RMR and VO2 Tests

We perform Resting Metabolic Rate (RMR) testing for use in determining precisely how many calories an individual should consume daily to reach weight loss, lean muscle gain, sports performance enhancement, or general health & wellness goals. With RMR test results, client history, and client goals, our nutritionists can design personalized nutrition programs with daily meal plans, grocery lists, web-based utilities & smartphone apps to provide you with the tools necessary to effectively & efficiently reach your health, fitness, & body composition goals.

We also offer professional VO2 testing services to precisely measure individual Aerobic Threshold (AeT), Anaerobic Threshold (AT), and VO2max. The test also calculates Respiratory Exchange Ratio (RER), carb/fat utilization, and calorie burn at different heart rates & exercise intensity levels. With VO2 test results, our Exercise Physiologists will design and prescribe personalized cardio exercise programs for weight loss, endurance sport performance enhancement, and general cardiovascular health & fitness.

Preparing for the RMR Test:
You need to arrive at your appointment prepared to rest. This includes not exercising the day of the test. You should be fasting for 4 hours prior to your appointment. Avoid stimulants such as caffeine or cold medications. Prescription medications should be taken according to schedule.

During the RMR Test:
You will be invited to recline in a comfortable position. You will place a padded nose clip on your nose. You will be given a MetaBreather mouthpiece to breathe into. You will be breathing in fresh air from the room, but the gas that you breathe out will go through a tube into the metabolic analyzer to measure your metabolic rate. Make a good seal with your lips around the mouthpiece to insure that all the air you exhale will be analyzed. Relax. After 15-20 minutes, the device will beep, indicating that the test is complete. Then, we interpret and apply the results to your personalized nutrition program.

Preparing for the VO2 Test:
Complete the Exercise Readiness Questionnaire (ERQ) or Physical Activity Readiness Questionnaire (PAR-Q) and the Informed Consent for Exercise Participation and Testing form. Dress in comfortable exercise attire. Refrain from exercise or endurance training for 24-hours prior to test. Fast 4-5 hours before testing, including no solid/liquid food intake and no caffeinated or stimulating beverages. Water at room temperature can be consumed until the test begins. Continue medications as usual. Warm-up per your usual exercise routine.

During the VO2 Test:
The client puts on a mask and a heart rate strap. The mask is connected to the CardioCoachCO2 device via the VO2 hose. The client exercises on a stationary device such as a bicycle, treadmill, or a stair stepper. They gradually increase their intensity over a period of 6 to 20 minutes until the client determines that their max effort has been reached (VO2max), or
until the CardioCoachCO2 indicates that the anaerobic threshold (AT) has been detected. At this point, the client may stop exercising and begin a cool down phase.

The CardioCoachCO2 compiles the data, analyzes the results, and will print a fitness profile in a simple, insightful report where exercise zones are identified. Data is visible that allows fitness professionals to evaluate each individual client’s numbers to customize the client’s training program.

The CardioCoach CO2™ from KORR Medical Technologies delivers the BEST in VO2 Max Testing for the EXPERT fitness professional. It provides V-slope and Respiratory Quotient (RQ) data which the experienced exercise physiologist can use to customize an individual’s exercise plan. CardioCoach CO2™ also measures Resting Metabolic Rate (RMR) and reports Respiratory Quotient (RQ) to maximize efforts in personalized weight loss programs.

What is Resting Metabolic Rate (RMR)?

Metabolism, quite simply, is the conversion of food to energy.

Metabolic rate is a measure of how much food, or fat, is converted to energy in a day. Resting metabolic rate (RMR) is the measurement of how much food, or energy, is required to maintain basic body functions such as heartbeat, breathing, and maintenance of body heat while you are in a state of rest. That energy is expressed in calories per day. So, an RMR test shows how many calories you burn at rest, doing nothing more than sitting in a chair.

How Metabolic Testing Works

Indirect calorimetry (a measurement of metabolic rate) relies on the fact that burning 1 calorie (Kilocalorie) requires 208.06 milliliters of oxygen. Because of this very direct relationship between caloric burn and oxygen consumed, measurements of oxygen uptake (VO2) and caloric burn rate are virtually interchangeable.

Oxygen uptake requires a precise measurement of the volume of expired air and of the concentrations of oxygen in the inspired and expired air. The process requires that all of the air a person breathes out be collected and analyzed while they rest quietly. The KORR™ indirect calorimeters contain a precision air flow sensor that measures the volume of expired air, and an oxygen sensor that measures the concentration of oxygen. Once the factors of humidity, temperature and relative humidity are accounted for, the KORR™ instrument provides the most accurate results available in a compact metabolic analyzer.

What are AeT, AT, and VO2max?

Aerobic Threshold (AeT) is an exercise intensity level where oxygen supply is adequate for the major muscle groups. Below the aerobic threshold, lipid oxidation (fat) is the primary source of energy, indicating a level of effort that can be maintained for many hours. Training just below this exercise intensity level is ideal for a sustained caloric burn. Aerobic Threshold is typically on the lower end of sustainable aerobic capacity and is detected by a KORR™ VO2 Max test.

Anaerobic Threshold (AT) is the exercise intensity level at which the muscles are not supplied enough oxygen and begin to incur an “oxygen debt.” At this exercise level, lactic acid production in the muscles increases and fatigue sets in. Vigorous effort can be sustained for an extended duration at exercise intensity levels below the anaerobic threshold. The anaerobic threshold is measured as a part of a VO2 Max test and is generally on the upper end of sustainable aerobic capacity, on the threshold of transitioning to anaerobic metabolism.

VO2 Max reflects the total capacity of the cardiac, respiratory and muscular systems during an individual’s absolute maximum exertion. To achieve an elevated VO2 Max requires that the heart is capable of supplying sufficient blood to the muscle tissue, that the lungs are capable of supplying the needed oxygen to the blood and that the muscle tissue is sufficiently conditioned to use all of the oxygen supplied by the blood. It is a measure of fitness that is adjusted for body size, allowing values to be comparable between individuals.

What is a VO2max Test?

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A VO2 Max Test is a measurement that reflects a person's ability to perform sustained exercise. It is generally considered the best indicator of cardiovascular fitness and aerobic endurance. The actual measurement is "milliliters of oxygen used in one minute per kilogram of body weight." It is suitable for a wide range of individuals, from the sedentary to elite athletes.

How VO2max is Measured

VO2 Max is the maximum rate of oxygen consumption that can be attained during the most intense exercise possible. The measurement requires that the subject breathe into an oxygen consumption analyzer during an all-out effort (usually on a treadmill or bicycle) as part of a graded exercise protocol. These protocols involve specific increases in the speed and intensity of the exercise. While exercising, the person wears a mask to collect all the air he breathes in and out for a measurement of the volume of exhaled gas and the concentration of oxygen in that exhaled gas. This determines how much oxygen is used during each minute of the exercise test.

A person's oxygen consumption rises in a linear relationship with exercise intensity -- up to a point. There are specific physiological markers (AeT, AT) that can be detected throughout the test as oxygen consumption is measured. Eventually, oxygen consumption plateaus even if the exercise intensity increases. When the person is no longer able to keep up with the oxygen demands of his muscles and complete fatigue forces him to stop exercising, then his oxygen consumption has reached a maximum, and VO2 Max can be calculated. The test usually takes between 10 and 15 minutes.

NUTRITION PROGRAMS

Weight Loss

It's time to shed those excess pounds and have the body you've always wanted. Look better, feel better, have more confidence, & be more attractive.

Whether you want to drop weight for an upcoming event, lose pounds that have slowly accumulated over the years, or just get a slimmer beach bod, learning how to eat a diet based on nutrient-dense whole foods will allow you to accomplish your goals.

While fad diets are restrictive, expensive, ineffective, and often unsafe, adopting a healthy eating style will result in fast, safe, and sustainable weight loss for the long term. It is easy to stay slim and trim when you are eating a nutritious diet that tastes delicious.

Optimal Wellness

Are you sick and tired of being sick and tired? The majority of Americans are overweight and suffering from obesity-related chronic diseases such as heart disease, cancer, diabetes, hypertension, constipation, & high cholesterol. What many fail to realize is that medications are not the answer to these problems. The health complications of obesity can only truly be resolved by addressing the root cause of the obesity epidemic: the Standard American Diet (SAD).

The SAD diet invariably results in over-eating on calories and under-eating on nutrients, leaving people overfed, but malnourished. The key to feeling better, reversing disease, decreasing medications, having more energy, and losing weight is learning how to break free from food addiction and choosing to eat a nutrient-dense diet that adequately nourishes the body and is naturally capable of preventing disease.

Sports Nutrition

As an athlete, your goal is to attain peak athletic performance. To achieve this, athletes invest an incredible amount of time in their training and often an equally impressive amount of money on the fastest equipment, the newest technology, top of the line coaching services, and advanced testing protocols. At the same time I often see athletes overlooking one of the most impactful investments you could make: proper nutrition. Optimizing your diet to properly fuel your most important piece of equipment -- your body -- will take your training and racing to the next level. Eat to win.

Benefits:

- Increased energy

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• Faster recovery
• Higher levels of motivation
• Less fatigue
• More stamina
• Better mood
• Reduced body fat

• Increased lean body mass
• Better sleep
• Less stress
• Greater consistency in training
• Improved performance in racing/competition
• Better overall health

FREQUENTLY ASKED QUESTIONS

Why measure RMR rather than use predictive formulas?

Predictive formulas have been used for years because an actual measurement through Indirect Calorimetry has not been practical. But the truth is, while predictions might hold their ground statistically, when applied to individuals, they are woefully inadequate. In an examination of published articles examining the validity of various predictive equations, Frankenfield, Roth-Yousey and Compher found that even the best equation (Miffin-St Jeor) was only within 10% of measured results. While 10% may seem statistically acceptable, for the individual desiring to lose weight, an RMR estimate that is 10% higher (2200 Kcals) than an actual measurement of 2000 Kcals a day would be significant. That additional caloric intake would result in 21 pounds gained in one year! Additionally, these same researchers noted that errors and limitations with equations exist when applied to individuals, and that “RMR estimation errors would be eliminated by valid measurement of RMR with indirect calorimetry.” (Frankenfield D, et al, J Am Diet Assoc. 2005 May;105(5):775-89.)

Additional researchers at the University of Pennsylvania noted that the obese have Resting Energy Expenditures that are particularly difficult to predict. Their findings read, “Caloric prescription for weight reduction must be tailored to individuals rather than recommending the same caloric intake to persons with varying metabolic rates.” (Foster GD, et al, Metabolism. 1988 May;37(5):467-72.)

What is the effect of dieting on RMR?

Each individual will react differently to dietary changes which is why a true measurement of RMR is so valuable. But if a patient reduces calories, don’t be surprised if their RMR also goes down. This may or may not be in conjunction with weight loss. It is critical to measure those changes periodically to make the necessary adjustments in diet and exercise to keep patients on track and avoid the dreaded “plateau.” (Martin)

Does RMR change after weight loss?

Often after a significant weight loss, RMR is depressed even lower than expected relative to the change in body composition. Most researchers point to this as a key factor in the high rate of weight regain among the formerly obese. Identifying this post-diet RMR is a vital step that is key to long term weight loss success. It gives the information necessary to set an appropriate caloric goal for maintenance and teach a patient to eat within the constraints of their new metabolic requirements. (Jequier, Elliot)

What is the effect of resistance training on RMR?

When calorie intake remains unchanged, even a minimal resistance training program (10-15 mins per session, 3 times per week) can result in an increase in RMR. (Kirk)

If calorie intake is decreased, most studies indicate that strength training can reduce the loss of fat-free mass (lean muscle) but not prevent the decline in RMR that invariably comes with dieting. (Geliebter)

But studies are difficult to compare and summarize due to the many differences in the resistance training protocols and experimental designs. Researchers at West Virginia University found success maintaining RMR through intensive high volume resistance training designed to affect more muscle groups and by increasing protein intake to 80 g/day. (Bryner)

What is the effect of aerobic exercise on RMR?

Although many studies have been done regarding this question, there is not a simple answer to this question due to the many variables involved: the type, duration, frequency and intensity of exercise, degree of energy deficit, total daily calorie intake, and distribution of calories between fats, proteins, and carbohydrates. A conservative summary of the existing research would be that RMR does decrease significantly in response to a diet of less than 1000 Kcals per day.
and that the addition of moderate intensity aerobic exercise (50%-70% maximum aerobic capacity) performed for 30-60 minutes, 4-5 times per week decreases this response but does not return RMR to baseline. (Connolly)

**Does RMR decline with age? Why?**

Resting Metabolic Rate declines slightly as individuals’ age. The cause is not clear. One reason may be due in part to a slowed metabolic rate of individual organs, such as the brain, liver, heart, and kidneys. These organs alone account for 60% of RMR in adults, and all but the heart decrease in mass with advancing age. Another cause may be a tendency for decline in physical activity and a sedentary lifestyle that leads to a decrease in lean mass and bone mineral density. (St-Onge)

**Is RMR affected by pregnancy?**

Studies show a considerable variation in the individual metabolic response to pregnancy, and thus the additional energy required to support a pregnancy. The individual increases in RMR can range from 456 KJ/d to 3389 KJ/d. Though clinicians often recommend an additional energy intake of 1250 KJ/d to their pregnant patients, the data suggests that this single recommendation is not justified. Metabolic testing would more precisely indicate the caloric needs of individual pregnant patients. (Kopp-Hoolihan LE)

**How is RMR affected by eating disorders?**

Studies indicate that these types of disorders can cause adaptive changes in metabolic rate, but these changes are highly individual and unpredictable. The question becomes relevant during nutritional therapy when it is time to set a caloric prescription. Caloric requirements based on empirical data or predicative formulas have been shown to be highly inaccurate for this population. For example, normal weight bulimics show evidence of a higher than predicted REE when binge eating, with a decrease in REE once eating behavior is controlled. For those suffering from anorexia nervosa, refeeding is associated with an increase in REE that cannot be explained by increased body mass. In each of these cases, consistent measuring of RMR throughout the treatment process is warranted to maintain the correct caloric prescription to aid recovery. (Schebendach,Krahn, Leonard)

**Is there a familial link to RMR?**

Both the New England Journal of Medicine and the American Journal of Clinical Nutrition have published studies that examine the familial influence on variances in Resting Energy Expenditure. Both conclude that REE is moderately heritable, and a low rate of energy expenditure may contribute to the aggregation of obesity in families. (Ravussin E, Bosy-Westphal A)

**How does caffeine affect RMR?**

As with any chemical ingested, rate of absorption, individual tolerance, and dosage relative to body weight all factor in to a person’s unique response. Under controlled conditions, studies suggest that caffeine can raise RMR at a rate relative to the dose ingested: around a 4% increase with 100 mg of caffeine, increasing up to as much as 15% with 500 mg (equivalent to 5 cups of coffee). It is a short-lived increase - no more than 3 hours. This potential effect is why caffeine consumption is discouraged prior to testing with KORR products.