Results of Taking Master Amino Acid Pattern® as a Sole and Total Substitute of Dietary Proteins in an Athlete During a Desert Crossing

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ABSTRACT

Study results show that a 51-year-old female athlete, while taking the Master Amino acid Pattern (MAP®) as a sole and total substitute for dietary protein, and performing physical activity, experienced (1) increased body muscle mass, strength, and endurance; (2) decreased body fat mass; (3) greater increase in performance of the nonprevailing muscles compared to the prevailing muscles; (4) improved cardiorespiratory performance; and (5) increased red blood cells, hemoglobin, and hematocrit parameters. It was concluded, confirming previous findings, that use of MAP as a sole and total substitute for dietary protein, in conjunction with physical activity, provides safer, unprecedented optimization of the body's protein synthesis, thereby improving anthropometric characteristics and physical and physiologic performance.

Keywords: aerobic profile; amino acid formula; body composition; isokinetic evaluation; protein; protein substitute

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INTRODUCTION

The safety and nutritional effectiveness of the Master Amino acid Pattern (MAP® [International Nutrition Research Center, Coral Gables, Fla, USA]), a dietary protein substitute, has been confirmed by results of a comparative, double-blind, triple-crossover net nitrogen utilization (NNU) clinical study.[1] The study results have shown that the participants, while taking MAP as a sole and total substitute of dietary proteins, achieved a body NNU of 99%.[1] This means that 99% of MAP's constituent amino acids followed the anabolic pathway, thus acting as precursor of the body's protein synthesis. In contrast, dietary proteins only provide between 16% and 48% NNU; this demonstrates that MAP is more nutritious than dietary proteins. This has been confirmed by observing that each participant's nitrogen balance was maintained in equilibrium by taking MAP in a dosage of only 400 mg/kg per day, which provided less than 2 kcal per day (MAP 1 g=0.04 kcal).[1] The study results have also shown that 1% of MAP's constituent amino acids followed the catabolic pathway, thus releasing only 1% of nitrogen catabolites.[1] By comparison, dietary proteins release between 52% and 84% nitrogen catabolites; this demonstrates that MAP is safer than dietary proteins.

Subsequently, comparative study results have shown that study participants, by taking MAP as a dietary protein substitute and performing physical activity, experienced (1) increased body muscle mass, strength, and endurance; (2) decreased fat mass; (3) increased basal metabolism rate; (4) a greater improvement in performance of the nonprevailing muscles compared to prevailing muscles; and (5) improved muscular and hematologic lactate clearance, allowing for better muscle performance and faster muscle recovery after physical activity.[2]

Because of MAP's unique characteristics, the investigators considered conducting a study to evaluate anthropometric, physiologic, and metabolic parameters[3,4] in a 51-year-old female athlete, before and after crossing the Taklimakan desert in China, while taking MAP as a sole and total substitute for dietary protein.

MATERIALS AND METHODS

The subject was a healthy 51-year-old white female athlete (height: 165 cm; initial weight: 58.1 kg; Table 1) who walked across the Taklimakan desert in China, a distance of 550 km, in 24 days. During the crossing, weather conditions were extremely variable, with temperatures ranging from –5°C at night to 30°C during the day. The desert terrain presented continuous slopes due to the dunes. The subject carried a knapsack weighing approximately 22 kg. The subject gave her informed consent to participate in the study.

Diet Definition

The diet consisted of a daily dosage of 24 g (24 tablets) of MAP (NEK™ I) as a protein substitute; 3 tablets containing vitamins, minerals, and trace elements (NEK™ II), in accordance with the US Recommended Daily Allowance (RDA); and 750 mL of carbohydrates, essential fatty acids, sodium chloride, and potassium (NEK™ III) (NeK™I, NeK™II, NeK™III, International Nutrition Research Center, Coral Gables, Fla, USA), equivalent to 3000 kcal.

The MAP dosage was calculated by multiplying the participant's daily protein requirement by 0.4. The dosage of 400 mg/kg daily was shown in a comparative, double-blind, triple-crossover clinical study of NNU to be adequate, as a sole and total substitute of dietary proteins, to maintain the body's nitrogen balance in equilibrium.[1] Considering the extreme physical conditions the athlete had to endure, an additional 15% of MAP was added to the daily dose, for a total of MAP 24 g (24 tablets) per day.

Study Tests

Before (T_0) and after (T_1) crossing the desert, the participant underwent:

(1) hematologic tests such as erythrocyte sedimentation rate, glucose, uric acid, transaminases (serum glutamic oxaloacetic transaminase, serum glutamic pyruvic transaminase), alkaline phosphatase, high-density lipoprotein and low-density lipoprotein cholesterol, triglycerides, red blood cells, white blood cells, hemoglobin, hematocrit, iron, ferritin, blood urea nitrogen, creatinine, electrolytes, and urinalysis.

(2) direct determination of percentage of body fat (% BF), by means of skinfold methodology, with a skinfold caliper (Holtain) and applying the Jackson and Pollok formula.[5] This consists of measurement of skinfolds of the triceps (mm), suprailium (mm), front of the thigh (mm), and gluteal circumference (cm).

(3) evaluation of aerobic characteristics through the exhaustion test performed on a treadmill: the athlete walked on a flat surface at a velocity of 4 km/h for 3 minutes; speed was increased by 0.5 km/h each minute until the velocity of 5.5 km/h was reached and maintained for 10 minutes. This was the "aerobic target," namely, the estimated velocity during crossing of the desert. After the aerobic target was reached, the velocity was increased by 0.5 km/h every 2 minutes, until a velocity of 8 km/h was reached. This was considered the maximum walking velocity for evaluation of metabolic parameters under exhausting conditions. The concentration of lactate (mmol/L) in capillary blood was determined with the Accusport automatic analyzer (Boehringer, Mannheim, Germany), both at the conclusion of the 5.5 km/h running cycle and at test conclusion.[6,7] During this test, the participant was connected to the V_{max} 29 ergospirometric system (Sensor-Medics, Yorba Linda, Calif, USA) in order to evaluate, for each respiratory cycle, (a) oxygen consumption (VO_2), calculated in mL/kg per minute; (b) carbon dioxide production (VCO_2), calculated in mL/kg per minute; (c) lung ventilation, calculated in liters per minute; and (d) respiratory quotient. Heart rate was monitored by means of a Polar cardiofrequency meter. These parameters allowed for analysis of the participant's general conditions and endurance during extreme exertion.[6,7]

(4) the PT 60°/s, PT 300°/s, Work 60°/s, and Work 240°/s isokinetic tests to evaluate the performance of the participant's muscles. Taking into consideration that the participant should walk in an unusual terrain, both knee extensor muscles were evaluated. In addition, because the participant carried a 22 kg (48.4 lb) knapsack on her back during the journey, her shoulder flexor and extensor muscles were also evaluated. The evaluation was performed with the Cybex 340 isokinetic dynamometer (Lumex Inc, Ronkonkoma, NY, USA). This instrument measures, in real time and with accuracy, the PT and Work of different muscle groups.[6]

RESULTS

The athlete's anthropometric results are shown in Table 1; skinfold test results are shown in Table 2; blood parameter results are shown in Table 3; cardiorespiratory parameter results are shown in Table 4; the PT 60°/s, PT 300°/s, Work 60°/s, and Work 240°/s isokinetic test results are shown in Table 5. The participant's lactate level remained almost invariable during the study and always below 4 mmol/L, which is considered the anaerobic level of lactate.

Table 1. Anthropometric Evaluation

Parameter	10/12/98	12/01/98	Difference, %
Height, cm	165.0	165.0	–
Weight, kg	58.1	56.7	–2.4
BMI, kg/m^2	21.34	20.83	–2.4

Table 2. Skinfold Test

Parameter	10/12/98	12/01/98	Difference, %
Triceps, mm	15.5	11.0	–29.0
Suprailium, mm	11.2	10.8	–3.6
Front of thighs, mm	26.3	20.0	–23.9
Gluteal circumference, cm	95.0	92.0	–3.16
Body density, g/cm^3	1.0444	1.0535	+0.9
Body fat, %	23.96	19.88	–20.5

Table 3. Blood Parameters

Parameter	10/12/98	12/01/98
Red blood cells, 10^6/mL	4.36	4.41
White blood cells, 10^3/mL	8.9	6.4
Hemoglobin, g/dL	13.3	13.9
Hematocrit, %	39.8	40.2
Erythrocyte sedimentation rate, mm/h	5.0	7.0
Blood urea nitrogen, mg/dL	43.0	39.0
Glucose, mg/dL	112.0	95.0
Creatinine, mg/dL	1.0	1.0

Safety and Tolerance

The participant did not report any side effects and did not show any adverse effects on blood parameters.

DISCUSSION AND CONCLUSIONS

Study results have shown that during the 24-day walking period, the athlete's body weight decreased by 1.4 kg (Table 1). Skinfold test results have shown that, during the same period, body fat mass decreased by 20.5%, which is equivalent to 2.650 kg (Table 2). The difference in body weight of +1.250 kg should be attributed to an increase in body lean tissue. This is confirmed by the observation that her body density increased by 0.9 g/cm^3 (Table 2). Moreover, her cardiorespiratory parameter results showed that at T_0, at 8 km/h, her heart rate was 149 beats/min, which improved at T_1 by decreasing to 128 beats/min (Table 4). During the same test, her oxygen consumption (Vo_2) also improved by decreasing 15.3% (Table 4). In addition, the participant's cost of energy (CE), determined by the ratio between the Vo_2 and the walking velocity, also improved by decreasing 15.5%.

During PT testing of the knee extensor muscles, performances of the right (nonprevailing) muscles increased by a mean of 11%, and that of the left (prevailing) muscles increased by a mean of 1.5%, thus reducing the difference between muscle performances from 13.5% to 4% (Table 5). During the Work 240°/s test of the knee extensor muscles, peformance of the right muscles increased by 10% and the left muscles increased by 5%, thus reducing the difference between muscle performances from 8% to 3% (Table 5).

During the PT 60°/s test of the shoulder extensor muscles, the right (nonprevailing) muscle performance increased by a mean of 15% and that of the left (prevailing) muscles increased by a mean of 12%, thus reducing the difference between muscle performances from 4% to 2% (Table 5). During the Work 60°/s test of the shoulder extensor muscles, the right muscle performance increased by a mean of 27% and that of the left muscles, by a mean of 12%, thus reducing the difference between muscle performances from 17% to 2% (Table 5).

During the PT 60°/s test of the shoulder flexor muscles, the right (nonprevailing) muscle performance increased by a mean of 63% and that of the left (prevailing) muscles, by a mean of 28%, thus reducing the difference between muscle performances from 33% to 4% (Table 5). During the Work 60°/s test of the shoulder flexor muscles, the right (nonpreveiling) muscle performance increased by a mean of 110% and that of the left muscles, by a mean of 35%, thus reducing the difference between muscle performances from 64% to 6%.

The greater improvements in performances of the nonprevailing muscles compared to the prevailing ones should be attributed to the fact that the athlete, by taking MAP, achieved improved body's protein synthesis. As is well known, when the body's protein synthesis is not optimal, there is benefit to the prevailing muscle, thus depleting the nonprevailing muscle.

The participant's blood test results showed (1) an increase in red blood cells, from 4.36 to 4.41 10^6/mL; (2) an increase in hemoglobin, from 13.3 to 13.9 g/dL; and (3) an increase in hematocrit, from 39.8% to 40.2% (Table 3). The participant's blood parameters did not show any adverse effects, and she did not report any side effects.

Table 4. Cardiorespiratory Parameters Evaluated at a Treadmill Speed of 8 km/h			
Parameter	**10/12/98**	**12/01/98**	**Difference, %**
Oxygen consumption (Vo_2), mL/kg/min	27.5	23.3	–15.3
Heart rate, beats/min	149.0	128.0	–14.1
Respiratory quotient, $Vco_2 \div Vo_2$	0.93	0.90	–3.2
Ventilation rate, L/min	42.2	31.9	–24.4
Energy cost, $Vo_2 \div$ velocity	206.0	174.0	–15.5

Table 5. Isokinetic Evaluation

Muscle Group	Test	Side	10/12/98, N/m	12/01/98, N/m	Difference, %	Range, N/m
Knee extensors	PT 60°	Right	132	139	5	120–140
		Left	146	145	0	
		Difference	10%	4%		
	PT 300°	Right	66	77	17	60–70
		Left	77	80	4	
		Difference	17%	4%		
	Work 240°	Right	1369	1511	10	1200–1400
		Left	1476	1552	5	
		Difference	8%	3%		
Shoulder extensors	PT 60°	Right	48	55	15	35–45
		Left	50	56	12	
		Difference	4%	2%		
	Work 60°	Right	66	84	27	55–65
		Left	77	86	12	
		Difference	17%	2%		
Shoulder flexors	PT 60°	Right	27	44	63	30–40
		Left	36	46	28	
		Difference	33%	4%		
	Work 60°	Right	31	65	110	50–60
		Left	51	69	35	
		Difference	64%	6%		

Values are expressed in Newton/meters.

Confirming previous findings,[2] the participant's body lean tissue mass increased by 1.250 kg (2.750 lb); while decreasing her body fat tissue mass by 2.650 kg (5.830 lb). Her cardiorespiratory performance improved by decreasing her heart rate by 14%, decreasing her oxygen consumption by 15.3%, and decreasing her cost of energy by 15.5%. Consistent with an earlier study,[2] her right and left flexor and extensor shoulder muscle performances showed a 29.5% mean increase during the PT testing, and a 46% mean increase during the Work tests. Also confirming an earlier report,[2] the difference between the prevailing and nonprevailing shoulder extensor and flexor muscle performances showed a 15% mean decrease during the PT 60° tests and a 36.5% mean decrease during the Work 60° tests.

The participant's blood test results showed increased red blood cells, increased hemoglobin, and increased hematocrit. Substantiating previous findings,[1,2] her blood parameters did not show any adverse effects, and she did not report any side effect. Furthermore, the participant was a 51-year-old, well-trained and well-nourished athlete in whom further optimization of her anthropometric characteristics and physical and physiologic performances is the exception and not the rule. She was taking, as a sole and total substitute of dietary proteins, 24 g of MAP per day, specifically 15% more than her daily recommended dosage. Study results have confirmed that this additional 15% of MAP allowed the participant to achieve a positive nitrogen balance. This was confirmed by the fact that, during the study, the participant's anthropometric characteristics and physical and physiologic performances have improved.

It was concluded from study results that, as reported in the literature,[1,2] the participant, by taking MAP as a sole and total substitute for dietary protein,[1] and performing physical activity, has experienced (1) increased body muscle mass, strength, and endurance; (2) decreased fat mass; (3) a greater increase in performance of the nonprevailing muscles compared to the prevailing muscles[2]; (4) improved cardiorespiratory performance; and (5) increased red blood cells, hemoglobin, and hematocrit.

It was also concluded, validating earlier findings,[2] that the use of MAP, as a sole and total substitute of dietary protein, in conjunction with physical activity, can provide safer and unprecedented optimization of the body's protein synthesis, thereby improving the body's anthropometric characteristics and physical and physiologic performance.

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