EFFECTS OF A 500 MILE BACKPACKING THROUGH HIKE ON THE PERFORMANCE OF A COMPETITIVE POWERLIFTER: AN OBSERVATIONAL CASE STUDY

A THESIS

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BY

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To the Dean of the Graduate School:

I am submitting herewith a thesis written by Anthony Paradis entitled "Effects of a 500 mile backpacking through hike on the performance of a competitive powerlifter." I have examined this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of MS with a major in Nutrition

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To my family for your love and support.

ABSTRACT

ANTHONY PARADIS B.S.

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MAY 2016

Objective- To evaluate the effects of a long-distance backpacking trip and a high protein diet on body composition, strength, power, and aerobic performance.

Methods- Study of a single-subject who hiked 34 days on the Colorado Trail. Dependent variables measured included body mass, body composition, bone mineral density, VO_2 max, resting metabolic rate, blood lipids, strength in squat, bench press, and deadlift, vertical leap, muscular endurance in pull ups, resting heart rate, and resting blood pressure. These variables were measured before and after the 34 day hike.

Results- Maximal squat performance decreased by 29.5kg (19%). Maximal bench press performance decreased by 18.2 kg (16%). Maximal deadlift decreased 31.7kg (17%). Box jump decreased 13 cm (14%). VO_{2max} increased 8.7 mL/kg/min (17%).

Conclusions- Despite a high protein diet, magnitude and duration of an extended backpacking trip can considerably reduce performance in strength and power.

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CHAPTER I

INTRODUCTION

Backpacking is a dynamic sport in which participants encounter changing environments, obstacles, and distances. According to a recent poll from the Statista statistics company, as many as 38.05 million Americans have gone hiking or backpacking in the past 12 months (Statista, 2014).

Long distance backpacking is a unique recreational sport because participants must balance their need for adequate calories with their need to keep the weight of equipment and carried food to a minimum.

Current Study

Research specifically pertaining to the preservation of lean body mass (LBM) and strength in trained strength athletes over non-competitive long duration and long distance backpacking hikes was not found in a recent scientific literature review.

This study sought to evaluate changes in strength and power, body composition, weight, VO_{2max}, and cardiovascular health markers in a powerlifter after completing an approximately 805 km (500-mile) backpacking journey along the Colorado Trail.

The participant in this study consumed a high protein diet (approximately 2g/kg of bodyweight per day), which was the normal dietary pattern according to previous dietary records.

This case study may be a platform to conduct future research studies to examine the possible beneficial or detrimental effects of long distance backpacking on strength and power athletes. Could overweight athletes benefit from the massive calorie deficit seen in other long distance hikers? Also, could long distance backpackers benefit from regular weight training to prevent injury and improve performance? Would front loading with additional weight, or adjusting to a high fat diet prevent some of the changes observed in this study?

CHAPTER II

LITERATURE REVIEW

The effects of long distance backpacking on strength and muscle mass in strength athletes have not been adequately described in the scientific literature.

Backpacking and Body Composition

One area of concern for backpackers is preservation of lean body mass during long distance hikes. Three previous studies have examined the effects of long distance backpacking on weight and body composition in individuals who were not trained strength athletes (L. Hill, Swain, E. Hill, 2008; Devoe, Israel, Lipsey, & Voyles, 2009; Koehler et al., 2011). Strength and body composition changes have measured in both fit and unfit individuals have been measured in long distance polar expedition studies with mixed results. (Frykman et al., 2003; O'Hara, Allen, & Shephard, 1977; Helge et al. 2003; Stroud et al., 1997).

In Hill's et al. (2008) 3-person case study of a 5-day backpacking trip over 160 kilometers, average weight loss was 1.7± 0.6 kg with an average caloric deficit of 2722 ± 770 kcal/day. Protein calories were approximately 17% and daily caloric intake varied substantially. Men and women in this study were trained and aerobically fit. Body composition was not measured before and after the study.

DeVoe's et al. single participant case study (2009) examined an 85 kg, 49 year-old male who was an experienced backpacker and started with a VO_{2max} of 32.8 mL/kg/min. The 118 day trip over 2669 km resulted in a decrease in body weight of 11.4 kg and a body fat % change from 25.18% to 14.31%. Calculated LBM loss was only 0.5kg over the course of the study. Preservation of LBM may be partially explained due to the relatively high starting body fat % and low VO_{2max} that reflected an initial untrained status. Average protein intake of the subject from 3 day analysis ranged from 71g/day to 123g/day.

Koehler's et al., 3-week backpacking expedition case study (2011) across the Atacama Desert in Chile involved a 35-year-old endurance athlete. Prior to the expedition, the participant intentionally gained 5 kg to prevent his loss of fat mass from falling below essential levels. The participant lost 10.5 kg total body weight including an 8.7 kg reduction in fat mass. Protein intake was not recorded. However, the participant consumed a pre-selected menu which included various high protein foods.

Hiking at High Altitude

Acute mountain sickness (AMS) is a condition caused by high elevation that can result in mild symptoms, such as headache, to severe clinical emergencies and death. Prevention of AMS can include standard practices such as acclimation time at higher altitudes and medications including acetazolamide and dexamethasone (Zafren, 2014). Non-prescription anti-steroidal drugs (NSAID) were also found to be effective in prevention of AMS (Pandit,

Karmacharya, Pathak, Giri, & Aryal, 2014). The reduction of the excessive oxidative stress of hypoxia may attenuate the effects of AMS, although no conclusive research has been performed (Askew, 2002).

Herbal supplement approaches to AMS are either ineffective or inconsistent. Ginkgo biloba may be effective in preventing AMS, although a full review of the research suggests that current studies are lacking and more controls of dosing and product consistency need to be established before recommendations can be made (van Patot, Keyes, Leadbetter, & Hackett, 2009). A rhodiola crenulata supplement was found be ineffective compared to placebo in prevention of AMS (Chiu, 2013).

Longer durations at high altitudes may affect the body's ability to regulate appetite and preserve LBM. Rapid ascent and AMS appears to contribute in reducing appetite and ad libitum energy intake in climbers (Aeberli et al., 2013). Although a loss of LBM is unavoidable, adequate calorie and protein intake could prove effective to minimize this loss (Stacie & Wing-Gaia, 2014).

Energy Expenditure

Calculating energy expenditure on long duration backpacking trips is difficult due to the changing terrain, environmental conditions, and exertion of participants. The use of an accelerometer in DeVoe and Dalleck's backpacking case study (2001) resulted in an underestimation of caloric needs versus the use of heart rate. A consumption of approximately 400 to 700 calories per hour was average. Use of a heart rate monitor and the Karvonen heart rate method was

also resulted in an underestimation of caloric needs in Hill's 3-person case study (Hill et al., 2008).

Koehler's et al. expedition journey (2011) case study accurately predicted energy expenditure before a hike by using gas exchange and assessing a variety of hiking speeds, inclines, and altitude simulation.

Hiking gear has also shown to influence energy expenditure, such as increasing the weight of boots worn by the hiker (Legg & Mahanty, 1986). The use of hiking poles does not appear to increase metabolic demand, but does show an increase in heart rate while exercising (Knight & Caldwell, 2000).

Competitive ultra-endurance events may provide some starting points for recommendations for athletes. Bourrilhon estimated an energy expenditure of approximately 800 calories per hour of athletes in an alpine climbing race (Bourrilhon et al., 2003). However due to the equipment, environmental conditions, intensity, and starting condition of the athlete, it may be difficult to extrapolate a direct translation into non-competitive backpacking.

Health Considerations Influencing Nutrition

There are many risks and health considerations with long distance backpacking. Infection from foodborne illness from giardia in a water source (Derlet, 2008) could be severe and lead to disturbances in the GI tract (Boulware, 2003). Poor hygiene and unsafe food and water practices may also lead to sickness on the trail (Boulware, 2004).

Therefore the purpose of this case study was to evaluate the effects of a long-distance backpacking trip and a high protein diet on body composition, strength, power, and aerobic performance.

CHAPTER III

METHODS

Participant

The participant is also the researcher of this case study and therefore consent is implied. The subject was a 29-year-old, male amateur competitive powerlifter who regularly engaged in resistance training and occasionally in recreational backpacking and hiking. The participant was apparently healthy with no diagnosed cardiovascular, pulmonary, or metabolic condition that would preclude him from exercise.

Initial and Post Hike Testing

The participant was evaluated pre-and post-hike testing to determine physical and performance characteristics. Pre-hike measurements were taken 5 days prior to the beginning of the expedition. Post hike measurements were taken 10 days after completion of the expedition.

The participant's mass and height was measured on a digital scale (Tanita BWB-800, Arlington Heights, Illinois, USA) and a stadiometer (Perspective Enterprises, Portage, Michigan, USA). Body fat % and total bone density mineral were measured with Dual-energy X-ray absorptiometry (DXA Lunar Prodigy, Fairfield, CT, USA). For maximal aerobic exercise, the participant was subjected to a Bruce protocol and connected to a 12-lead EKG, a mouthpiece attached to a

mass flow sensor, and metabolic cart (Cardiac Science Quinton Q-stress, Waukisha, Wisconsin, USA). Resting metabolic rate was measured using indirect calorimetry (Parvo Medics TrueOne 2400, Sandy, Utah, USA). Single repetition maximum strength (1RM) lifts were performed using standard Olympic sized barbells and bumper plates and judged according to USA Powerlifting criteria (Northern Light Fitness Products, Cornwall, Ontario, Canada). Pull-ups were performed using the full range-of-motion of the lift and ending when full repetitions with minimal body momentum were not able to be achieved consecutively. Blood pressure was assessed using a digital blood pressure cuff (Sun Tech Tango, Morrisille, North Carolina, USA).

Field Testing

Exercise intensity and calories expended while hiking were measured using a heart rate monitor which was worn during all hiking activities (Polar, FT-4, Lake Success, New York, USA). Total calories expended on hiking days were calculated by combining calorie values from the heart rate monitor software and adding non-hiking hours with the resting metabolic rate recording from initial testing (70 calories/hour). Estimated resting total daily energy expenditure was assumed to be 2011 kcal/day equivalent to the measured resting metabolic rate multiplied by a factor of 1.2 to estimate light activity during non-hiking hours.

The participant recorded food items consumed during the hike (Myfitnesspal, San Francisco, CA). Calories and macronutrients were determined using a combination of the manufacturer’s food labels and nutrient analysis tools

built into the food journaling software. Distance covered was determined using a trail map (CT Trail Guidebook, Golden, CO, USA). Water was collected from natural sources using microfiltration and consumed as needed. Hydration status was performed by a visual assessment of urine color. Supplements and NSAIDs were consumed as needed and also not recorded. Supplements included fish oil (Vitamin Shoppe, 1290mg fish oil), multivitamin and mineral (Vitamin Shoppe, One Daily Men's Multi), Spirulina (NOW, Spirulina, 1000mg), Ginkgo Biloba (NOW, Ginkgo Biloba, 120mg), and ibuprofen (Equate, ibuprofen, 200mg).

The backpacking expedition consisted of a 34-day trip through the Rocky Mountains along the Colorado Trail in Colorado, covering a total distance of approximately 804 km. The average elevation was greater than 3048 m and a total elevation climb greater than 27235 m (CT Foundation, 2015). The backpack base weight (without food or water) was 9.5 kg. Equipment carried included an interior frame backpack, sleeping bag, air mattress, tent, headlamp, cooking equipment, gas stove and burner, rain coat, first aid kit, water filter, knife, rope, personal hygiene items, hiking poles, and clothes. The participant arrived in Denver on June 20th, 2015 and began the expedition the following day at the Indian Creek Trailhead segment of the Colorado Trail.

Daily Routine

This varied but a typical schedule would include:

6:00am- breakfast and break down camp

6:45am- begin hiking

8:00am- snack while hiking

10:00am- collect water, short rest, and snack

12:00pm- rest for lunch

1:00pm- resume hiking

3:00pm- snack while hiking

6:00pm- set up camp, collect water, begin cooking dinner

7:00pm- dinner, chores, and recording data

10:00pm- sleep

CHAPTER IV

RESULTS

Table 1. *Summary of Results*

Value	Initial testing	Final testing	Change	% Change
Mass (kg)	65.5	62.4	-3.1	-5%
% fat	16.1	14.9	-1.2	-7%
RMR (kcal/day)	1676	1671	-5	-0.03%
Resting heart rate (beats per minute)	85	67	-18	-21%
Systolic blood pressure (mmHg)	145	106	-39	-27%
Diastolic blood pressure (mmHg)	69	67	-2	-3%
LDL (mg/dL)	104	128	+24	+23%
1RM squat (kg)	154.5	125	-29.5	-19%
1RM bench press (kg)	111.4	93.2	-18.2	-16%
1RM deadlift (kg)	184	152.3	-31.7	-17%
Box jump (cm)	94	81	13	-14%
Max consecutive pull up test (repetitions)	21	20	-1	-5%
VO_2 max (mL/min)	3.23	3.61	+0.38	+12%
VO_2 max (mL/kg/min)	50.1	58.8	+8.7	+17%

Hiking Measurements

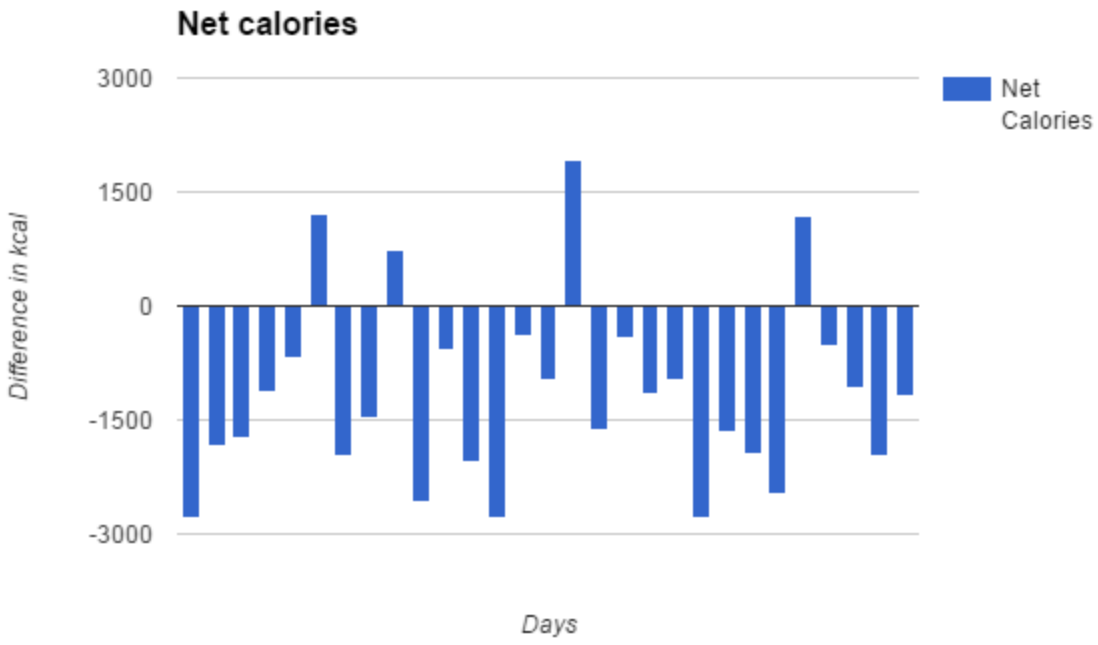

Fig 1. Net Calories

Average calories consumed were 4000 ± 463 kcal/day. The participant was resting for an extended period on days where positive net calories are shown. The average calories expended from hiking and metabolic rate combined was 5188 ±1197 kcal/day. Average daily caloric deficit was -1165 ± 1070 kcal/day (Fig. 1).

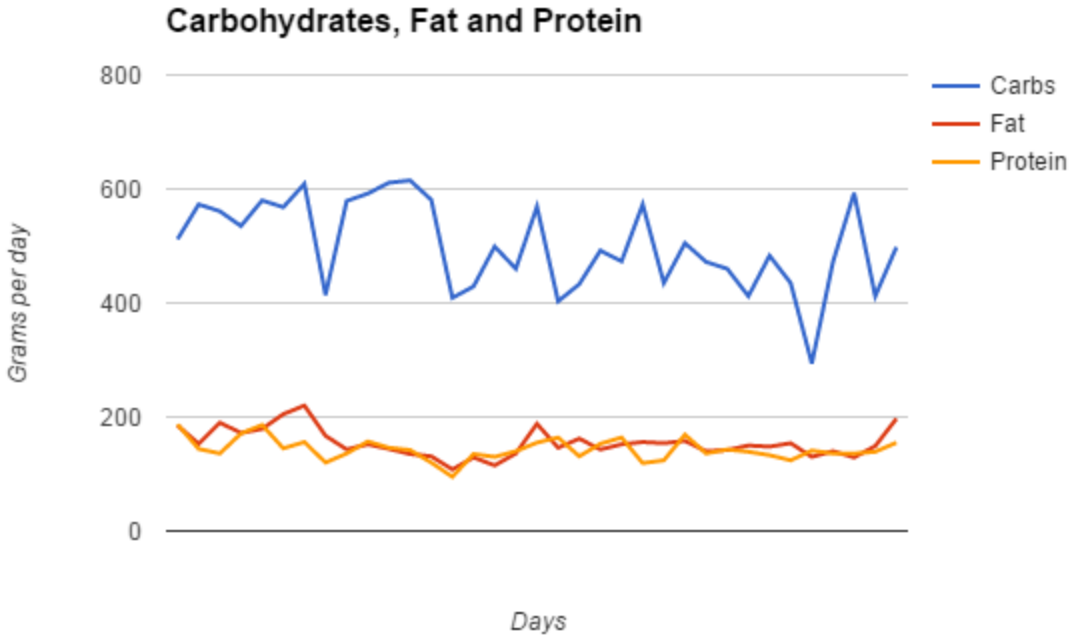

Fig. 2. Carbohydrates, fat, and protein consumption

The average carbohydrate intake was 501 ± 78 g/day. The average protein intake was 143 ± 19 g/day. Average fat intake was 154 ± 25 g/day (Fig. 2).

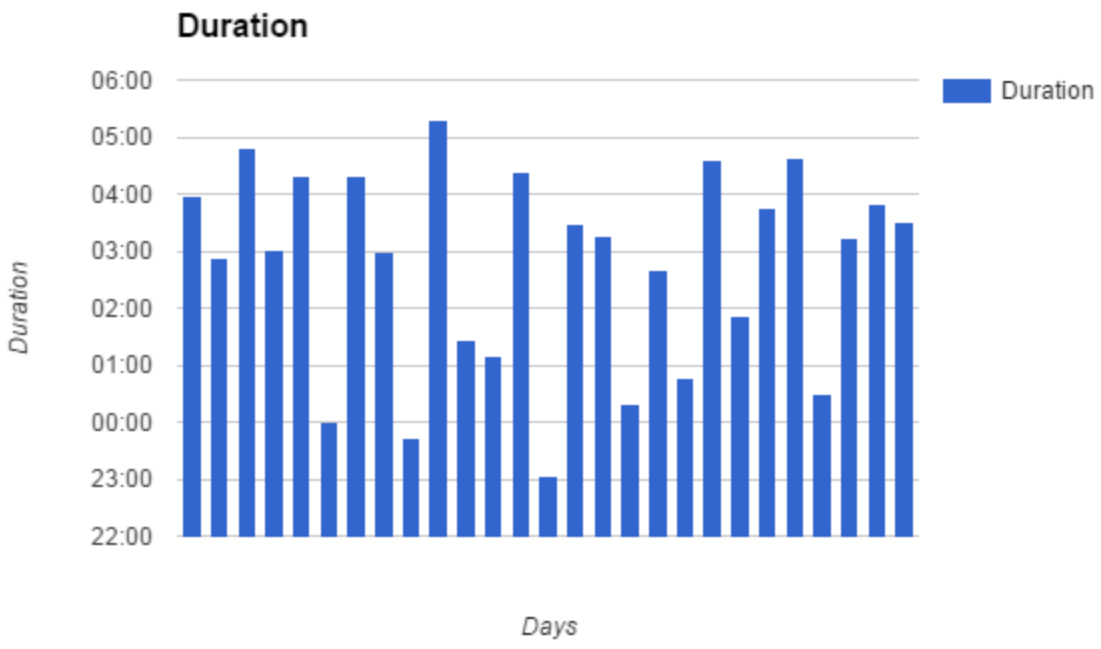

Fig. 3. Hiking duration

The average duration of daily hiking was 8:43 ±1:45 (Fig. 3).

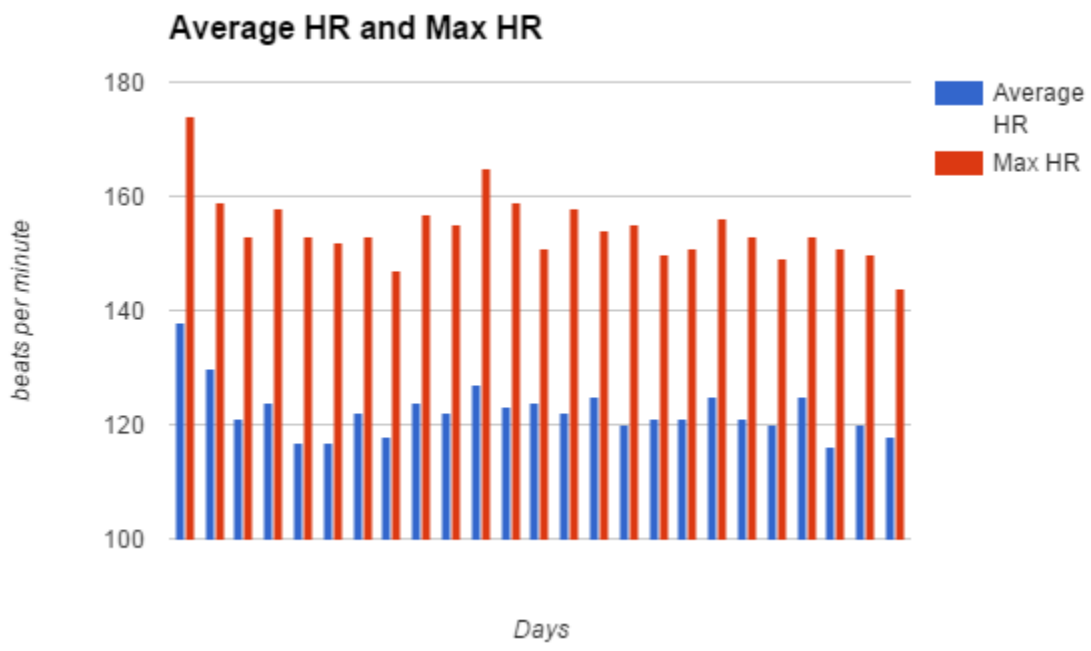

Fig 4. Average and maximum heart rate

The average heart rate during hiking activities was 122 ±5 bpm (43% of VO_{2max}). The average maximum heart rate was 154 ± 6 bpm (Fig. 4). Data for hiking duration, calories burned, and heart rate were lost due to heart rate monitor malfunctions on 6 non-consecutive days of hiking and were eliminated from the presented figure (Fig. 4).

Anthropometrics and Health Parameters

From initial to post hike testing, the participant's body weight decreased 3.1 kg (5% of body weight). Body fat decreased 1.2%. The Z-score increased 1 standard deviation. The RMR decreased 5 kcal/day. Total cholesterol increased 18 mg/dL (10%). Triglycerides decreased by mg/dL (29%). HDL decreased by 1 mg/dL (2%). LDL increased 24 mg/dL (23%). Resting heart rate decreased from 85 bpm to 67 bpm (21%). The systolic blood pressure decreased 39 mmHg (27%). The diastolic blood pressure decreased 2 mmHg (3%) (Table 1).

Fitness Performance Tests

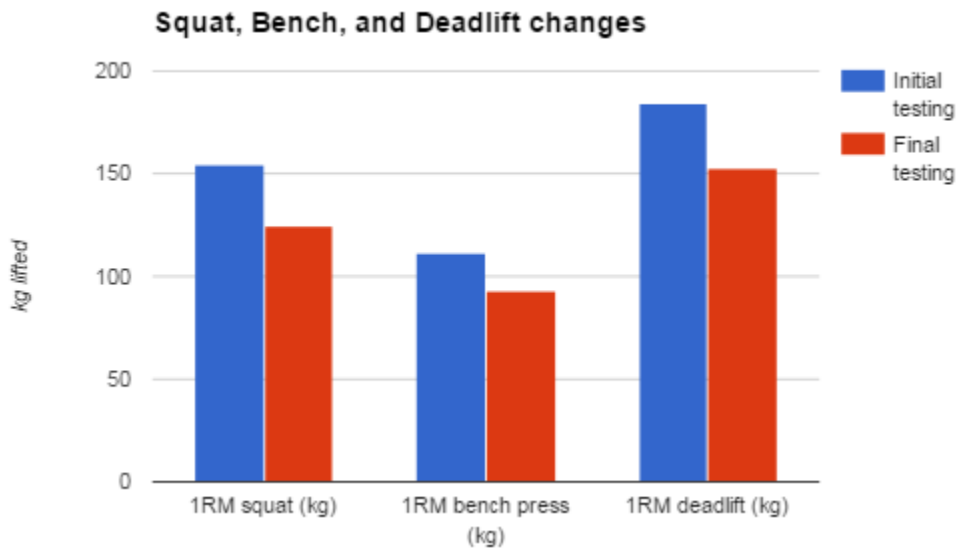

Fig. 5. Squat, Bench, and Deadlift Results

Maximal squat performance decreased 29.5 kg (19%). Maximal bench press performance decreased 18.2 kg (16%). Maximal deadlift decreased 31.7 kg (17%) (Fig. 5). Maximum pull ups decreased 1 repetition (5%). Box jump decreased 13 cm (14%). VO_{2max} increased 8.7 mL/kg/min (17%)

CHAPTER V

DISCUSSION

The table presented below compares pertinent data from previously mentioned backpacking case studies to the results from the present study (table 2).

Table 2

Backpacking Studies

Study	Duration (days)	Distance (km)	Change mass (kg)	Change in fat mass (kg)	% weight loss as fat	Notes
DeVoe, et al., 2009	118	2669	-11.4	-10.9	96%	Participant overweight n = 1
Koehler, et al., 2011	23	597	-10.5	-8.7	83%	-3,046 kcal/ day deficit n = 1
Hill, et al., 2008	5	161.5	-1.7 ± 0.6	N/A	N/A	-2,722 ±770 kcal/ day deficit n = 3
Paradis, et al., 2016	34	805	-3.1	-1.2	39%	-1165 ± 1070 kcal/day deficit n = 1

A summation of previous findings in long distance polar expeditions have been described in table 3.

Table 3

Polar Expedition Studies

Study	Duration (days)	Distance (km)	Change mass	Change fat mass	Strength changes	Notes
Stroud, et al., 1997	95	2300	> -25% bodyweight	From approx 16% to < 3% body fat	-10-50% ↓ in selected exercises	Sledge pulling
Shantz, et al., 1982	57	1500	N/A	N/A	No significant change in lower body muscle fibers	Skiing with backpacks
O'Hara, et al., 1976	10	69	-1 kg	-4.2 kg	Handgrip power ↑approx 5kg. Lean mass ↑.	Unfit untrained participants
St. Pierre, et al., 1996	21	NA	-5.1 kg	-3 kg	-2.1 kg fat free mass	Skiing and sleigh pulling
Frykman, et al., 2003	86	2928	Average - 4.85 kg	Average -3.8 kg	Maximal lift, vertical jump, and Wingate performance ↓.	Skiing and sled pulling
Helge, et al., 2003	42	650	-5.7±0.5 kg	- 4.6 kg	Small ↑ in type II muscle fibers in triceps	Pulling a 120 kg sledge

The participant in this study expended approximately 5000 kcal (~21 kJ) per day over the 34-day backpacking trip. Caloric intake was insufficient to maintain the body mass. These findings were within range of other reported energy expenditure values measured from backpacking and expedition studies that ranged from 3988 to 4928 kcal/day (Frykman et al., 2003; Hill et al., 2008; Koehler et al., 2011).

The participant lost 3.1 kg of total body mass. A total body mass decrease of 4.4 kg was predicted from calculating total daily caloric deficit. Other studies predicting weight loss using heart rate during backpacking expeditions (Hill, et al., 2008) overestimated weight loss in subjects. Participants in Koehler's case study, a 4 kg weight gain within 10 days of completing an expedition was found (Koehler, et al., 2011). Inaccuracies may have occured in calorie records when food was consumed outside of pre-planned meals during the hike and before the final testing.

Two kg of lean tissue (of the 3.1 kg total) was lost by the participant. In previous backpacking and expedition case studies, a decrease in body fat % was observed in all subjects while changes in lean mass varied (DeVoe, et al., 2009; Frykman et al., 2003). In an intervention study performed on elite athletes engaging in a periodized resistance training program, participants lost 0.7% to 1.4% of body weight per week while maintaining or slightly increasing lean body mass (Garthe, Raastad, Refsnes, Koivisto, & Sundgot-Borgen, 2011). The participant in this study lost an average of 0.83% of body weight per week.

Exposure to a high altitude can promote considerable muscle and body weight loss due to the loss of appetite, increased energy expenditure, the loss of body water, impaired nutrient absorption, and/or the effects of hypoxia on muscle metabolism (Kayser, 1992). As the altitude 5,000 meters, the loss of muscle mass was mostly due to a significant caloric deficit and replacement of a

structured weight lifting program with daily, long duration, lower intensity aerobic conditioning.

The participant had an average protein intake of approximately 2.6 g/kg of lean body mass at 143 ± 19 g/day. This intake was significantly higher compared to other backpacking studies ranging from 1.4 to 1.6 g/kg of lean body mass (DeVoe, et al., 2009; Frykman, et al., 2003). A systematic review examining protein intake during severe calorie restriction on retention of lean body mass suggested a higher intake of protein may attenuate muscle loss with an intake of 2.3-3.1g/kg of protein per day (Helms, Zinn, Rowlands, & Brown, 2014). It appears in this case study that a higher protein intake was not completely protective against loss of lean body mass. A long distance backpacker who is physically fit and has a lower body fat percentage may be at greater risk for muscle mass loss compared to an untrained participant with a higher body fat percentage.

The significant decrease of heart rate observed in this study has also been observed in DeVoe's et al. long distance backpacking study (2009). A meta-analysis of the effects of exercise on blood pressure indicates a predicable decrease in both systolic and diastolic blood pressure (Cornelissen & Smart, 2013).

In the current study VO_{2max} increased 18%. This may be due to a training effect of long duration aerobic activity with a concurrent drop in body mass. Although it is likely that adaptations from training in a hypoxic environment

occurred during the hike, it is unlikely that these adaptations persisted in the weeks following the study when VO_{2max} test was assessed. According to a review on the adaptations of altitude training, any increases in VO_{2max} are marginal (approximately 4%), and there is little evidence to support that these benefits persist longer than 7 days after the adaptations occur (Bailey & Davies, 1997).

The participant's maximum strength and power decreased in all tests (i.e., a loss of 14% to 19% from initial testing). Trained athletes can retain the majority of their strength over 2 to 3 week detraining period. Elite athletes may retain their maximum strength gains for up to 30 days post training (McMaster, Gill, Cronin, & McGuidan, 2013). An inverse relationship exists between strength, increased frequency, and duration of running (Wilson, et al., 2012). Therefore, the observed loss of strength and power in the participant may be due to the significant volume and duration of the hike and less dependent on the amount of detraining.

An unanticipated preservation of upper body endurance was observed in the maximum repetition effort pull-up test of this study. This could due to a combination of body mass loss and the use of hiking poles which incorporate more upper body engagement (Knight, 2000).

A limitation of this study includes dietary intake records on days when unplanned meals were consumed. Quantities of some food items, such as added oils, were estimated. Another limitation is that supplements and vitamins were taken ad lib and were difficult to predict any possible effect. The participant also

experienced difficulty in the precise use of the heart rate monitor worn during the trip. However because field data was collected daily during the expedition, the frequency should aid in normalizing outlier data. The researcher was also the participant in this study.

Points of interest and Concerns During This Study

- Hiking alone: the mental difficulty of solitude over a long period of time and the self-reliance needed in case of emergencies.
- Food preparation at home and on the trail: dehydrating food and creating recipes that are light and palatable. Recipes were modified to fit the macronutrient needs of the participant, cooked, dehydrated, vacuum sealed, and labeled. It was difficult to carry enough food and calories to prevent a weight loss. Food was mailed to the town post offices ahead of time and picked up along the trail.
- Navigation: Due to record rain fall this year, some portions of the trail were flooded and some bridges were inaccessible. Alternative routes were followed using a map, compass, and landmark identification.
- Dangerous weather: Lightening storms are almost a daily occurrence during the summer and there are sections of the trail that are above the tree line for multiple days. Careful planning of hiking times were necessary to avoid lightening dangers.

- Temperature: Some arid portions of the trail stretch approximately 20 miles without water supply and some of the higher elevations are still capped with snow and can reach temperatures near freezing.
- Wild animals: Large predators such as bears or cougars live in the regions of the Colorado trail. Pepper spray was included in the pack for self-defense if needed.

Future Studies

This is the first case study examining the effects of a long distance backpacking expedition on a strength athlete. Future research questions may be developed to investigate the relationship between strength training and distance backpacking.

When cycling and running are performed with concurrent strength training, cycling is more effective at minimizing strength loss when compared to running (McMaster, et al., 2013) A different mode of aerobic exercise, such as backpacking, may offer a greater benefit to strength athletes due to its relatively lower sustained intensity, addition of a weighted pack, and upper body involvement with the use of hiking poles, particularly if duration and intensity are reduced to a lower amount. Due to the potential for a massive caloric deficit, improvements in cardiovascular health, and increase in VO_{2max}. There may be an opportunity for strength athletes to acquire these adaptations from backpacking during appropriate phases in their periodization or off-season training cycle.

Strength training with a focus on power may improve exercise economy, anaerobic capacity, lactate threshold, maximal strength, rate of force development, improved maximal speed, and improved endurance performance, or reduce and even delay fatigue (Rønnestad & Mujika, 2014). These performance variables are also transferred from resistance training to backpacking. A structured resistance training program may be able to cause a significant difference in hiking performance and injury prevention.

Based on this case study compared to previous backpacking case studies, males with a body composition > 20% fat and females with >30% fat would likely see more benefit with fat loss and preserving lean body mass. Leaner athletes in their first few years of training will benefit greater than benefits of the sport due to their starting training status. Backpacking in shorter intense trips could be an effective strategy for weight loss for even advanced athletes in an off-season setting.

Greater focus should be placed on athletes as human beings and time and care should be given to athletes who are exiting their sports and backpacking and powerlifting are great individual sports in which an athlete could transition into.

Further investigation could determine quick hand equation would benefit recreational backpackers who want to determine their predicted caloric expenditure to plan their meals more effectively. Also fat loading for a metabolic

shift to utilize more fatty acids as fuel may be investigated to show an improvement in hiking performance.

Finally, backpacking is an excellent platform for team building, peer bonding, and developing mental toughness. It teaches an appreciation for nature and the primitive beginnings of humans and the fragility of life and ecosystems. There may be a psychological benefit for humans to return and immerse in nature periodically.

Summary/Conclusion

Despite a high protein diet, magnitude and duration of an extended backpacking trip can considerably reduce performance in strength and power

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APPENDIX

INDEX

CLINICAL PATHOLOGY LABORATORIES

(800)633-4757

		ACCOUNT NUMBER:	22029
PATIENT NAME:	**PARODIS,ANTHONY P**	ACCOUNT NAME:	TEXAS WOMAN'S UNIVERSITY
DOB-Age:	04/24/1986 - 29 Y		305 ADKIN DR-HUBBARD HALL BASEMENT
Gender:	MALE		DENTON, TX 76201
MED REC NO:	IWH-3HS	REFERRING DR:	MINARD,CONSTANCE
ORDER#:	A0804545	Collection Date/Time:	06/12/2015 09:45
ACCESSION#:	NW289616	Received Date/Time:	06/12/2015 20:38
PATIENT PHONE:	N/A	Reported Date/Time:	06/13/2015 03:03

PT FASTING

Result Name	Abnormal	Normal	Range/Units	Lab
COMPREHENSIVE METABOLIC PANEL				
GLUCOSE		95	65-100 MG/DL	MAIN
BUN		18	8-25 MG/DL	
CREATININE		1.2	0.8-1.4 MG/DL	
eGFR AFRICAN AMER.		87	>60 ML/MIN/1.73	
eGFR NON-AFRICAN AMER.		72	>60 ML/MIN/1.73	
CALCULATED BUN/CREAT		15	6-28 RATIO	
SODIUM		142	133-146 MEQ/L	
POTASSIUM		4.8	3.5-5.3 MEQ/L	
CHLORIDE		104	97-110 MEQ/L	
CARBON DIOXIDE	31 H		18-30 MEQ/L	
CALCIUM		9.8	8.5-10.5 MG/DL	
PROTEIN, TOTAL		7.4	6.0-8.4 G/DL	
ALBUMIN		4.7	2.9-5.0 G/DL	
CALCULATED GLOBULIN		2.7	2.0-3.8 G/DL	
CALCULATED A/G RATIO		1.7	0.9-2.5 RATIO	
BILIRUBIN, TOTAL		0.8	0.1-1.3 MG/DL	
ALKALINE PHOSPHATASE		68	30-132 U/L	
SGOT (AST)		16	5-35 U/L	
SGPT (ALT)		13	7-56 U/L	
LIPID PANEL				
CHOLESTEROL		176	<200 MG/DL	MAIN
TRIGLYCERIDES		79	<150 MG/DL	
HDL CHOLESTEROL		56	>39 MG/DL	
CALCULATED LDL CHOL	104 H		<100 MG/DL	
RISK RATIO LDL/HDL		1.86	<3.55 RATIO	

Legend:

MAIN----------> Clinical Pathology Laboratories
9200 Wall St.
Austin, TX 78754
Mark A Silberman, M.D., Laboratory Director
CLIA NO. 45D0505003

CLINICAL PATHOLOGY LABORATORIES

(800) 633-4757

		ACCOUNT NUMBER:	22029
PATIENT NAME:	**PARADIS,ANTHONY P**	ACCOUNT NAME:	TEXAS WOMAN'S UNIVERSITY
DOB-Age:	04/24/1986 - 29 Y		305 ADMIN DR-HUBBARD HALL BASEMENT
Gender:	MALE		DENTON, TX 76201
MED REC NO:	TWH-TWU	REFERRING DR:	MENARD,CONSTANCE
ORDER#:	220290000128	Collection Date/Time:	08/10/2015 09:10
ACCESSION#:	NX200398	Received Date/Time:	08/10/2015 21:03
PATIENT PHONE:	N/A	Reported Date/Time:	08/11/2015 07:50

PT FASTING

Result Name	Abnormal	Normal	Range/Units	Lab
COMPREHENSIVE METABOLIC PANEL				
GLUCOSE		86	65-100 MG/DL	MAIN
BUN		20	8-25 MG/DL	
CREATININE		1.1	0.8-1.4 MG/DL	
eGFR AFRICAN AMER.		96	>60 ML/MIN/1.73	
eGFR NON-AFRICAN AMER.		79	>60 ML/MIN/1.73	
CALCULATED BUN/CREAT		18	6-28 RATIO	
SODIUM		142	133-146 MEQ/L	
POTASSIUM		4.8	3.5-5.3 MEQ/L	
CHLORIDE		104	97-110 MEQ/L	
CARBON DIOXIDE		28	18-30 MEQ/L	
CALCIUM		9.5	8.5-10.5 MG/DL	
PROTEIN, TOTAL		6.7	6.0-8.4 G/DL	
ALBUMIN		4.2	2.9-5.0 G/DL	
CALCULATED GLOBULIN		2.5	2.0-3.8 G/DL	
CALCULATED A/G RATIO		1.7	0.9-2.5 RATIO	
BILIRUBIN, TOTAL		0.4	0.1-1.3 MG/DL	
ALKALINE PHOSPHATASE		68	30-132 U/L	
SGOT (AST)		16	5-35 U/L	
SGPT (ALT)		18	7-56 U/L	
LIPID PANEL				
CHOLESTEROL		194	<200 MG/DL	MAIN
TRIGLYCERIDES		56	<150 MG/DL	
HDL CHOLESTEROL		55	>39 MG/DL	
CALCULATED LDL CHOL	128 H		<100 MG/DL	
RISK RATIO LDL/HDL		2.32	<3.55 RATIO	

UNLESS OTHERWISE INDICATED, ALL TESTING PERFORMED AT
CLINICAL PATHOLOGY LABORATORIES, INC. 9200 WALL ST AUSTIN, TX 78754
LABORATORY DIRECTOR: MARK A. SILBERMAN, M.D.
CLIA NUMBER 45D0505003 CAP ACCREDITATION NO. 21525-01

Legend:

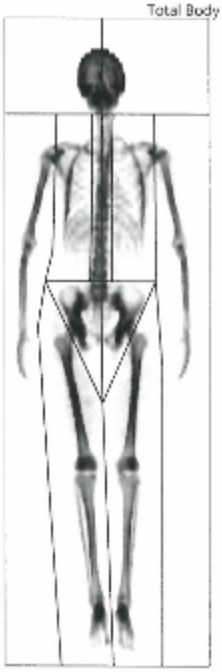
MAIN----------> Clinical Pathology Laboratories
9200 Wall St.
Austin, TX 78754
Mark A Silberman, M.D., Laboratory Director
CLIA NO. 45D0505003

Texas Woman's University

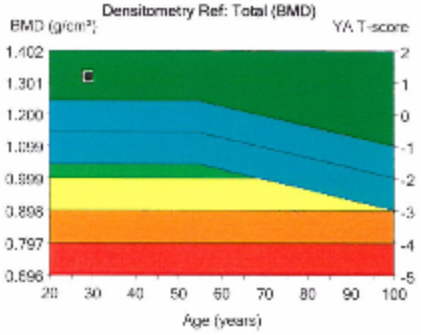
PO Box 425876, 017 HD Building
Denton, Texas, 76204

Patient:	Paradis, Tony	**Facility ID:**			
Birth Date:	4/24/1986 29.1 years	**Referring Physician:**			
Height / Weight:	67.0 in. 142.8 lbs.	**Measured:**	6/12/2015	9:23:53 AM	(14.10)
Sex / Ethnic:	Male White	**Analyzed:**	6/12/2015	9:24:39 AM	(14.10)

Total Body Bone Density



Densitometry Ref: Total (BMD)



Densitometry (Enhanced Analysis)

Region	1 BMD (g/cm²)	2 Young-Adult (%)	2 Young-Adult T-score	3 Age-Matched (%)	3 Age-Matched Z-score
Head	2.201	-	-	-	-
Arms	1.057	-	-	-	-
Legs	1.352	-	-	-	-
Trunk	1.170	-	-	-	-
Ribs	0.984	-	-	-	-
Spine	1.234	-	-	-	-
Pelvis	1.283	-	-	-	-
Total	1.320	108	1.2	112	1.8

COMMENTS:

Image not for diagnosis

Printed: 9/16/2015 2:48:33 PM (14.10/76.0.15.153.04.31.4.0.00 - 1.00.4.0.1.1.0.0.12.4 %Fat=16.1%
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Filename: i35upr6rjs.dfb
Scan Mode: Standard 0.4 µGy

1 - Statistically 68% of repeat scans fall within LSD (± 0.010 g/cm² for Total Body Total)
2 - USA (Combined NHANES (ages 20-30) / Lunar (ages 22-40)) Total Body Reference Population (v113)
3 - Matched for Age, Weight (males 25-100 kg), Ethnic

GE Healthcare

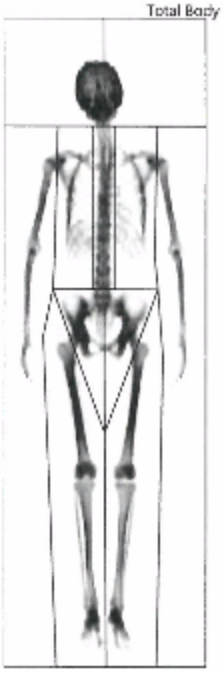
Lunar Prodigy Advance
PA - 320166

Texas Woman's University

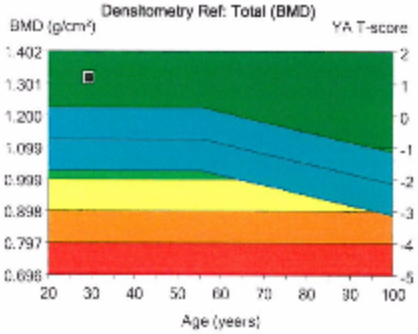
PO Box 425876, 017 HD Building
Denton, Texas, 76204

Patient:	Paradis, Tony	**Facility ID:**				
Birth Date:	4/24/1986 29.2 years	**Referring Physician:**				
Height / Weight:	67.0 in. 135.6 lbs.	**Measured:**	8/10/2015	8:40:21 AM	(14.10)
Sex / Ethnic:	Male White	**Analyzed:**	8/10/2015	8:40:58 AM	(14.10)

Total Body Bone Density



Densitometry Ref: Total (BMD)



Densitometry (Enhanced Analysis)

Region	BMD (g/cm²) [1]	Young-Adult [2] (%)	Young-Adult [2] T-score	Age-Matched [3] (%)	Age-Matched [3] Z-score
Head	2.245	-	-	-	-
Arms	1.080	-	-	-	-
Legs	1.367	-	-	-	-
Trunk	1.137	-	-	-	-
Ribs	0.960	-	-	-	-
Spine	1.202	-	-	-	-
Pelvis	1.239	-	-	-	-
Total	1.318	108	1.2	113	1.9

COMMENTS:

Image not for diagnosis
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0.00:0.00 0.00:0.00
Filename: 1xcvsmlh.xdb
Scan Mode: Standard 0.4 µGy

1 - Statistically 95% of repeat scans fall within 1SD (± 0.010 g/cm²) for Total Body Total)
2 - USA (Combined NHANES (ages 20-30) / Lunar (ages 20-40)) Total Body Reference Population (V13)
3 - Matched for Age, Weight (males 25-100 kg), Ethnic

GE Healthcare

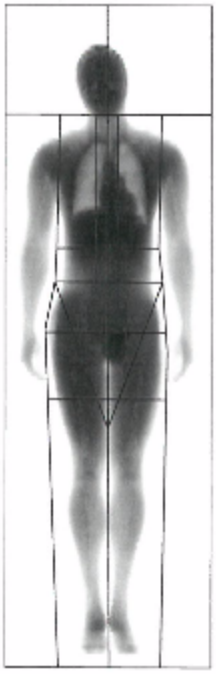
Lunar Prodigy Advance
PA+302656

Texas Woman's University

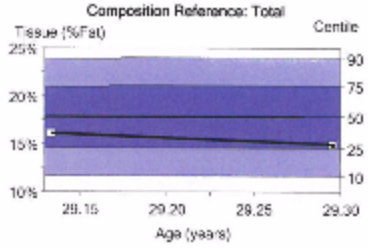
PO Box 425876, 017 HD Building
Denton, Texas, 76204

Patient:	Paradis, Tony	**Facility ID:**			
Birth Date:	4/24/1986 29.2 years	**Referring Physician:**			
Height / Weight:	67.0 in. 135.6 lbs.	**Measured:**	8/10/2015	8:40:21 AM	(14.10)
Sex / Ethnic:	Male White	**Analyzed:**	8/10/2015	8:40:58 AM	(14.10)

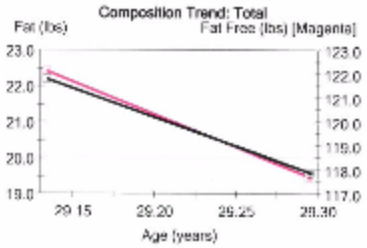
Total Body Tissue Quantitation



Composition Reference: Total



Composition Trend: Total



Trend: Total (Enhanced Analysis)

Measured Date	Age (years)	Tissue[1] (%Fat)	Centile[2,3]	Total Mass (lbs)	Region (%Fat)	Tissue[1] (lbs)	Fat[1] (lbs)	Lean[1] (lbs)	BMC (lbs)	Fat Free (lbs)
8/10/2015	29.2	14.9	27	137.3	14.3	131.0	19.6	111.5	6.2	117.7
6/12/2015	29.1	16.1	36	144.3	15.4	138.1	22.2	115.9	6.2	122.1

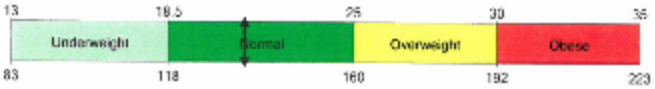
Trend: Fat Distribution (Enhanced Analysis)

Measured Date	Age (years)	Android (%Fat)	Gynoid (%Fat)	A/G Ratio	Total Body[1] (%Fat)
8/10/2015	29.2	13.8	14.1	0.98	14.9
6/12/2015	29.1	14.8	16.5	0.90	16.1

COMMENTS:

World Health Organization BMI Classification

BMI = 21.2 (kg/m²)



Weight (lbs.) for height = 67.0 in.

Image not for diagnosis
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11.0%Fat=14.9%
0.00:0.00 0.00:0.00
Filename: 1ewvbhjje.dfh
Scan Mode: Standard 0.4 µGy

1 - Statistically 68% of repeat scans fall within 1SD (± 0.8 % Fat, ±0.40 lbs. Tissue Mass, ±1.15 lbs. Fat Mass, ± 1.34 lbs. Lean Mass for Total Body Total)
2 - USA (Lunar) Total Body Composition Reference Population (n=113)
3 - Composition Matched for Age

GE Healthcare

Lunar Prodigy Advance
PA-320366

Texas Woman's University
Exercise and Sports Nutrition Clinic

*** Metabolic Text Report ***

Patient Information

Name:	PARADIS, ANTHONY	File number:	1029	Test time:	2015/06/15 14:04
Age:	29 yrs	Sex:	M	Doctor:	
Height:	67.0 in (170 cm)	Weight:	142.0 lb (64.5 kg)	Tech:	mm

Test Protocol

Test degree:	Maximal
Exercise device:	Other

Test Environment

Insp. temp.:	25.0 deg C	Baro. pressure:	744.0 mmHg
Insp. humidity:	46.0 %	Exp. flow temp.:	Mean of room temp. and 37.0 deg C
Insp. O2:	20.94 %	Insp. CO2:	0.03 %
(STPD to BTPS:	1.2382)		

Base Values for Sampling

Base O2:	20.94 %	Base CO2:	0.03 %	Measured O2: 21.05%, CO2: -0.00%

TIME min:sec	VO2 STPD L/min	VO2/kg STPD ml/kg/m	METS	VCO2 STPD L/min	VE BTPS L/min	RER	RR BPM	Vt BTPS L	FEO2 %	FECO2 %	AcKcal Kcal
1:00	0.37	5.7	1.6	0.32	10.30	0.87	12	0.86	16.65	3.88	2
2:04	0.30	4.7	1.3	0.27	8.68	0.88	10	0.84	16.70	3.85	3
3:00	0.34	5.3	1.5	0.29	9.72	0.85	14	0.70	16.69	3.76	5
4:01	0.48	7.4	2.1	0.42	13.60	0.87	17	0.82	16.72	3.81	7
5:02	0.71	11.0	3.2	0.63	19.66	0.88	18	1.10	16.57	3.97	11
6:02	1.13	17.6	5.0	0.88	23.60	0.78	16	1.49	15.27	4.65	16
7:00	1.12	17.4	5.0	0.89	23.49	0.79	22	1.08	15.28	4.71	21
8:01	1.37	21.3	6.1	1.12	29.58	0.82	20	1.48	15.41	4.73	28
9:00	1.64	25.4	7.3	1.41	34.90	0.86	20	1.74	15.29	5.02	36
10:01	1.62	25.0	7.2	1.45	36.09	0.90	22	1.65	15.51	5.02	44
11:01	1.96	30.3	8.7	1.87	46.19	0.96	21	2.20	15.74	5.05	54
12:00	2.23	34.6	9.9	2.28	54.35	1.02	24	2.25	15.83	5.22	65
13:00	2.32	35.9	10.3	2.52	62.07	1.09	27	2.28	16.23	5.05	76
14:00	2.45	37.9	10.8	2.65	66.48	1.08	27	2.49	16.30	4.96	89
15:01	3.02	46.8	13.4	3.37	81.15	1.12	29	2.82	16.22	5.17	105
16:00	3.23	50.1	14.3	3.81	101.40	1.18	37	2.71	16.85	4.69	121

Max VO2: 3.23 L/min, 50.1 ml/kg/min, 14.3 METS

Texas Woman's University, Exercise and Sports Nutrition Clinic
RMR

*** Metabolic Text Report ***

Patient Information

Name:	PARADIS, TONY	File number:	1029	Test time:	2015/08/10 08:03
Age:	29 yrs	Sex:	M	Doctor:	
Height:	67.0 in (170 cm)	Weight:	135.6 lb (61.6 kg)	Tech:	sd

Test Protocol

Test degree:	Rest
Exercise device:	Other

Test Environment

Insp. temp.:	25.0 deg C	Baro. pressure:	743.0 mmHg	
Insp. humidity:	47.0 %	Exp. flow temp.:	Room air temp.	Ex
Insp. O2:	20.94 %	Insp. CO2:	0.03 %	
(STPD to BTPS:	1.2399)			

Base Values for Sampling

Base O2:	20.94 %	Base CO2:	0.03 %	Measured O2: 20.94%, CO2: 0.04%

TIME min:sec	VO2 STPD ml/min	VO2/kg STPD ml/kg/m	METS	VCO2 STPD ml/min	VE BTPS L/min	RQ	FEO2 %	FECO2 %	REE Kcal/D
1:00	414	6.7	1.9	301	33.78	0.73	19.51	1.14	2800
2:00	348	5.6	1.6	306	33.06	0.88	19.67	1.18	2438
3:00	285	4.6	1.3	265	32.71	0.93	19.87	1.04	2021
4:00	268	4.3	1.2	244	33.21	0.91	19.96	0.94	1889
5:00	267	4.3	1.2	232	32.76	0.87	19.96	0.91	1869
**05:00	Baseline (O2: 20.91%, CO2: 0.04%)								
6:00	250	4.1	1.2	229	32.12	0.91	19.99	0.91	1768
7:00	252	4.1	1.2	217	32.02	0.86	19.99	0.87	1759
8:00	247	4.0	1.1	217	32.08	0.88	20.01	0.87	1733
9:00	245	4.0	1.1	213	32.52	0.87	20.03	0.84	1715
10:00	237	3.8	1.1	195	32.00	0.83	20.06	0.79	1639
**10:00	Baseline (O2: 20.90%, CO2: 0.05%)								
11:00	236	3.8	1.1	200	31.70	0.85	20.05	0.81	1642
12:00	243	3.9	1.1	203	30.88	0.84	20.00	0.85	1687
13:00	251	4.1	1.2	211	30.99	0.84	19.97	0.87	1742
14:00	240	3.9	1.1	206	30.65	0.86	20.00	0.86	1676
15:00	253	4.1	1.2	213	30.76	0.84	19.95	0.89	1760
**15:00	Baseline (O2: 20.90%, CO2: 0.04%)								
16:00	224	3.6	1.0	196	30.42	0.87	20.05	0.83	1568
17:00	237	3.8	1.1	193	30.53	0.82	20.01	0.82	1639
18:00	250	4.1	1.2	204	30.42	0.82	19.96	0.86	1726
19:00	246	4.0	1.1	204	30.41	0.83	19.97	0.86	1706
20:00	234	3.8	1.1	191	30.55	0.82	20.03	0.80	1618

Avg = 1676 kcal/day

Max VO2: 0.41 L/min, 6.7 ml/kg/min, 1.9 METS

VO2 Max Protocol

Name: Tony Paradis Date: 6/15/15

Age: 29 Gender: M Weight: _____ kg Height: _____in

BP_{rest}: 145/69 mmHg HR_{rest}: 85 b/min VO_{2rest}: ____ml/kg/min

Stage	Time (min)	Speed (mph)	Grade (%)	VO_2 (ml/kg/min)	BP (mmHg)	HR (b/min)	RPE
1	0		0	17.6	161/71	112	8
2	2		2	25.6	190/72	138	13
3	4		4	35.1	233/61	170	15
4	6		6	50.4	197/70	190	17
5	8		8	Recovery	184/66		
6	10		10		161/70		
7	12		12				
8	14		14				
9	16		16				

VO2 Max Protocol

Name: Tony Date: 8/10/15

Age: 29 Gender: M Weight: 135 kg Height: 67 in

BP_{rest}: 106/67 mmHg HR_{rest}: 67 b/min VO_{2rest}: ____ ml/kg/min

End: 116/73

Stage	Time (min)	Speed (mph)	Grade (%)	VO_2 (ml/kg/min)	BP (mmHg)	HR (b/min)	RPE
1	0	Bruce	0	17.1	148/66	101	7
2	2		2	24.5	160/66	123	17
3	4		4	38.3	183/60	156	14
4	6		6	51.6	174/60	181	
5	8		8	60	153/59	190	
6	10		10				
7	12		12				
8	14		14				
9	16		16				

Texas Woman's University, Exercise and Sports Nutrition Clinic
RMR

*** Metabolic Text Report ***

Patient Information

Name:	PARADIS, TONY	File number:	1029	Test time:	2015/06/12 08:41
Age:	29 yrs	Sex:	M	Doctor:	
Height:	67.0 in (170 cm)	Weight:	142.8 lb (64.9 kg)	Tech:	sd

Test Protocol

Test degree:	Rest
Exercise device:	Other

Test Environment

Insp. temp.:	24.0 deg C	Baro. pressure:	742.0 mmHg	
Insp. humidity:	53.0 %	Exp. flow temp.:	Room air temp.	Ex
Insp. O2:	20.94 %	Insp. CO2:	0.03 %	
(STPD to BTPS:	1.2417)			

Base Values for Sampling

Base O2:	20.94 %	Base CO2:	0.03 %	Measured O2: 20.93%, CO2: 0.04%

TIME min:sec	VO2 STPD ml/min	VO2/kg STPD ml/kg/m	METS	VCO2 STPD ml/min	VE BTPS L/min	RQ	FEO2 %	FECO2 %	REE Kcal/D
1:00	362	5.6	1.6	262	26.90	0.72	19.37	1.24	2448
2:00	341	5.3	1.5	282	32.24	0.83	19.67	1.11	2363
3:00	294	4.5	1.3	251	33.11	0.85	19.87	0.97	2051
4:00	296	4.6	1.3	261	32.70	0.88	19.84	1.02	2076
5:00	284	4.4	1.2	275	32.61	0.97	19.87	1.08	2029
**05:00	Baseline (O2: 20.93%, CO2: 0.05%)								
6:00	221	3.4	1.0	215	30.85	0.97	20.05	0.90	1584
7:00	222	3.4	1.0	213	27.46	0.96	19.95	0.99	1583
8:00	227	3.5	1.0	204	27.06	0.90	19.92	0.96	1595
9:00	239	3.7	1.1	214	26.46	0.89	19.84	1.03	1682
10:00	236	3.6	1.0	210	26.59	0.89	19.86	1.01	1659
**10:00	Baseline (O2: 20.94%, CO2: 0.04%)								
11:00	238	3.7	1.0	206	27.00	0.87	19.88	0.98	1661
12:00	241	3.7	1.1	196	26.87	0.81	19.87	0.93	1665
13:00	256	3.9	1.1	222	26.83	0.87	19.79	1.06	1787
14:00	248	3.8	1.1	204	26.34	0.82	19.81	0.99	1716
15:00	238	3.7	1.0	191	26.46	0.80	19.87	0.93	1641
**15:00	Baseline (O2: 20.94%, CO2: 0.05%)								
16:00	243	3.7	1.1	208	26.51	0.86	19.84	1.01	1695
17:00	237	3.7	1.0	206	26.17	0.87	19.84	1.01	1660
18:00	230	3.5	1.0	187	26.14	0.81	19.89	0.92	1589
19:00	240	3.7	1.1	207	26.02	0.86	19.83	1.02	1677
20:00	232	3.6	1.0	205	26.03	0.88	19.86	1.01	1627

Max VO2: 0.36 L/min, 5.6 ml/kg/min, 1.6 METS

Texas Woman's University
Exercise and Sports Nutrition Clinic

*** Metabolic Text Report ***

Patient Information

Name:	PARADIS, TONY	File number:	1029	Test time:	2015/08/10 13:57
Age:	29 yrs	Sex:	F	Doctor:	
Height:	67.0 in (170 cm)	Weight:	135.0 lb (61.4 kg)	Tech:	mm

Test Protocol

Test degree:	Maximal
Exercise device:	Other

Test Environment

Insp. temp.:	25.0 deg C	Baro. pressure:	743.0 mmHg
Insp. humidity:	41.0 %	Exp. flow temp.:	Mean of room temp. and 37.0 deg C
Insp. O2:	20.94 %	Insp. CO2:	0.03 %
(STPD to BTPS:	1.2399)		

Base Values for Sampling

Base O2:	20.94 %	Base CO2:	0.03 %	Measured O2: 21.04%, CO2: 0.05%

TIME min:sec	VO2 STPD L/min	VO2/kg STPD ml/kg/m	METS	VCO2 STPD L/min	VE BTPS L/min	RER	RR BPM	Vt BTPS L	FEO2 %	FECO2 %	AcKcal Kcal
1:04	0.34	5.5	1.6	0.29	10.93	0.86	16	0.69	17.25	3.30	2
2:01	0.32	5.2	1.5	0.28	10.83	0.89	14	0.79	17.37	3.29	3
3:00	0.40	6.5	1.9	0.39	14.27	0.98	16	0.89	17.48	3.42	5
4:01	0.59	9.6	2.7	0.52	18.44	0.89	20	0.93	17.07	3.55	8
5:02	1.11	18.1	5.2	0.77	23.03	0.69	20	1.18	15.34	4.19	13
6:02	1.13	18.4	5.3	0.84	24.89	0.74	21	1.17	15.61	4.22	19
7:01	1.41	22.9	6.5	1.12	31.28	0.80	21	1.49	15.61	4.46	25
8:00	1.54	25.1	7.2	1.29	34.66	0.84	22	1.61	15.61	4.65	33
9:02	1.58	25.8	7.4	1.36	36.88	0.86	22	1.66	15.78	4.60	41
10:01	2.01	32.8	9.4	1.86	47.12	0.93	20	2.33	15.73	4.93	50
11:02	2.17	35.4	10.1	2.11	53.65	0.97	24	2.27	15.95	4.90	61
12:00	2.39	39.0	11.1	2.36	61.14	0.99	26	2.35	16.10	4.82	73
13:02	2.83	46.1	13.2	2.81	70.44	0.99	24	2.91	15.97	4.97	87
14:00	3.19	52.0	14.9	3.33	85.25	1.04	30	2.85	16.26	4.87	103
15:01	3.28	53.4	15.3	3.53	95.93	1.08	34	2.86	16.63	4.59	120
16:01	3.61	58.8	16.8	4.01	112.30	1.11	39	2.88	16.86	4.45	138
16:47	3.09	50.4	14.4	3.55	113.50	1.15	49	2.33	17.46	3.91	151

Max VO2: 3.61 L/min, 58.8 ml/kg/min, 16.8 METS