female elite standup paddleboard racer in preparation for racing an ultra-distance 32-mile open ocean race across the Ka'iwi Channel. The Ka'iwi channel is between the islands of Molokai and Oahu; it is one of the most treacherous channels in the world. Conditions can vary throughout the event, which presents numerous challenges from the environment such as current, wind, and waves. During this specific event, the conditions were as follows: the first 8 miles the winds were 15 - 20 knots from behind the paddlers back (downwind) and waves were 2 - 3 feet. The next 12 miles, the winds picked up to 25 - 30 knots downwind, with seas of 8 - 10 feet. The following 8 miles, the winds died down to 15 knots (downwind) with seas 3 to 4 feet, and the remainder of the race the winds turned, coming into the paddlers face (headwind) about 20-25 knots as a storm came through with seas of 2 - 3 feet. The average time of elite racers during this race is anywhere from five to eight hours depending on the conditions encountered. The athlete finished the race in 6th place overall female with a time of 6:37:36.

The aim of this training program was to increase the athlete's aerobic power and muscle endurance to withstand all elements that take place, such as strong winds coming from any direction (side wind, head wind, down wind), strong currents, and waves of any size. It was found that Elite SUP athletes display aerobic power outputs similar to other upper-limb-dominant elite water athletes such as dragon-boat racing and canoeing.[1] A careful nutrition strategy and training plan which was created by a sports scientist was in place throughout the six-month training period; overall there was a focus on a higher intake of protein and an increase in training volume (i.e., more distance during SUP training as well as distance running). See appendices A, B, and C for details.

In one of the few SUP studies by Schram et al, it was found that significant physiological changes in untrained subjects have been noted after a six-week training program.[2] During the six weeks, the subjects completed three one-hour sessions per week of SUP workouts. Participants did not perform any other physical activity aside from what was performed in their training program. After the six weeks of training, improvements were shown in aerobic and anaerobic fitness as well as speed and distance covered. The study also found an increase in the strength of the "core" muscles. However, there were no changes in body composition.[2]

In another SUP study by Schram et al, heart rate was analyzed over a marathon distance SUP race on 10 elite SUP athletes. It was found that the athlete's peak heart rate varied from 168 to 208 bpm among the competitors with the average heart rate of 168.6±9.8bpm.[3] Significantly higher durations were spent in elevated heart rate zones with participants spending 89.3% of their race within 80 to 100% of their age-predicted heart rate max (HRmax), suggesting that marathon SUP races appear to involve a high aerobic demand, with maintenance of near maximum heart rates required for the duration of the race.[3] This differs from many studies in running, such as Best and Braun, who looked at the heart rate of half-marathoners, marathoners, and mountain runners. It was shown that in all three groups, there was a drop in heart rate in the second half of the race, unlike SUP, which has much higher heart rates for longer periods of time.[4]

In a study by O'Toole on training for ultra-endurance triathlons, it was found that training distances appear to be more important than training paces in preparation for an ultra-endurance triathlon.[5] While this study was on running, biking, and swimming, it appears this can be utilized with ultra-distance paddling as well.[5] Nonetheless, there are no training studies on elite SUP athletes. Thus, the purpose of this investigation was to report the training and dietary changes of an elite SUP racer and its effects on body composition as well as race performance.

METHODS

This case study was conducted over a six-month period. Institutional Review Board approval and consent were obtained. The athlete started a periodized training program six months prior to the event. The program included paddling, running, and weight training. Average training volume per month included 75.5 miles/month (mi/m) of SUP training at various speeds (HIIT, fartlek, and steady state cardio), 24.6 mi/m run training at a pace ranging from 7:30min/mile to 10:00min/mile, and twice a week full body strength training program with an emphasis on core rotational movements.

During the six-month training program, the athlete's daily average food intake consisted of 151 grams/day (g/d) protein, 122 g/d carbohydrate, and 62 g/d fat. The athlete kept a food diary through MyFitnessPal®, which is a free website/smartphone app that is used to track caloric intake and nutrients based on a database of food labels derived from the USDA National Nutrient database. If the data are not found in the website/app, users are able to manually input the macronutrient details of the product. Size portions were validated with the use of a scale prior to logging food intake.

In addition to the athlete's food intake, dietary supplements also played an important role. The athlete consumed a minimum of 30g protein within 30 minutes post training sessions, maintaining a daily average of 151g/d. In addition, several supplements were added to the athlete's daily regimen. Electrolyte tabs were added to the athletes' diet prior to each training session and practice races. Each tablet contained 215mg of sodium and 63mg of potassium. The athlete took two tablets prior to each event. Beta alanine was also supplemented with a dose of 3.0g/d up until the race day. During each training session the athlete used two servings of Tailwind® endurance fuel powder in a 1.5L water-pack. Tailwind endurance fuel consists of 100 kcal, 303 mg sodium, 88 mg potassium, 25 g carbs, and 35 mg caffeine per serving. Lastly, the athlete consumed 2000mg/day of beta-hydroxy methylbutyrate (HMB).

Body composition was assessed via air displacement plethysmography (Bod Pod®).[6] Body composition was assessed after a 3 hour fast and no exercise within 24 hours prior to the test. The Bod Pod® was calibrated prior to each test. The athlete wore tight fitting shorts, a sports bra, and a swim cap for each test. Thoracic gas volume was estimated using a predictive equation integral to the Bod Pod® software. The calculated value for body density used the Siri equation to estimate body composition. Data from the Bod Pod® included body weight, percent body fat, fat free mass, and fat mass. It has been stated that multiple trials may be necessary to detect small treatment effects when measuring with the Bod Pod.[7] Therefore, throughout the six-month training period, the athlete was tested four times.

RESULTS

During the six-month treatment period, the athlete was assessed for body composition on four different occasions (Bod Pod®) to show descriptive statistical analysis of progression with her training and nutrition plan at various stages. Her baseline data was body mass of 62.7 kg with 19% body fat. At the end of the six-month treatment period, her body composition was: 65.0 kg body mass and 17% body fat, with a result of a gain of 2.3 kg and 2.0% body fat. This was a 3.2 kg gain in lean body mass (LBM) and a loss of 0.9 kg fat mass (FM) (Table 1).

Table 1. Body composition changes over six-month training program

Measurement (kg)	Baseline	Race Week
Total Body Mass (TBM)	**62.7**	**65.0**
Lean Body Mass (LBM)	**50.8**	**54.0**
Fat Mass (FM)	**11.9**	**11.0**
% Fat	**19%**	**17%**

DISCUSSION

Pacing in SUP can be influenced by a multitude of intrinsic and extrinsic factors such as wind, current, wave size, athlete profile and composition, and more. As observed in SUP races, typically the faster and farther a paddler can pull away in the start, leaving a significant gap, the greater their chances are to remain in that position for the entire race. Knowing this, emphasis is placed on the first mile or 10 minutes of a SUP race. After that, especially in flat water races, the SUP racer settles into a pace for the rest of the race and will incorporate short sprints in the middle. There are extrinsic factors that affect the speed and work performed by the SUP athlete, such as wind, which is similar in other sports such as running. For example, a study on runners was performed to show the increase in oxygen uptake when running against the wind.[8] The Molokai to Oahu race is quite a bit different though, known as a downwinder (the wind being at your back for much of the time). Between the wind and swell of the open ocean, downwind races are known to be more of a sprint and glide race. Emphasis is placed on the start and after about 3 to 4 miles, turns into a sprint to catch each bump and surf the wave race strategy.

Prior to the six-month training plan, the athlete was only paddle training about 3-6 miles/week and running 2-4 miles/week. Aside from calisthenics once a week, the athlete performed no standardized resistance training. The training program for the SUP athlete in this case study was mainly based on longer distances rather than speed work. However, speed work was incorporated twice weekly in order to prepare for the start of the race as well as the short sprint and recovery of the wind and swell conditions that would be encountered.

Proper nutrition results in increased substrate availability, better performance, and accelerated recovery. Peters suggests that maximizing skeletal muscle glycogen stores is of benefit to endurance performance.[9] Thus, total daily carbohydrate intake is a critical component of an endurance athletes' diet. Furthermore, it is well known that consuming carbohydrates during an endurance race has an ergogenic effect.[10] Thus, daily strategies to maximize skeletal muscle glycogen, as well as race-day fueling is critical for maximizing performance in these events. A detailed nutrition plan was in place during training sessions, recovery, and all races leading up to the main event. Practice feeding was performed during the local race season to make necessary adjustments. The athlete experienced extreme forearm cramps, so to combat the loss of sodium and cramping, electrolyte tablets were added to the athletes' diet prior to each training session and practice races. The athlete took two tablets prior to each event.

During each training session, the athlete used two servings of Tailwind® endurance fuel powder in a 1.5L water-pack. Based on prior research, the athlete could have consumed slightly more carbohydrates during hard training sessions in order to reach the energy needs of the training session. Jeukendrup found that a single carbohydrate source can be oxidized at rates up to approximately 60 g/h and this is the recommendation for exercise that is more prolonged (2 to 3 h).[11] Thus, during each 1.5 hour training session, the athlete consumed 50g of carbohydrates. It has yet to be assessed whether the energy expenditure is higher in events such as running or cycling than in SUP. For an event such as a downwind SUP race, there are periods of "rest" while riding a swell, whereas in running events there is no such rest while maintain forward movement.

Rowlands and Hopkins also reiterated the above in a study on cycling, which looked at the effects of high-fat and high-carbohydrate diets on metabolism and performance in cycling.[12] It was found that high-fat dietary conditioning increased fat oxidation, and although the main effects were not statistically significant, there was some evidence for enhanced ultra-endurance cycling performance relative to high-carbohydrate consumption.[12]

Current research suggest that carbohydrate intakes in the diets of ultra-distance athletes range from 5 - 7g/kg/d during normal training days to 7 - 10 g/kg/d during heavy training days.[13] The athlete's intake of carbohydrates was much lower than the recommended range of 5 - 7g/kg/d (322g/d - 450g/d) on normal training days. Recommendations would be to increase carbohydrate intake, especially on high training days and during the event. This could have been achieved by increasing the number of scoops of Tailwind® in each water pack to three to four scoops (75g - 100g of carbs per 1.5L pack), consumed over 1.5 hours to avoid hyponatremia. Though one can speculate that paddling may not require the same energy expenditure as a land-based sport such as running. We would speculate that this is due to the fact that one's body weight is supported by the board and that as a paddler becomes more skilled and efficient, the energy expenditure at the same given speed is likely to be lower.

To maximize muscle protein synthesis, and thus skeletal muscle remodeling and recovery, it is suggested that endurance athletes consume a minimum of 20g of protein post workout and continue protein consumption throughout the day.[14] The athlete consumed a minimum of 30g of protein within 30 minutes post training sessions as well as maintained a daily average of 151g/d.

Prior to the start of the study, the athlete had a 19% body fat reading from the Bod Pod, which dropped for the duration of supplementation and training; however after the event, the athlete discontinued the use of supplements, which following a three-month post body composition test, showed her body fat reading at 20%. Thus, supplementation also appeared to play a part in the athlete's body composition changes over the six months, most likely because of the use of HMB and Beta-alanine along with the addition of more protein. HMB has been shown to reduce muscle damage induced by mechanical stimuli of skeletal muscle which in turn increases lean body mass and strength while decreasing body fat.[15] Portal et al have shown that combining exercise training with HMB supplementation leads to increased muscle mass and strength, and there is some anecdotal evidence of aerobic improvement.[16] Not only is HMB known to increase muscle mass and performance, but it has also been shown to aid in body fat loss.[15] The International Society of Sports Nutrition's Position Stand on HMB supplementation suggests that it may assist with muscle protein synthesis and body composition improvements.[17] Wilson et al found that HMB appears to be most effective when consumed for two weeks prior to an exercise bout.[15] Another study found that when an appropriate exercise prescription was utilized, individuals in trained and untrained populations who consumed 38mg/kg of HMB daily, enhanced skeletal muscle hypertrophy, strength and power, and demonstrated a decline in fat mass.[17] Because of the findings of the supplementation of HMB, the athlete consumed 2000mg/day. Although the daily recommendations of 38mg/kg which would be 2382mg/day, the athlete did not have a dose that would allow reaching that specific number, thus only taking 2000mg/day. It is not clear if the 382 mg difference in dosing would have mattered over the course of training and racing.

Beta-alanine supplementation has been shown to increase lean mass by approximately 1 kg.[18] Beta-alanine is a non-proteogenic amino acid that is produced endogenously in the liver and has been shown to increase levels of carnosine in human skeletal muscle. Studies on beta-alanine supplementation and exercise performance have demonstrated improvements in performance during multiple bouts of high-intensity exercise and in single bouts of exercise lasting more than 60 seconds; however, it does not appear to have an effect on those under 60 seconds.[19]

As found in a position stand by the International Society of Sports Nutrition (ISSN), doses of 4 – 6 g/d of beta-alanine have been shown to increase muscle carnosine concentrations by up to 64% after 4 weeks and up to 80% after 10 weeks.[20] While beta alanine has been shown to have no effect on aerobic performance, it has been shown to benefit anaerobic performance.[21] A systematic review of beta alanine found an improvement in performance when supplementing 3.2-6.4g of beta-alanine.[22].During the six-month training program, the athlete trained both anaerobically and aerobically, therefore she supplemented with 3.0 g/d of beta-alanine for six months up until the race day in order to possibly increase peak performance. We would speculate that during the sprint portions of the race, the buffering of hydrogen ions would have been critical to performance. Hence, this is where beta-alanine supplementation may have played a role. It should be noted that despite the seemingly low energy intake, the athlete's protein intake, which was 64% higher, may have contributed to the increase in lean body mass over the course of the treatment period.

CONCLUSION

The Molokai to Oahu SUP (M2O) race is unique in that it requires a skill set that is not typically required for flat-water races. In addition, as a unique power-endurance sport, athletes must possess tremendous aerobic power, muscular endurance, and balance. The periodized training program of this SUP athlete involved progressively increasing the total volume of SUP training in addition to incorporating traditional weight-training and distance running. The nutritional strategies undertaken included an increased daily protein intake as well as supplementation with HMB and beta-alanine. Together, these strategies led to a successful finish of 6th place overall female with a time of 6:37:36 at the M2O Stand-up Paddleboard Championship.

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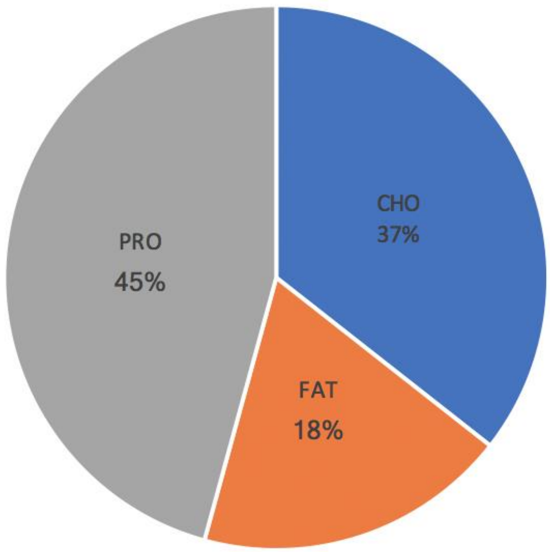
Appendix A. Example of two-week training plan

Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
1AM	SUP SESSION 1 12X4MIN W 1 MIN REST	SUP SESSION 2 4X3, 6X5', 4X3' FIRST AND LAST 30 SECONDS SPRINT	OFF	SUP SESSION 3 10X6MIN 1 MIN REST BTW	SUP SESSION 4 5 MIN WARMUP 6X4MIN – 2MIN REST 6X2MIN – 1 MIN REST	SUP SESSION 5 10/10/8/8/6/6/4/4/2/2 1 MIN REST IN BETWEEN	OFF
1PM	GYM SET 1 5 MINS WUP ON BIKE 10 REPS EACH X4 SEATED ROW SEATED SQUAT PRESS SEATED SHOULDER PRESS LEG EXTENSION LAT PULL DOWN LEG CURL AB CURL 5 MINS TREADMILL	50 CHINUPS RUN SESSION 1 5 MIN WUP 3 MILE TT 5 MIN C/D	GYM SET 2 5 MIN WUP BIKE FREE WEIGHTS 10 REPS X3 BICEP CURL/PRESS SQUAT ON HALF EXERCISE BALL LUNGES FRONT AND SIDE DELT RAISE PUSH UPS REVERSE FLYS SINGLE. ARM PULLS	50 CHIN UPS RUN SESSION 2 5 MIN STEADY 5X4MIN WITH 1 MIN REST 5 MIN STEADY	GYM SET 3 5 REPS 1 MIN PLANK 30 SEC SIDE PLANK 30 SEC SIDE PLANK 30 SIT UPS 30 LEG RAISES 30 CRUNCHES 30 ANKLE TOUCHES	OFF	OFF
2AM	SUP SESSION 1 12X5MIN W 1 MIN REST	SUP SESSION 2 4X3, 6X5', 4X3' FIRST AND LAST 30 SECONDS SPRINT	OFF	SUP SESSION 3 10X6MIN 1 MIN REST BTW	SUP SESSION 4 5 MIN WARMUP 6X4MIN – 2MIN REST 6X2MIN – 1 MIN REST	SUP SESSION 5 10/10/8/8/6/6/4/4/2/2 1 MIN REST IN BETWEEN	OFF
2PM	GYM SET 1 5 MINS WUP ON BIKE 10 REPS EACH X4 SEATED ROW SEATED SQUAT PRESS SEATED SHOULDER PRESS LEG EXTENSION LAT PULL DOWN LEG CURL AB CURL 5 MINS TREADMILL	50 CHINUPS RUN SESSION 1 5 MIN WUP 3 MILE TT 5 MIN C/D	GYM SET 2 5 MIN WUP BIKE FREE WEIGHTS 10 REPS X3 BICEP CURL/PRESS SQUAT ON HALF EXERCISE BALL LUNGES FRONT AND SIDE DELT RAISE PUSH UPS REVERSE FLYS SINGLE. ARM PULLS	50 CHIN UPS RUN SESSION 2 5 MIN STEADY 5X4MIN WITH 1 MIN REST 5 MIN STEADY	GYM SET 3 5 REPS 1 MIN PLANK 30 SEC SIDE PLANK 30 SEC SIDE PLANK 30 SIT UPS 30 LEG RAISES 30 CRUNCHES 30 ANKLE TOUCHES	OFF	OFF

Appendix B. Daily average macro intake



Appendix C. Sample Daily Nutrition Plan

Breakfast	Dymatize ISO 100 - Protein, 0.25 scoop Quaker Oatmeal - Old Fashioned Oatmeal, 1/2 cup dry 1 whole egg, 3 egg whites Smithfield - Bacon, 2 fried slices Coffee - Coffee with Creamer, 16 oz
Lunch	Homemade - Organic Chicken Broth, 1 cup Starkist - Tuna, 0.5 can Aladdin - Mixed Green Salad, 2.5 oz Mayo- Mayo, 1 tbs
Dinner	Smart Balance - Smart Balance Butter Spread, 1 tbsp Sweet Potato - Plain, 250 grams Homemade - Lobster Tail Steamed, 6.25 oz
Snacks	Labrada Protein - Lean Body Cookies and Cream, 17 fl oz Fair Life - Skim Milk, 8.1 fluid ounce Peanut Butter - Peter Pan Whipped, 2 tbsp yoplait Greek 100 - Peach yogurt, 1 container 150g